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# The comparison of several factorial structures of the Cornell Critical Thinking Test Level Z

**Andrea BARTA[1,*], Borbála TAMÁS[1], Tünde PÓKA[1,2]**

**ABSTRACT.** The Cornell Critical Thinking Test (CCTT) level Z is a broadly applied instrument for the measurement of undergraduate, gifted students' and adults' critical thinking abilities, however, there is a lack of studies in the literature investigating its factorial structure. The test developers emphasize the interpretation of the test results as a general critical thinking factor, including different cognitive abilities, but also highlight the overlap between the items of the subfactors. The aim of the study is the investigation of internal consistency, the comparison of different factorial structures (unidimensional, correlated, and hierarchical models), and gender invariance testing of the CCTT level Z. Hungarian-speaking undergraduate students participated in the study (N = 825). For the confirmatory factor analysis (CFA) the Mplus version 8.7, with weighted least squares mean and variance adjusted estimation was used. Measurement invariance of the test across genders was analyzed using Muthén's two-step procedure for dichotomous data. The results indicated that the correlated four-factor and second-order structures of the test exceeded the acceptable model fit criteria. Post hoc inspection was conducted on the second-order four-factor model, indicating a shortened 22-item version of the test (with a general critical thinking factor, including four subfactors: deduction, meaning and fallacies, induction, assumption identification) with excellent fit indices [$\chi 2$ (203) = 259.309, CFI = .967, TLI = .963, RMSEA = .018, SRMR = .056]. Configural and scalar invariance of the abbreviated Hungarian version of the test across genders were confirmed.

**Keywords**: critical thinking, undergraduate students, confirmatory factor analysis, measurement invariance

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## 1. INTRODUCTION

Critical thinking is a higher-order cognitive ability that also includes critical thinking disposition, personality, and motivational and cognitive characteristics that contribute to the application of critical thinking abilities (Ennis, 2018; Facione, 1990a; Haber, 2020; Halpern & Sternberg, 2019). There is no consensus in the literature regarding the definition of critical thinking. Watson and Glaser (1980) emphasize five cognitive skills within critical thinking: interpretation, recognition of assumptions, deduction, inference-making, and evaluation of arguments. Furthermore, they also highlight the role of the improvement of critical thinking for the increase of academic success (Aiyub et al., 2021). Facione (1990a) differentiated six main critical thinking skills: interpretation, analysis, evaluation, conclusion, explanation, and self-regulation. Ennis (2018) grouped critical thinking abilities into four main categories (problem clarification abilities, advanced clarification abilities, decision-making abilities, and inference abilities), which include several specific subskills. Halpern (1997) defined critical thinking as the totality of cognitive skills and strategies applied in problem-solving, drawing conclusions, and decision-making. The aim of the APA Delphi study was the unified definition of critical thinking. As a result of this study, the researchers concluded that analysis, evaluation, inference, interpretation, explanation, and self-regulation are the basic critical thinking skills (Facione, 1990b).

Critical thinking, as a 21st-century ability, was examined in several psychological areas. Educational psychology research concentrates on the role of critical thinking in learning, teaching, and learning achievement, respectively on its improvement in the case of students as well as in the case of teachers (Bezanilla et al., 2019; Cruz et al., 2019; D'Alessio et al., 2019; Janssen et al., 2019; Renatovna, & Renatovna, 2021; Yuan et al., 2022). Cognitive psychology studies focus on the association between critical thinking and other cognitive processes and also investigate the role of critical thinking in complex cognitive activities, like problem-solving (Işıklar, & Abalı-Öztürk, 2022; Muhammad Raflee, & Halim, 2021; Sholihah, & Lastariwati, 2020; Song et al., 2022) and metacognition (Boran, & Karakuş, 2022; Danial et al., 2018; Deliligka, & Calfoglou, 2022; Jin, & Ji, 2021; Marthaliakirana et al., 2022; Murtadho, 2021). In clinical psychology, it is mainly the role of the maladaptive form of critical thinking, and self-criticism that is studied in several mental disorders (Harman, & Lee, 2009; Moreira, & Canavarro, 2018; Moroz, & Dunkley, 2019; Wakelin et al., 2022). In personality psychology, the relationships between critical thinking dispositions and personality traits (Eshmirzaeva, 2020; Fitriana et al., 2018; Toker, & Akbay, 2022), as well as effective personality (Merma-Molina et al., 2022) were measured.

The level of development of critical thinking has an effect on individual achievement, success, and prosperity in every stage of life (Evans, 2020; Franco et al., 2018; van der Zanden et al., 2019; Živković, 2016) because critical thinking abilities are cognitive processes that are indispensable instruments of learning, problem-solving, and innovation (Culver et al., 2019; Ericson, 2022; Mujanah et al., 2022; Muhammad Raflee, & Halim, 2021; Sari, & Wardhani, 2020; Song et al., 2022). Several studies demonstrated positive associations between critical thinking skills and learning performance (Akpur, 2020; Fatmawati et al., 2019; Ghanizadeh, 2017; Ibrahim et al. 2021; Ng et al., 2022; Shahzadi et al., 2020). After graduating, critical thinking also promotes fulfillment in the job market and career success (Crosta, & Banda, 2022; Jebreen, & Nabot, 2021; Okolie et al., 2022; Saleh, 2019; Teng et al., 2019).

Due to the comprehensive applicability of critical thinking, the assessment and development of this cognitive process have a critical role. Reliable measurement of critical thinking abilities can provide relevant information about the level of development of a student's critical thinking skills and which skills require further development to achieve successful academic results. The Cornell Critical Thinking Test Level Z is one of the most commonly used assessment tools in the academic context to measure students' critical thinking abilities. However, there is no prior research in the literature regarding the test's factorial structure. Furthermore, there is no previously validated tool for measuring critical thinking among Hungarian-speaking university students.

### *1.1. The measurement of critical thinking*

Several instruments have been developed for the measurement of critical thinking abilities and dispositions. For the assessment of critical thinking, standardized tests are applied most frequently (Gunawardena, & Wilson, 2021; Imperio et al., 2020). There are overlaps between the cognitive abilities that are measured with different tests, but some assessed abilities differ in terms of the theoretical models of the tests, so scientists defined the term of critical thinking differently and emphasized different cognitive processes, or activities within critical thinking. A further difference between the tests is that they could require recognition or recall memory. Tests and exercises requiring recall memory have short answers, or short essays as answers, while the tests calling for recognition memory have a forced-choice question format (Butler et al., 2012).

One of the most frequently applied instruments for the assessment of critical thinking is the Cornell Critical Thinking Test (Alias et al., 2022; Ennis et al., 2005), which is based on the Cornell/Illinois model, and measures the deduction, induction, credibility, observation, and assumption identification abilities within

critical thinking (Ennis et al., 2005; Imperio et al., 2020). Another very widely used, recognition-requiring tool for the assessment of adults' critical thinking, is the California Critical Thinking Skills Test, developed by Facione (1990b) based on the conclusions of the Delphi report. The test measures critical thinking skills (interpretation, analysis, evaluation, inference, explanation, except for self-regulated learning) approved by the 46 experts contributing to the Delphi report (Alias et al., 2022; Butler et al., 2012; Facione, 1990b).

The Ennis-Weir Critical Thinking Essay Test (Ennis, & Weir, 1985) contains open-ended questions. The test taker reads a letter relating a fictive problem-solving situation including a list of arguments, then the responder needs to express their point of view supporting it with arguments in an essay format. The responder needs to react, give an answer in every paragraph, and then needs to explain their viewpoint regarding the whole text. They receive points for identifying the strengths and weaknesses of the read arguments, and respectively for the arguments that support their decisions. Compared with the forced-choice format, the test assesses not only the evaluative function of critical thinking but also the creative, productive characteristics of it, thereby it is a more holistic instrument for the assessment of critical thinking. However, the subjectivity resulting from the evaluation of the answers may lead to biases (Alias et al., 2022; Butler et al., 2012; Ennis, & Weir, 1985; Werner, 1991). Another test requiring recall memory for the measurement of critical thinking is the Watson and Glaser Critical Thinking Appraisal (Watson, & Glaser, 1980) which examines critical thinking during problem-solving. Initially, the test assessed five abilities within critical thinking (recognition of assumptions, evaluation of arguments, deduction, inference making, interpretation), later they operationalized the intercorrelated interpretation, inference, and deduction abilities as one overall factor, which was called conclusions. The abilities of recognition of assumptions and evaluation of arguments were still treated as separate factors (Aiyub et al., 2021; Alias et al., 2022; Butler et al., 2012; Watson, & Glaser, 2010).

Contrary to the Cornell Critical Thinking Test and the California Critical Thinking Skills Test, which have forced-choice questions, respectively the Ennis-Weir Critical Thinking Essay Test and the Watson-Glaser Critical Thinking Appraisal, which require recall memory, the Halpern Critical Thinking Assessment combines recall and recognition memory, contains open-ended and also forced-choice questions regarding the read situations (Butler et al., 2012; Gunawardena, & Wilson, 2021; Alias et al., 2022). The test measures the following critical thinking abilities: verbal reasoning, argument analysis, skills in thinking (hypothesis testing), using likelihood and uncertainty, decision-making, and problem-solving (Halpern, 1997; Butler et al., 2012).

### *1.2. The internal structure of Cornell Critical Thinking Test Level Z*

The Cornell Critical Thinking Test rests on the Cornell/Illinois model (Gunawardena & Wilson, 2021; Imperio et al., 2020; Ling & Loh, 2020). Ennis differentiated three cognitive abilities within critical thinking: induction, deduction, and value judgment, and four methods applied during these cognitive processes: assumptions, inferences, observations, and statements (Ennis, 2018; Ennis et al., 2005; Ling & Loh, 2020). The model based on the interaction of these cognitive abilities and methods provided the basis of the Cornell Critical Thinking Test (Ennis et al., 2005; Ling & Loh, 2020). Two versions of the test were developed for the measurement of critical thinking in two different age groups. The Cornell Critical Thinking Test Level X was developed for the measurement of critical thinking of middle school and high school students (4-12 grades), while the Cornell Critical Thinking Test Level Z is applicable for the measurement of critical thinking abilities of advanced and gifted high school students, college students and adults (Ennis et al., 2005). Both tests have a forced-choice question format and dichotomous items. The Cornell Critical Thinking Test Level Z has 52 items and measures cognitive abilities such as deduction, induction, observation, credibility, meaning, and assumption identification (Gunawardena & Wilson, 2021; Ennis et al., 2005; Verburgh et al., 2013). The CCTT is a domain-general instrument, the results are independent of domain-specific knowledge.

The CCTT Level Z is a widely used instrument for the measurement of students' critical thinking in educational, cognitive psychology studies (Bataineh, & Zghoul, 2006; Beavers et al., 2017; Frost et al., 2019; Heidari, 2020; Kusumoto, 2018; Saud, 2020). However, there is a lack of empirical studies in the literature investigating the factorial structure of the CCTT Level Z. The instrument contains seven subtests: deduction, meaning and fallacies, observation and credibility of sources, induction: hypothesis testing, induction: planning experiments, definition, and assumption identification. As seen in the enumeration above, the induction ability is composed of two subscales. The test measures the application of induction in hypothesis testing and planning experiments. Similarly, the test contains two sections for the measurement of assumption identification ability (Ennis et al., 2005). The test authors emphasize the interdependency and overlap of the measured cognitive abilities. Due to the reduced number of items assessing the separate cognitive abilities, the test authors suggest taking into consideration the total score for concluding individual differences in critical thinking. In the manual of the Cornell Critical Thinking Test, the reliability results of the instrument regarding undergraduate and graduate student samples are reported. The Kuder-Richardson reliabilities ranged between .50 and .76, and the split-half reliabilities were between .49 and .80 (Ennis et al., 2005; Verburgh et al., 2013).

### *1.3. The aims of the study*

The main aim of the study was the translation into Hungarian language of the first instrument that measures the critical thinking abilities of high school students, gifted students, and adults. Due to the lack of earlier studies investigating the factorial structure of the Cornell Critical Thinking Test Level Z, based on the recommendations of the authors of the test (Ennis et al., 2005), besides the unidimensional model, our aim was to test and compare several correlated and hierarchical factorial models (two-factor models: deductive reasoning, inductive reasoning; three-factor models: deduction, induction, meaning and fallacies; four-factor models: deduction, induction, meaning and fallacies, assumption identification) translated into Hungarian language. Our further aim was the invariance testing of the CCTT across genders.

## 2. METHODS

### *2.1. Participants*

825 Hungarian-speaking undergraduate students from Babeş-Bolyai University participated in the study. The participants had given their written consent to voluntary participation in the research and the anonymous use of their data. There were no multiple outliers identified, based on the Mahalanobis distance. 78.3% of the participants were females, with a mean age of 21.76 years (SD = 7.12). The youngest person was 18, and the oldest was 64 years old. The majority of participants were first-year (85%), 13.9% of them were third year and only 1.1% of the participants were second-year undergraduate students. 86.7% of the participants were full-time students, and 42.2% of them studied at the Faculty of Psychology and Educational Sciences. The detailed Faculty distribution of the participants is presented in Table 1.

**Table 1.** *Faculty-based distribution of the participants*

| Faculty | N | % |
|---|---|---|
| Psychology and Educational Sciences | 348 | 42.2 |
| Geography | 70 | 8.5 |
| Mathematics and Computer Science | 68 | 8.2 |
| Physical Education and Sport | 62 | 7.5 |
| Letters / Humanities | 58 | 7.0 |
| Biology and Geology | 40 | 4.8 |
| Reformed Theology and Music | 32 | 3.9 |

| Faculty | N | % |
|---|---|---|
| Sociology and Social Work | 30 | 3.6 |
| History and Philosophy | 29 | 3.5 |
| Chemistry and Chemical Engineering | 21 | 2.5 |
| Political, Administrative and Communication Sciences | 19 | 2.3 |
| Economics and Business Administration | 19 | 2.3 |
| Physics | 9 | 1.1 |
| Theatre and Film | 7 | .8 |
| Law | 6 | .7 |
| Roman Catholic Theology | 4 | .5 |
| Environmental Science and Engineering | 3 | .4 |

### *2.2. Instrument*

The Cornell Critical Thinking Test Level Z was applied for the measurement of students' higher-order thinking abilities (Ennis et al., 2005). The CCTT contains 52 items and seven sections: deduction (1-10), meaning and fallacies (11-21), observation and credibility of sources (22-25), induction (Hypothesis Testing) (26-38), induction (Planning Experiments) (39-42), definition and assumption identification (43-46), assumption identification (47-52). The CCTT is a multiple-choice test, has a forced-choice question format, and dichotomously scored items, the answer for an item can be correct or incorrect. The retranslation method was applied for the translation of the instrument into Hungarian language, executed by two experts. The participation in the study was preceded by the informed consent of the participants, the test was completed in Google Forms.

### *2.3. Data analysis*

For the CFA analysis, we applied the Mplus version 8.7 with weighted least squares, mean, and variance-adjusted estimation (WLSMV; Muthén et al., 1997; Muthén & Muthén, 2021). The following absolute fit indices were used to evaluate model-data fit: Chi-squared, Root Mean Squared Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR). Some relative fit indices, like the Comparative Fit Index (CFI), and Tucker-Lewis Index (TLI) were also applied. Acceptable model-data fit criteria included CFI > 0.90, TLI > 0.90, RMSEA < 0.05, SRMR < 0.08 (Awang, 2012; Hu & Bentler, 1999; Kline, 2015), while models having CFI and TLI values greater than .95 indicate excellent fit (Hu & Bentler, 1999; Kline, 2015). The relative fit of the alternative factor structures was compared based on the difference between CFI values. Post hoc inspection was

conducted on the best-fitting model, and the following item retention criteria were applied: items with significant factor loadings and items with factor loadings ≥ 0.32 (Costello & Osborne, 2005; Leach et al., 2020).

We also tested measurement invariance across genders with Muthén's (2013) two-step procedure for dichotomous data (Leach et al., 2020). We have tested configural and scalar invariance models because metric invariance testing is not allowed for binary variables. The configural model was applied to determine if the four-factor structure existed across the two groups, without applying equality constraints. In the scalar invariance model, the factor loadings and intercepts were constrained as equal across groups (Leach et al., 2020; Muthén, 2013; Muthén & Muthén, 2017). Due to our relatively large sample size and the sensitivity of the absolute $\Delta\chi 2$ to sample size, ΔRMSEA and ΔSRMR were used for testing the change in model fit, values < .015 and < .01 indicated no difference between the models (Chen, 2007; Meade et al., 2008).

## 3. RESULTS

The descriptive statistics of the *CCTT Level Z* items are presented in Table 2. Item means varied substantially with values ranging from .11 (Item 18) to .80 (Item 8), and standard deviations ranged from .30 (Item 18) to .50 (Items 4 and 29). These values reveal that several items were very difficult (e.g., Items 12, 18, 32, 37), while other items were easier (e.g., Items 2, 8, 17, 26, 46).

**Table 2.** Means and Standard Deviations of CCTT level Z Hungarian version items

| Item | *M* | *SD* | Item | *M* | *SD* |
|---|---|---|---|---|---|
| 1 | .45 | .49 | 27 | .58 | .49 |
| 2 | .74 | .43 | 28 | .72 | .45 |
| 3 | .30 | .45 | 29 | .51 | .50 |
| 4 | .50 | .50 | 30 | .45 | .49 |
| 5 | .65 | .47 | 31 | .27 | .44 |
| 6 | .42 | .49 | 32 | .12 | .32 |
| 7 | .40 | .49 | 33 | .64 | .48 |
| 8 | .80 | .40 | 34 | .64 | .47 |
| 9 | .37 | .48 | 35 | .40 | .49 |
| 10 | .73 | .44 | 36 | .56 | .49 |
| 11 | .60 | .49 | 37 | .15 | .36 |
| 12 | .15 | .35 | 38 | .36 | .48 |

| Item | *M* | *SD* | Item | *M* | *SD* |
|---|---|---|---|---|---|
| 13 | .30 | .45 | 39 | .32 | .46 |
| 14 | .16 | .36 | 40 | .46 | .49 |
| 15 | .28 | .45 | 41 | .35 | .47 |
| 16 | .28 | .44 | 42 | .53 | .49 |
| 17 | .74 | .44 | 43 | .39 | .48 |
| 18 | .11 | .30 | 44 | .57 | .49 |
| 19 | .25 | .43 | 45 | .36 | .47 |
| 20 | .16 | .36 | 46 | .79 | .40 |
| 21 | .17 | .38 | 47 | .51 | .50 |
| 22 | .31 | .46 | 48 | .58 | .49 |
| 23 | .43 | .49 | 49 | .72 | .44 |
| 24 | .46 | .49 | 50 | .61 | .48 |
| 25 | .36 | .48 | 51 | .43 | .49 |
| 26 | .74 | .43 | 52 | .27 | .44 |

### *3.1. The comparison of several factorial structures of the CCTT Level Z in Hungarian*

Based on the recommendations of the test authors (Ennis et al., 2005), beside the unidimensional model, several correlated and hierarchical models [(two-factor models: deductive reasoning (Items 1-25, 43-52), inductive reasoning (Items 26-42); three-factor models: deduction (Items 1-10, 43-52), meaning and fallacies (Items 11-21), induction (Items 26-42); four-factor models: deduction (Items 1-10), meaning and fallacies (Items 11-21), induction (Items 26-42), assumptions (43-52)] were also tested. The analysis of the observation and credibility of sources as a discrete factor and the items belonging to this factor were excluded from the CFA analysis due to the insignificant factor loadings of all four items and negative covariances, residual variances with other latent variables. Due to the overparameterized factor structure, negative covariances, and residual variances, the items belonging to the induction-hypothesis testing and induction-planning experiments subscales were treated as the induction factor, similarly, the definition-assumption identification and assumption identification subscales were also treated as a single factor. The results of the tested CFA models are presented in Table 3.

**Table 3.** Goodness of fit statistics of the tested CFA models

| Model | $\chi 2$ | df | p | RMSEA | 90% CI | | SRMR | CFI | TLI |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | LI | UI | | | |
| Unidimensional | 1557.576 | 1267 | <.001 | .017 | .014 | .019 | .064 | .860 | .854 |
| Two-factor correlated | 1508.969 | 1266 | <.001 | .015 | .012 | .018 | .063 | .883 | .877 |
| Two-factor second-order | 1508.969 | 1266 | <.001 | .015 | .012 | .018 | .063 | .883 | .877 |
| Three-factor correlated | 1255.214 | 1071 | <.001 | .014 | .011 | .018 | .062 | .906 | .901 |
| Three-factor second-order | 1255.214 | 1071 | <.001 | .014 | .011 | .018 | .062 | .906 | .901 |
| Four-factor correlated | 1247.415 | 1068 | <.001 | .014 | .010 | .018 | .061 | .909 | .904 |
| Four-factor second-order | 1248.971 | 1070 | <.001 | .014 | .010 | .018 | .061 | .909 | .904 |
| Four-factor second-order abbreviated model | 259.309 | 203 | .005 | .018 | .011 | .025 | .056 | .967 | .963 |

The CFA results of the tested models revealed that the four-factor correlated [$\chi 2$ (1068) = 1247.415, CFI = .909, TLI = .904, RMSEA = .014, SRMR = .061] and the four-factor second order models [$\chi 2$ (1070) = 1248.971, CFI = .909, TLI = .904, RMSEA = .014, SRMR = .061] exceeded the minimum criteria for acceptable model fit on the majority of fit indices (Awang, 2012; Hu & Bentler, 1999; Kline, 2015).

### *3.2. The abbreviated Hungarian version of the CCTT Level Z*

Due to the very similar statistical fit indices of the two four-factor models, for post hoc inspection the second-order four-factor model was chosen based on the theoretical approach of the test developers, who suggest the interpretation of critical thinking as a construct involving subfactors (Ennis et al., 2005). Based on the post hoc inspection of the four-factor second-order model, items loaded insignificantly to the deduction factor (3, 4) were not retained. Similarly, three items were identified (13, 15, 19) that were not loaded significantly to the meaning and fallacies factor, two items with insignificant factor loadings to the induction factor (39, 40), and one item (43) that loaded insignificantly to the assumption identification factor. Within the deduction subfactor five items were identified, (1, 2, 6, 9, 10) within the meaning and fallacies subfactor five items (12, 14, 16, 20, 21), within the induction subfactor five items (31, 35, 38, 41, 42), and within the assumptions subfactor four items (44, 45, 51, 52) with factor loadings < .32. After the exclusion of items with

insignificant and lower than .32 factor loadings (Costello, & Osborne, 2005; Leach et al., 2020), the abbreviated version of the test included 22 items, three items (5, 7, 8) loaded significantly to the deduction factor, four items (11, 17, 18, 20) to the meaning and fallacies factor, ten items (26, 27, 28, 29, 30, 32, 33, 34, 36, 37) to the induction factor and five items (46, 47, 48, 49, 50) to the assumption identification factor. The abbreviated 22-item four-factor second-order model indicated excellent fit indices [$\chi 2$ (203) = 259.309, CFI = .967, TLI = .963, RMSEA = .018, SRMR = .056]. The factor loadings of the abbreviated model are presented in Table 4.

**Table 4.** Standardized factor loadings of the abbreviated Hungarian 22-item four-factor second order model

| Item | Factor | Standardized | | |
|---|---|---|---|---|
| | | Estimate | SE | RV |
| 5 | Deduction | .417 | .062 | .826 |
| 7 | Deduction | .332 | .060 | .890 |
| 8 | Deduction | .576 | .069 | .669 |
| 11 | Meaning and fallacies | .429 | .060 | .816 |
| 17 | Meaning and fallacies | .456 | .067 | .792 |
| 18 | Meaning and fallacies | -.370 | .082 | .863 |
| 20 | Meaning and fallacies | -.341 | .074 | .884 |
| 26 | Induction | .485 | .050 | .765 |
| 27 | Induction | .567 | .048 | .678 |
| 28 | Induction | .668 | .045 | .554 |
| 29 | Induction | .403 | .050 | .837 |
| 30 | Induction | .578 | .048 | .666 |
| 32 | Induction | -.371 | .063 | .862 |
| 33 | Induction | .322 | .054 | .897 |
| 34 | Induction | .535 | .048 | .714 |
| 36 | Induction | .506 | .049 | .744 |
| 37 | Induction | -.407 | .064 | .834 |
| 46 | Assumption identification | .631 | .057 | .601 |
| 47 | Assumption identification | .343 | .056 | .883 |
| 48 | Assumption identification | .340 | .056 | .885 |
| 49 | Assumption identification | .514 | .056 | .735 |
| 50 | Assumption identification | .616 | .053 | .621 |

*Notes*. SE = Standard Error; RV = residual variance

Table 5 presents the descriptive statistics of the abbreviated 22-item four-factor second-order model.

**Table 5.** Descriptive statistics of the CCTT level Z Hungarian version

| Factor | *M* | *SD* | *Min.* | *Max.* |
|---|---|---|---|---|
| Deduction | 1.85 | .86 | 0 | 3 |
| Meaning and fallacies | 1.59 | .77 | 0 | 4 |
| Induction | 5.11 | 2.00 | 0 | 9 |
| Assumption identification | 3.21 | 1.30 | 0 | 5 |
| Total critical thinking | 11.77 | 3.23 | 2 | 19 |

The internal consistency of the 22-item Hungarian version of the test was acceptable (α = .601).

### *3.3. Measurement invariance across genders of the Hungarian version of the CCTT level Z*

Measurement invariance across genders (males and females) of the 22-item abbreviated version of the Cornell Critical Thinking Test Level Z was tested using configural and scalar models. The models showed acceptable model fit indices for both genders at every level of invariance. The configural model indicated the 22-item four-factor structure for males and females. The scalar model indicated that item loadings onto the factors and item intercepts are similar across gender groups. The changes in fit indices (ΔCFI and ΔRMSEA) indicated no significant differences in relative model fit between the configural and the restrictive model, which confirms the configural and scalar invariance of the instrument across genders. Table 6 presents the fit indices for configural and scalar invariance models across genders for the 22-item solution.

**Table 6.** Results of Measurement Invariance between genders ($n_{females}$= 645; $n_{males}$ = 179)

| Model | $\chi 2$ (df) | $\Delta\chi 2$ | CFI | ΔCFI | RMSEA | 90% CI | ΔRMSEA |
|---|---|---|---|---|---|---|---|
| Configural | 450.724 (402)* | 15.341 | .968 | .001 | .017 | .002 - .025 | < .001 |
| Scalar | 466.065 (416)* | | .967 | | .017 | .003 - .025 | |

*Notes*. * $p < .05$.

## 4. DISCUSSION

The main aim of the study was the translation into Hungarian and the investigation of the factorial structure of the CCTT Level Z with confirmatory factor analysis. Due to the lack of studies investigating the factorial structure of the test, we analyzed several factorial models (unidimensional, two-factor correlated, two-factor hierarchical, three-factor correlated, three-factor hierarchical, four-factor correlated and four-factor hierarchical) based on the recommendations of the test authors (Ennis et al., 2005).

The results of the CFAs indicated that the four-factor correlated, and the four-factor hierarchical models exceeded our criteria for acceptable model fit, except for the $\chi 2$ indicator (Awang, 2012; Hu & Bentler, 1999; Kline, 2015). Post hoc inspection was also conducted for the detection of insignificantly loading items to the factors and for the exclusion of items with factor loadings ≥ 0.32 (Costello, & Osborne, 2005; Leach et al., 2020). From the two four-factor models (including the induction, meaning and fallacies, deduction, and assumption identification factors), the second-order model was chosen for post hoc inspection, based on the theoretical framework of the test authors (Ennis et al., 2005), who defined critical thinking as a higher order cognitive construct including different critical thinking abilities. The abbreviated 22-item four-factor second-order Hungarian version of the CCTT exceeded our criteria for excellent model fit (Hu, & Bentler, 1999; Kline, 2015).

The internal consistency of the shortened version of the test is similar to the findings of test authors (Ennis et al., 2005), who examined the CCTT's internal consistency in the case of several undergraduate and graduate samples, revealing Kuder-Richardson reliabilities between .50 and .76. The current internal consistency indicator (.601) exceeds the reliability of the original version of CCTT applied in the study of Verburgh et al. (2013), who found a lower Cronbach alpha indicator (.52) in the case of Belgian Educational Science students.

The results regarding the measurement invariance test of the 22-item Hungarian version of the CCTT indicated configural and scalar invariance across genders, with the two tested models having acceptable fit indices for both the male and female groups. The configural model demonstrated the 22-item four-factor structure for both genders, and the scalar model showed that item loadings and item intercepts are similar across the two gender groups.

Based on our results, the 22-item four-factor second-order version of CCTT is reliably applicable in the case of Hungarian-speaking undergraduate students. Our findings support the approach of the test developers concerning the interpretation of the results (Ennis et al., 2005), indicating the presence of a general factor that can be used for the comparison of the critical thinking of

students, adults from different groups; but also highlight the existence of different cognitive abilities (deduction, meaning and fallacies, induction, assumption identification) within critical thinking that can be interpreted separately in the case of Hungarian-speaking students population.

This is the first study that aimed at the comparison of different factorial structures of the CCTT level Z. Similarly, there is a lack of instruments in Hungarian language measuring students' and adults' critical thinking. The results of this study, the translated and validated Hungarian version of the CCTT level Z, are very important for the empirical measurement of critical thinking skills in education, and in different work environments. The empirical measurement of students' critical thinking provides information about their level of thinking skills and promotes the identification of those skills that require further development in the educational context.

### *4.1. Limitations and future directions*

One of the limitations of our study is that the instrument was applied only to Hungarian-speaking undergraduate students, so our results cannot be generalized to Romanian-speaking and other language-speaking students. Our further aim is the application of the test and the investigation of its factorial structure on other undergraduate student samples, including other universities, the translation and validation of the test into Romanian, besides the Hungarian language version to increase the generalizability of the results and the literature regarding the CCTT's internal consistency and its factorial structure.

Another limitation of the study is a consequence of the convenience sampling method, that is the unequal distribution of participants based on their socio-demographic characteristics. The majority of participants were first-year undergraduate females, who studied at the Faculty of Psychology and Educational Sciences, so the social science academic discipline was overrepresented compared to other academic disciplines, like humanities, natural sciences, sports, and arts. In the future, it would be meritorious to apply the cluster sampling method for the equal representation of students based on gender, academic discipline, and academic year. Additionally, our aim is the application of the CCTT to master students, besides undergraduate students.

It is very important to continue to analyze the psychometric properties, validity, and reliability of the test on different samples, due to the reduced number of studies providing empirical evidence regarding these characteristics of the CCTT level Z. The measurement invariance of the test across genders was conducted on an unequally distributed gender sample, the number of female

participants was almost four times higher than that of male participants. Future studies should focus on the analysis of the measurement invariance of the test across genders on samples with balanced gender distribution. It would also be worth to assess the test's measurement invariance across other important socio-demographic (e.g. age, parents' educational level) and academic variables (e.g. academic achievement, earlier academic degree, academic discipline) of students that could influence their critical thinking level, and the factorial structure of the test could change across different groups of students.

## 5. CONCLUSION

The CCTT is an extensively used instrument for the measurement of critical thinking in different psychological areas, but there is a lack of earlier studies in the literature investigating its factorial structure and reliability. Due to the questionable factorial structure of the test and the absence of instruments assessing adults' critical thinking abilities, the aim of the current study was the translation of the test into Hungarian language and the analysis of different factorial structures proposed by the test developers (Ennis et al., 2005). Comparing the unidimensional model with different correlated and hierarchical factorial structures, our results revealed that the four-factor structure of the test, including four higher-order cognitive abilities within the general critical thinking factor, namely the deduction, meaning and fallacies, induction and assumption identification factors, is the most applicable, reliable and valid model for the measurement of the level of critical thinking of undergraduate Hungarian-speaking students. Post hoc inspection of the four-factor second-order structure indicated a 22-item shortened version of the test with excellent fit indices.

Additionally, invariance testing of the instrument across genders was conducted. The results revealed configural and scalar invariance across genders of the 22-item four-factor structure Hungarian version of the CCTT, confirming that the test has similar factorial structure, item loadings, and intercepts in the case of both male and female groups. The internal consistency of the abbreviated test is similar to other results regarding the reliability of the test (Ennis et al., 2005; Verburgh et al., 2013).

Based on the limitations of the study, for future research it is recommended to evaluate the factorial structure and reliability of the instrument on older master students, on samples with balanced gender, academic discipline, and academic year distribution, replacing the convenience sampling method with the cluster one. Similarly, it would be beneficial to translate and validate the test into other

languages, its measurement invariance analysis between groups formed based on socio-demographic and academic characteristics of students, to complete the literature with additional results regarding the factorial structure and the reliability of the test.

***Statements and declarations. Declaration of competing interest.*** None.

***Contributions.*** All authors contributed substantially to the study and approved the submitted version.

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# Executive Functions in Clinical and Non-Clinical Populations. A Comparative Analysis

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**ABSTRACT.** The primary aim of the study was to assess and compare executive functions in psychiatric inpatients (n=65) with those of a matched control group of healthy individuals (n=65). Both cohorts underwent rigorous evaluation using neuropsychological performance-based tests and self-assessment scales. Findings indicated a superior performance by the control group in both self-assessed and computerized evaluations. Notably, there was an absence of correlation between results from the performance-based test (Corsi) and self-assessments of executive function. Subsequent analysis focusing on primary diagnostic categories highlighted that patients diagnosed with depression consistently undervalued their performance in the self-assessment as opposed to the objective, computer-based evaluations. This undervaluation was observed across total scores and individual subscales. In contrast, patients diagnosed with alcohol dependence exhibited a tendency to overestimate their performance in self-assessments relative to the objective tests. The study investigates the causes of these observed differences and considers their implications for subsequent research and clinical practices.

**Keywords:** executive functions, performance-based measurements, self-assessment scales, depression, alcohol dependency.

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## INTRODUCTION

Executive Functions (EF) is one of the most invoked constructs in cognitive sciences, and there is no consensus concerning definition and measurement of EF. The definition of EF has evolved and changed over time, one of the most quoted definitions in the literature is the one given by Barkley (2014): EF represent a set of self-regulating processes that help us achieve our goals, often in a social context (Barkley, 2014). The concept of EF is a meta construct that involves several mental processes or abilities that interact and jointly contribute to EF. Dysfunctions in one module can affect EF in different ways compared to dysfunctions in other modules, highlighting the complexity and multifactorial nature of these cognitive functions. According to Barkley (2014), the components of EF include self-directed attention (monitoring), inhibition, working memory (nonverbal - especially visual images and verbal working memory), planning, and problem-solving. The operationalization and quantification of executive functions remain pivotal concerns, influencing the conclusions drawn regarding these cognitive competencies. Procedures used in studies for operationalizing EF in clinical environments use performance-based tests or self-assessment scales. Performance-based ones involve standardized procedures that are administered by an examiner and usually evaluate accuracy and/or response time. EF evaluation can also be done through self-assessment scales. The purpose of this study was to examine the relationship between these two types of EF measurements, and to compare them with similar assessments in the non-clinical population. The aim of the study is to provide clinicians with a theoretically and empirically grounded perspective for the use of these evaluations in the context of a clinical assessment.

Conventional measurement of EF has been based on cognitive performance tests (Pennington & Ozonoff, 1996). Performance-based tests are administered under extremely standardized conditions. Stimulus presentation is carefully controlled so that each examinee experiences and completes the task in exactly the same way as everyone else. Additionally, performance measures usually rely on response accuracy, response time, and/or rapid response under a time constraint (Toplak, West, & Stanovich, 2013).

Thus, performance tests are administered under standardized conditions with a single examiner who provides specific feedback or direct recommendations to the examinee to guide performance. Accuracy and response time are the dependent values of these tests.

Self-assessment scales have been developed to provide a valid ecological indicator of executive functioning in complex, everyday problem-solving situations (Roth, Isquith, & Gioia, 2005). The assumption behind the use of these self-

assessment scales is that they measure behaviours that are related to processes that are assessed through performance tests of EF (Toplak, West, & Stanovich, 2013).

If computerized tests and self-reporting tests evaluate the same general construct, then these measures should show a strong and positive correlation. That is, high competence measured by computerized tests should be associated with high competence on self-assessment scales. From an operationalization perspective, the two types of measurements differ in how they are administered and scored. Toplak and colleagues (2013) performed a literature analysis on the correlation between the two types of assessments and concluded that they are only minimally correlated. The authors argue that the two types of measurements evaluate different aspects of cognitive and behavioural functioning, which independently contribute to clinical problems. According to the authors, the algorithmic level refers to mental processes that occur automatically and are often outside conscious control. These processes are efficient, quick, and rely on pre-set mental algorithms. The reflective level refers to mental processes that are consciously controlled and involve deliberation and reflection. These processes are slower, but allow for greater flexibility and adaptability.

Performance tests, which evaluate aspects such as inhibition and attention, can be seen as the equivalent of the algorithmic level, they measure cognitive processes that are often quick and automatic. On the other hand, EF self-assessment can be seen as the equivalent of the reflective level. This involves reflective processes, which pertain to how a person controls and directs their behaviour in everyday life in order to achieve their goals. Thus, EF self-assessment could capture aspects of executive functioning that are not necessarily highlighted by performance tests, especially those aspects that involve conscious and directed control of behaviour. Only self-assessment scales measure rational control, which relate to behaviour in the real environment, and which serves to achieve a goal. Performance tests are often used to evaluate EF and can be very efficient in measuring certain aspects of these, for example, inhibition. However, performance tests may not fully address EF aspects such as rational pursuit of goals and they may not fully capture the complexity and variety of these functions, especially when it comes to efficient planning and pursuit of goals (Toplak et al., 2013).

In conclusion, numerous studies have shown that the relationship between self-reported questionnaires and objective, performance-based tests of EF is weak and often non-existent (Bogod, Mateer, & MacDonald, 2003; Burgess, Alderman, Evans, Emslie, & Wilson, 1998; Nęcka, Lech, Sobczyk, & Śmieja, 2012; Wingo, Kalkut, Tuminello, AsConape, & Han, 2013). Factors that may contribute to this lack of association include differences in abilities

measured by these methods, self-reports influenced by personality traits (for example, healthy individuals with higher levels of neuroticism tend to report more dysfunction), and, for clinical populations, a lack of insight, which itself results from psychopathology (Goldberg, 2017).

Several neurological and psychiatric disorders have been linked to difficulties with executive functions. These include: traumatic brain injuries (Labudda et al., 2009), schizophrenia (Nakamura et al., 2008), substance abuse (Barry & Petry, 2008), obsessive-compulsive disorder (Lawrence et al., 2006), psychopathy (Mahmut, Homewood, & Stevenson, 2008), attention-deficit/ hyperactivity disorder (Toplak, Jain, & Tannock, 2005), and pathological gambling (Toplak, Liu, MacPherson, Toneatto, & Stanovich, 2007).

Research on the elderly population has demonstrated that older adults with depression and executive dysfunction might have a less favourable response to antidepressant therapy. The specific elements of this complex construct that contribute to a poorly response to medication is not yet fully understood. Pimontel and colleagues (2016) conducted a meta-analysis to determine whether executive dysfunction is a predictive factor for a diminished treatment response in geriatric depression, and to identify which specific areas of executive functions play a role in this correlation. The findings indicated a significant association between diminished treatment response and problems with planning and organization. Uncovering the factors that could help predict a patient's likelihood of having a poor reaction to medication could enhance our understanding of the physiological mechanisms involved in treatment response, and could potentially guide the development of individualized treatment strategies. Moreover, this understanding could be beneficial for clinicians in predicting the likely outcomes of treatment for depressed patients, and in making informed decisions about future therapeutic approaches (McLennan & Mathias, 2010).

Gustavson and colleagues (2016) found that patients over 65 with depression and executive dysfunction who received problem-solving therapy exhibited a reduction in suicidal ideation compared to those who received supportive therapy, both during the treatment and 24 weeks later. Given the decrease in suicidal ideation and other positive outcomes associated with problem-solving therapy for patients with executive dysfunctions, mental health professionals are encouraged to consider this therapy when deciding on the treatment course for older individuals suffering from depression and executive dysfunctions (Gustavson et al., 2016).

In conclusion, the measurement of EF in clinical settings is very important, given their role in various neurological and psychiatric conditions. The proper assessment of EFs can provide critical information about the patients' cognitive abilities, can also predict treatment outcomes, guide therapeutic approaches.

Given the findings of previous studies on clinical and non-clinical populations, the primary aim of this study is to assess executive functions through performance tests and self-assessment scales in patients with psychopathology, in an ecological setting - during hospitalization and medication. These results will be compared with those from the non-clinical population.

### *Hypotheses*

There is a positive relationship between evaluations of executive functions through performance tests and self-assessment scales. In other words, we expect the results from performance tests and self-assessment scales to correlate positively, hence achieving significant and positive correlations between the BDEFS scale and the Corsi and Stroop tests, and a significant negative correlation between the BDEFS scale and the RT Choice test (where a high score implies better performance).

There is a significant difference in executive functions between clinical patients, in conditions of hospitalization and medication, for both types of evaluations - performance tests and self-assessment scales, compared to the non-clinical population. We expect the clinical population to exhibit a deficit in executive functions.

There is no significant difference in executive functions between the depression group and the alcohol dependence group for both types of evaluations - performance tests and self-assessment scales. We expect people with alcohol dependence to show a similar deficit in executive functions as people with depression.

## METHOD

### *Participants*

The participants in the clinical group (n=65) were recruited from the Psychiatry Clinic of the Municipal Clinical Hospital in Cluj-Napoca, Romania, and they were in-patients at the time of the study. In the clinical cohort, there were 32 females (49.2%) and 33 males (50.8%), ranging in age from 23 to 73 years, with a mean age of 51.25 years, *SD*=9.82, with diagnoses of recurrent depressive disorder, alcohol dependence, generalized anxiety disorder, bipolar affective disorder - manic episode, somatization disorder, organic delusional disorder. From a socio-demographic point of view, 13.8% of participants had higher education, the majority come from urban areas (58.5%), were married

or in a relationship (70.7%) and all were under psychiatric treatment. The participants' medication belonged from the following classes: benzodiazepines, SNRI antidepressants, SSRI antidepressants, tricyclic antidepressants, other antidepressants, anxiolytics, antiepileptics, barbiturates, antipsychotics, hypnotics and sedatives, systemic antihistamines and/or metabolism of nerve cells and blood circulation in the brain. After obtaining informed consent, they were tested during their hospitalization period.

The non-clinical sample (n=65) was randomly drawn from a larger sample of the general population (non-clinical). This group comprised 32 females (49.2%) and 33 males (50.8%), with ages ranging from 24 to 75 years and a mean age of 50.55 years, *SD*=9.88. None of these participants had a history of psychiatric conditions or a current diagnosis. Individuals from the non-clinical sample were matched for gender and age with those from the clinical sample. From a socio-demographic perspective, 87.8% of participants had higher education, the majority come from urban areas (86.2%), were employed (50.8%) or were entrepreneurs (32.3%), and without current or prior psychiatric treatment.

### *Instruments / Materials*

The study collected demographic data such as age, educational level, marital status, education level, occupation, rural / urban environment, and socio-economic status. Medical data were also collected, including treatment for various somatic diseases, neurological or neurocognitive diagnosis, psychiatric diagnosis, medication treatment, and substance use.

Executive functions were measured through performance tests (neuropsychological tests) and a self-assessment scale, presented below.

**The Barkley Deficits in Executive Functioning Scale" long form (BDEFS-LF)**, developed by Russell A. Barkley and published by Guilford in 2011, is a self-assessment tool that can be used to test adults aged between 18 and 81 years old, and it evaluates the cognitive and behavioural manifestations of executive dysfunction. BDEFS-LF assesses those neuropsychological abilities that support and contribute to self-regulation over time, oriented towards the future: self-management to time, self-organization/problem-solving, self-restraint (inhibition), self-motivation, and self-regulation of emotions. The BDEFS scale is a theoretically and empirically well-founded instrument for evaluating the dimensions of adult executive functioning in everyday life. Evidence indicates that the BDEFS scale is much more predictive for deficits in major life aspects than performance tests that measure executive functions. BDEFS is a self-assessment tool organized on several sub-domains or factors (Barkley et al.,

2022). The BDEFS scale has been translated and adapted into Romanian by the company Cognitrom, and has been standardized for the Romanian population. The BDEFS scale has good psychometric properties (reliability, validity), and is useful in evaluating the dimensions of EF in daily activities. In the test manual, Barkley (2011) reported a Cronbach's alpha coefficient of internal consistency >0.91, based on a more representative sample from the USA. The BDEFS manual adapted for the Romanian population reports the internal consistency of each BDEFS-LF subscale (Cronbach's alpha coefficient), which proved to be satisfactory: Self-management to time, αCronbach=0.949; Self-organization/Problem-solving, αCronbach =0.958; Self-restraint, αCronbach =0.930; Self-motivation, αCronbach =0.914; and Emotion self-regulation, αCronbach =0.946.

**The Corsi Test (Traditional Corsi Block-Tapping Test, t-Corsi)** was initially developed by Philip Michael Corsi (1972) as part of his doctoral thesis. The task assesses visuospatial working memory and has been used for evaluating cognitive deficits in the field of neuropsychiatry, on patients with Korsakoff Syndrome, Alzheimer's disease, Huntington's disease, schizophrenia, and neurological disorders (Berch, Krikorian & Huha, 1998). The test was developed based on Baddeley's model and evaluates the visuospatial component of working memory. The task used in the study was developed by Cognitrom Company based on validated specifications from the specialized literature (Berch, Krikorian & Huha, 1998; Fischer, 2001).

**The classic STROOP Test (TIC-S)**, designed by Stroop (1935), is a widely used neuropsychological test for both experimental and clinical purposes. It evaluates the ability to inhibit cognitive interference that occurs when processing one characteristic of a stimulus affects the simultaneous processing of another attribute of the same stimulus, i.e., the ability to inhibit competing responses in the presence of evident contradictory information (Scarpina & Tagini, 2017). The Interference Test evaluates the extent to which a person is capable of suppressing internal or external stimuli, irrelevant to the task at hand, that initiate an automatic cognitive or behavioural response and can affect the provision of an adequate or necessary response.

**Choice RT Test - RTC** (reaction time) has been defined as the time in milliseconds from the presentation of the stimulus to a recorded response. There are many types of RT tasks such as simple reaction time, which refers to the time needed to respond to a single stimulus and only one response option is available. SRT does not require substantial cognitive effort; it is sufficient for the tested person to simply indicate that the stimulus is perceived (Johnson & Deary, 2011). Choice RT tasks (RTC) assume minimal processing of informational content. For example, in a four-choice RT task, arrows can appear up, down, left

or right, and the corresponding arrow must be chosen from the keyboard (Johnson & Deary, 2011), or the person must give a response that corresponds to the stimulus, such as pressing a key corresponding to a letter if the letter appears on the screen (Kosinski, 2013).

## DESIGN

This study employs a correlational and comparative design, conducted in an ecological environment, using a natural situation to analyse EF in patients hospitalized in a psychiatric unit. The objective was to understand the relationship between different measures of EF as variables, as well as to compare the mean scores between the psychiatric patient group and the control group.

### *Procedure*

After the recruitment procedure, the participants took part in a meeting with the researcher. This took place at the premises of the Psychiatry Clinic, as they were hospitalized. The first part of the study involved the computerized evaluation and then the completion of the self-assessment scale. The computerized testing was performed individually, under the same conditions for all participants, receiving the same instructions, in a quiet room, alone with the experimenter. The environment was controlled regarding the testing time, control of distractors, brightness, noise, the presence of other devices in the testing room. First, the computerized testing was performed, namely the Stroop, Corsi, and RT Choice tests, then the BDEFS-LF test and demographic data questionnaires were handed over to be completed later. Information about the medical treatment was taken from the hospital record.

### *Data analysis*

Descriptive statistical methods were used for demographic data analysis: averages, frequencies. The statistical analysis was done using the SPSS version 26 program, one-way analysis of variance (one-way ANOVA), checking the assumptions of the Levene test for homogeneity of variances, followed by post-hoc comparisons using the Games-Howell test, where the assumption of homogeneity of variances was not met. Significant effects were reported at the traditional level of significance ($p < .05$) (Field, 2017).

## RESULTS

To compare the two large groups (clinical vs. non-clinical), a one-way ANOVA analysis was performed. The analysis did not require the testing of variance homogeneity as comparisons were made between two groups, so wherever the variance analysis was significant, it means that significant differences between groups were obtained, and further post-hoc analysis was not necessary. There was a significant effect of psychopathology on: the final Corsi score at the level of $p<.05$ [$F(1, 128) = 54.98$, $p < 0.001$]; Corsi forward score [$F(1, 128) = 50.74$, $p < 0.001$]; Corsi backward score [$F(1, 128) = 37.54$, $p < 0.001$]; total BDEFS score [$F(1, 128) = 43.35$, $p < 0.001$]; and on the symptom count scale [$F(1, 128) = 33.90$, $p < 0.001$] (Table 1).

**Table 1.** One-way ANOVA analysis

| | | df | Mean Square | F | *p*. |
|---|---|---|---|---|---|
| corsi score final | **Between Groups** | **1** | **88,069** | **54,98** | **<0,001** |
| | Within Groups | 128 | 1,602 | | |
| | Total | 129 | | | |
| corsi fwd span | **Between Groups** | **1** | **88,069** | **50,74** | **<0,001** |
| | Within Groups | 128 | 1,736 | | |
| | Total | 129 | | | |
| corsi bkwd span | **Between Groups** | **1** | **88,069** | **37,54** | **<0,001** |
| | Within Groups | 128 | 2,346 | | |
| | Total | 129 | | | |
| BDEFS total | **Between Groups** | **1** | **4451,406** | **43,35** | **<0,001** |
| | Within Groups | 128 | 102,687 | | |
| | Total | 129 | | | |
| BDEFS symp count | **Between Groups** | **1** | **581,731** | **33,90** | **<0,001** |
| | Within Groups | 128 | 17,161 | | |
| | Total | 129 | | | |

In the subsequent stages of our analysis, participants belonging to specific diagnostic groups—namely, generalized anxiety disorder, bipolar affective disorder (manic episode), somatization disorder, and organic

delusional disorder—were excluded, due to the limited representation of these categories in our sample. Consequently, our analytical cohort was partitioned into two main subsets: clinical and non-clinical. The clinical subset, comprising 56 patients, was further classified into two salient pathological categories: alcohol dependence, with 30 patients, and depression, with 26 patients. Descriptive statistics associated with performance on the EF tests (BDEFS and CORSI) for the three groups are presented in Table 2, with minimum and maximum scores ranging between 2 and 9, and 20 and 66, for the Corsi test and BDEFS, respectively.

**Table 2**. Descriptive statistics associated with performance on EF tests

| | | Mean | SD | SE | 95% CI | | Min. | Max. |
|---|---|---|---|---|---|---|---|---|
| | | | | | LL | UL | | |
| Corsi final score | non-clinic | 5,48 | 1,05 | 0,131 | 5,2237 | 5,7456 | 2,50 | 7,50 |
| | alcohol | 3,53 | 1,72 | 0,314 | 2,8904 | 4,1762 | 0,00 | 6,00 |
| | depression | 4,35 | 0,87 | 0,170 | 3,9951 | 4,6972 | 2,00 | 6,00 |
| Corsi fwd span | non-clinic | 5,68 | 1,28 | 0,158 | 5,3607 | 5,9931 | 2,00 | 9,00 |
| | alcohol | 3,77 | 1,70 | 0,310 | 3,1336 | 4,3998 | 0,00 | 7,00 |
| | depression | 4,35 | 0,75 | 0,146 | 4,0451 | 4,6472 | 3,00 | 6,00 |
| Corsi bkwd span | non-clinic | 5,29 | 1,06 | 0,131 | 5,0305 | 5,5541 | 3,00 | 8,00 |
| | alcohol | 3,30 | 2,04 | 0,372 | 2,5395 | 4,0605 | 0,00 | 6,00 |
| | depression | 4,35 | 1,29 | 0,254 | 3,8233 | 4,8690 | 0,00 | 6,00 |
| BDEFS total | non-clinic | 28,71 | 7,57 | 0,939 | 26,83 | 30,58 | 20 | 47 |
| | alcohol | 36,36 | 11,71 | 2,138 | 31,99 | 40,73 | 20 | 61 |
| | depression | 43,96 | 11,42 | 2,239 | 39,35 | 48,58 | 21 | 66 |
| BDEFS symp count | non-clinic | 1,35 | 2,27 | 0,281 | 0,79 | 1,92 | 0 | 9 |
| | alcohol | 3,70 | 4,46 | 0,814 | 2,04 | 5,36 | 0 | 14 |
| | depression | 7,12 | 5,54 | 1,087 | 4,88 | 9,36 | 0 | 18 |

To assess the nature of the observed mean differences between the three groups in the two types of EF evaluations, the ANOVA analysis was followed by post-hoc comparisons using the Games-Howell test (Table 3).

**Table 3**. Post-hoc Analysis, Games-Howell test for multiple comparisons

Dependent variable

| corsi final score | a | b | Mean difference (a-b) | SE | *p.* | 95% CI | |
|---|---|---|---|---|---|---|---|
| | | | | | | LL | UL |
| | non-clinic | alcohol | 1.951* | 0.340 | **<0,001** | 1.1222 | 2.7803 |
| | | depression | 1.138* | 0.215 | **<0,001** | 0.6213 | 1.6556 |
| | alcohol | non-clinic | -1.951* | 0.340 | **<0,001** | -2.7803 | -1.1222 |
| | | depression | -0.813 | 0.358 | .070 | -1.6800 | 0.0544 |
| | depression | non-clinic | -1.138* | 0.215 | **<0,001** | -1.6556 | -0.6213 |
| corsi fwd span | | alcohol | 0.813 | 0.358 | .070 | -0.0544 | 1.6800 |
| | non-clinic | alcohol | 1.910* | 0.348 | **<0,001** | 1.0675 | 2.7530 |
| | | depression | 1.331* | 0.215 | **<0,001** | 0.8159 | 1.8457 |
| | alcohol | non-clinic | -1.910* | 0.348 | **<0,001** | -2.7530 | -1.0675 |
| | | depression | -0.579 | 0.342 | .220 | -1.4119 | 0.2529 |
| | depression | non-clinic | -1.331* | 0.215 | **<0,001** | -1.8457 | -0.8159 |
| corsi bkwd span | | alcohol | 0.579 | 0.342 | .220 | -0.2529 | 1.4119 |
| | non-clinic | alcohol | 1.992* | 0.394 | **<0,001** | 1.0290 | 2.9556 |
| | | depression | 0.946* | 0.286 | .006 | 0.2502 | 1.6421 |
| | alcohol | non-clinic | -1.992* | 0.394 | **<0,001** | -2.9556 | -1.0290 |
| | | depression | -1.046 | 0.450 | .062 | -2.1338 | 0.0415 |
| | depression | non-clinic | -.946* | 0.286 | **.006** | -1.6421 | -0.2502 |
| BDEFS total | | alcohol | 1.046 | 0.450 | .062 | -0.0415 | 2.1338 |
| | non-clinic | alcohol | -7.654* | 2.335 | **.006** | -13.33 | -1.97 |
| | | depression | -15.256* | 2.428 | **<0,001** | -21.21 | -9.31 |
| | alcohol | non-clinic | 7.654* | 2.335 | **.006** | 1.97 | 13.33 |
| | | depression | -7.603* | 3.096 | .045 | -15.07 | -0.14 |
| | depression | non-clinic | 15.256* | 2.428 | **<0,001** | 9.31 | 21.21 |
| BDEFS symp count | | alcohol | 7.603* | 3.096 | .045 | 0.14 | 15.07 |
| | non-clinic | alcohol | -2.346* | 0.861 | .026 | -4.45 | -0.24 |
| | | depression | -5.762* | 1.123 | **<0,001** | -8.54 | -2.98 |
| | alcohol | non-clinic | 2.346* | 0.861 | **.026** | 0.24 | 4.45 |
| | | depression | -3.415* | 1.358 | **.040** | -6.70 | -0.13 |
| | depression | non-clinic | 5.762* | 1.123 | **<0,001** | 2.98 | 8.54 |
| | | alcohol | 3.415* | 1.358 | **.040** | 0.13 | 6.70 |

The pairwise comparisons of means using the post-hoc Games-Howell test indicated significant comparisons as follows: the average EF total score for the depression group (M = 43.96, SD = 11.42) was significantly different from the non-clinical group (M = 28.71, SD = 7.57); the average EF total score for the depression group (M = 43.96, SD = 11.42) was significantly different from the alcohol dependence group (M = 36.36, SD = 11.71); and also the average EF total score for the alcohol dependence group (M = 36.36, SD = 11.71) was significantly different from the non-clinical group (M = 28.71, SD = 7.57). The results for the average total EF score are graphically presented in Figure 1.

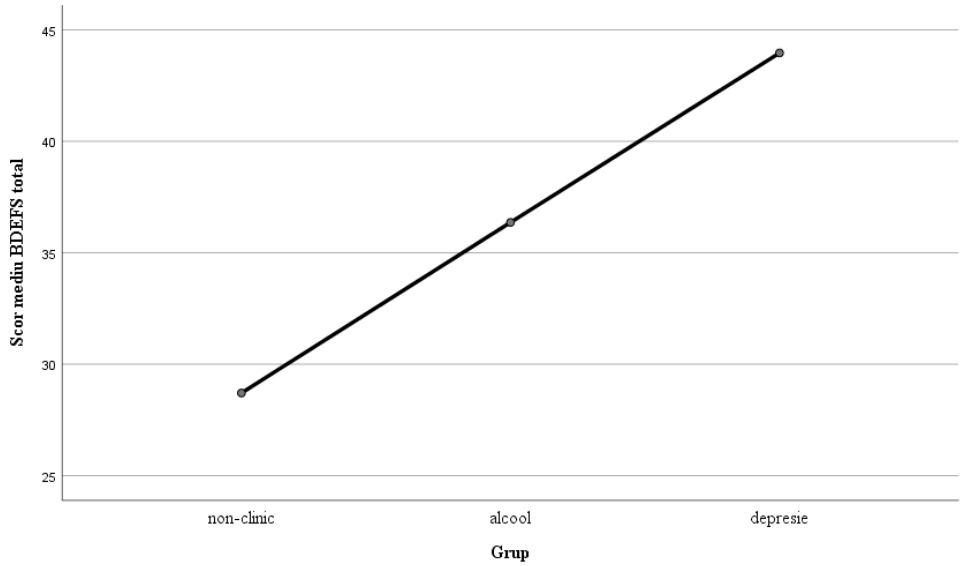


**Figure 1**. Mean score on total EF in the three groups.

If we looked at the BDEFS scale that evaluates the number of symptoms, the results are similar: the average symptom score of EF for the depression group (M = 7.12, SD = 5.54) was significantly different from the non-clinical group (M = 1.35, SD = 2.27); the average symptom score of EF for the depression group (M = 7.12, SD = 5.54) was significantly different from the alcohol dependence group (M = 3.70, SD = 4.46); and also the average total EF score for the alcohol dependence group (M = 36.36, SD = 11.71) was significantly different from the non-clinical group (M = 1.35, SD = 2.27). The results for the average number of EF symptoms are graphically presented in Figure 2.

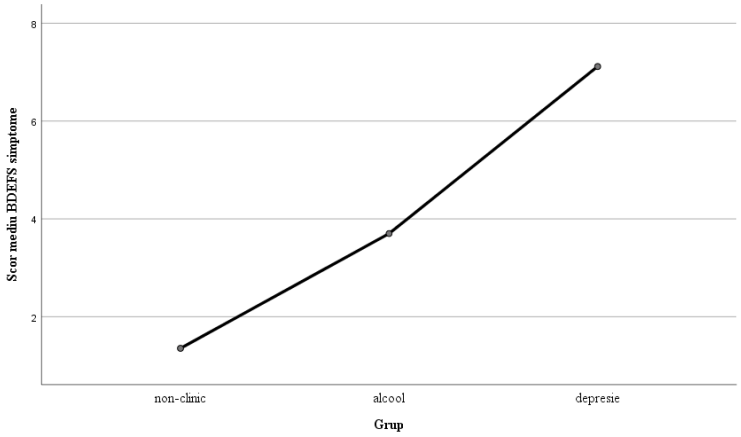


**Figure 2.** Mean score on number of symptoms in the three groups.

Regarding the total score on the Corsi test, the average score for the depression group (M = 4.35, SD = 0.87), as well as the average score for the alcohol dependence group (M = 3.53, SD = 1.72) were significantly different from the non-clinical group (M = 5.48, SD = 1.05) (here a larger absolute value meaning better performance). There were no statistically significant differences between the depression group (M = 4.35, SD = 0.87) and the alcohol dependence group (M = 3.53, SD = 1.72). Even though these differences were not statistically significant, looking at the average values we observe that the average score in people with depression was higher than the score of people with alcohol dependence, meaning that people with depression had better performance. The results for the total score of the Corsi test are graphically presented in Figure 3.

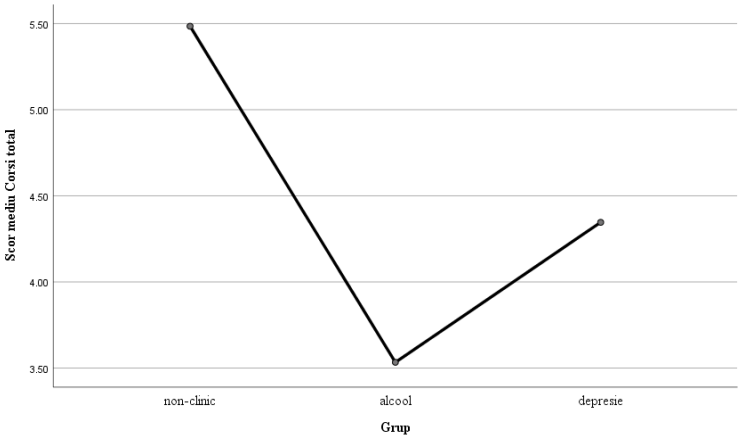


**Figure 3.** Mean score on total score on the Corsi test in the three groups.

Similar results are also observed on the Corsi sub-scales, as follows: looking at the Corsi forward sub-scale, the average score for the depression group (M = 4.35, SD = 0.75), and the average score for the alcohol dependence group (M = 3.77, SD = 1.70) were significantly different from the average scores of the non-clinical group (M = 5.68, SD = 1.28) (here again, a higher absolute value meaning better performance). There were no statistically significant differences between the depression group (M = 4.35, SD = 0.75) and the alcohol dependence group (M = 3.77, SD = 1.70). Similarly, looking at the average values we observe that the average score in people with depression was higher than the score of people with alcohol dependence, meaning that people with depression had better performance. The results for the score on the Corsi forward test are graphically presented in Figure 4.

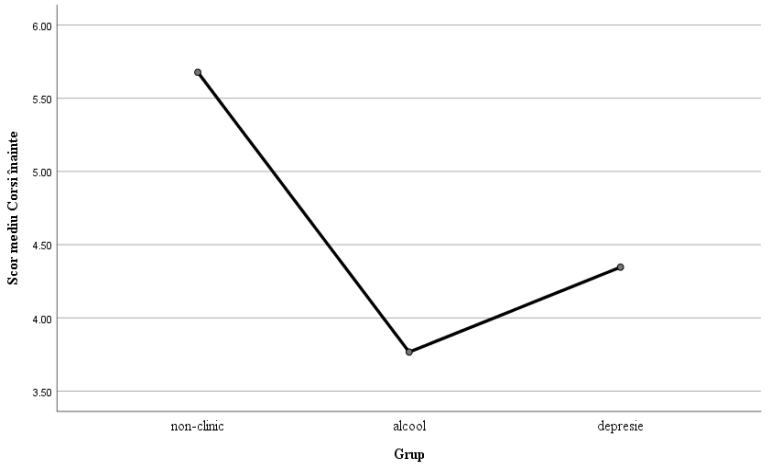


**Figure 4.** Mean score on total score on Corsi forward sub-scale in the three groups.

In the case of the Corsi backwards sub-scale, the average score for the depression group (M = 4.35, SD = 1.29), as well as the average score for the alcohol dependence group (M = 3.30, SD = 2.04) were significantly different from the non-clinical group (M = 5.29, SD = 1.06) (again, a higher absolute value indicating better performance). There were no statistically significant differences between the depression group (M = 4.35, SD = 0.75) and the alcohol dependence group (M = 3.77, SD = 1.70), but looking at the average values we observe that the average score in people with depression was higher than the score of people with alcohol dependence, meaning that people with depression had better performance. The results for the score on the Corsi backwards test are graphically presented in Figure 5.

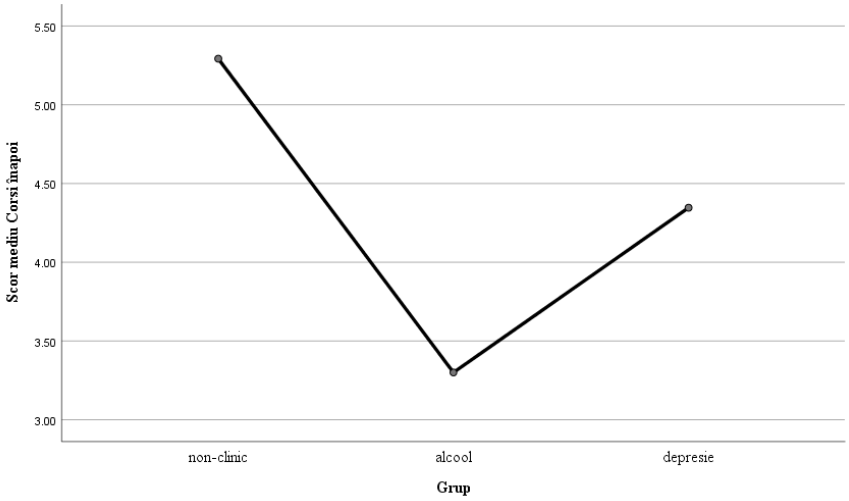


**Figure 5.** Mean score on total score on Corsi backwards sub-scale in the three groups.

Taken together, these results suggest that the clinical groups, depression and alcohol dependence, performed worse than the non-clinical group, both on the self-assessment scale of EF and the Corsi test, both on total scores and on sub-scale scores. Upon examining the performances of both the depression and alcohol dependence cohorts, a notable observation emerges: the depression group consistently underestimates their abilities in self-evaluations compared to the alcohol dependence group. However, the outcomes from the objective tests do not corroborate these perceived disparities.

For a more detailed assessment of EF, the study was narrowed to only encompass participants with alcohol dependency and depression. This decision was predicated on the limited representation of other disorders, which were insufficient to produce statistically significant outcomes. This part of the study comprised a total of 56 individuals (N=56) divided into two groups: the group of patients with alcohol dependence (n1=30) aged between 30 and 73 years, with an average age of M=53.03, and the group of patients with depression (n2=26) aged between 23 and 62 years, with an average age of M=49.88. The results from the Corsi, Stroop, and RT choice tests, presented in Table 4, indicate average values of 3.5 and 4.5 for Corsi, 15.1 and 16.8 for Stroop, and 695.1 and 705.8 for RT-choice, when referring to patients with alcohol dependence and depression, respectively.

**Table 4.** The mean scores from Corsi, Stroop, and RT choice tests for the clinical population

| | | N | Mean | SD | SE | 95% CI | | Min. | Max. |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | LL | UL | | |
| Corsi final score | alcohol | 30 | 3.5 | 1.7 | 0.314 | 2.890 | 4.176 | 0.0 | 6.0 |
| | depression | 26 | 4.3 | 0.9 | 0.170 | 3.995 | 4.697 | 2.0 | 6.0 |
| | Total | 56 | 3.9 | 1.4 | 0.192 | 3.525 | 4.296 | 0.0 | 6.0 |
| Stroop final score | alcohol | 30 | 15.1 | 6.5 | 1.187 | 12.683 | 17.540 | 2.884 | 30.034 |
| | depression | 25 | 16.8 | 8.1 | 1.615 | 13.450 | 20.115 | 5.049 | 37.267 |
| | Total | 55 | 15.9 | 7.2 | 0.976 | 13.914 | 17.828 | 2.884 | 37.267 |
| Rt choice final score | alcohol | 30 | 695.1 | 157.5 | 28.749 | 636.316 | 753.913 | 499.991 | 1101.857 |
| | depression | 26 | 705.8 | 170.8 | 33.504 | 636.798 | 774.802 | 381.889 | 1089.803 |
| | Total | 56 | 700.1 | 162.4 | 21.700 | 656.589 | 743.562 | 381.889 | 1101.857 |

The variance analysis highlights a statistically significant effect only in the case of the total Corsi score [F(1, 56) = 4.74, p =.035]. For the total Stroop and RT Choice scores, no statistically significant effect was found (Table 5).

**Table 5.** ANOVA variance analysis on the Corsi, Stroop, and RT choice tests for clinical population

| | | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corsi final score | Between Groups | 1 | 9.202 | 4.74 | 0.034 |
| | Within Groups | 54 | 1.942 | | |
| | Total | 55 | | | |
| Stroop final score | Between Groups | 1 | 38.070 | 0.72 | 0.399 |
| | Within Groups | 54 | 52.657 | | |
| | Total | 55 | | | |
| Rt choice final score | Between Groups | 1 | 1590.194 | 0.06 | 0.809 |
| | Within Groups | 54 | 26827.597 | | |
| | Total | 55 | | | |

The results of the BDEFS subscales in the two categories of patients indicate average values of 37.4 and 45.7 for the Self-organization subscale, 45.4 and 57.3 for the Time management subscale, 36.8 and 40.0 for the Self-control subscale, 19.4 and 21.7 for the Self-motivation subscale, 26.5 and 31.7 for the Emotion regulation subscale, 165.5 and 196.3 for the total EF score, 18.5 and

31.4 for the EF Symptoms subscale, when referring to patients with alcohol dependence and depression, respectively. On all measured dimensions, patients with depression scored higher averages than patients with alcohol dependence.

Table 6 shows that there was a significant effect of the diagnostic group on the BDEFS Self-organization subscale levels of happiness, $F(1,54) = 4.83$, $p = 0.032$; on time management $F(1,54) = 7.11$, $p = 0.010$; on emotional self-regulation $F(1,54) = 5.12$, $p = 0.028$; on the total EF score $F(1,54) = 5.29$, $p = 0.025$; on ADHD symptoms $F(1,54) = 4.46$, $p = 0.039$; and on the number of EF symptoms, $F(1,54) = 5.13$, $p = 0.028$. There was no significant effect of the diagnostic group on the Self-control subscale $F(1,54) = 1.28$, $p = 0.262$; and on the Self-motivation scale $F(1,54) = 1.37$, $p = 0.247$.

**Table 6**. Variance analysis (ANOVA) of the BDEFS test subscales for the clinical population

| | | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Self-organization | Between Groups | 1 | 950.318 | 4.83 | 0.032 |
| | Within Groups | 54 | 196.912 | | |
| | Total | 55 | | | |
| Time management | Between Groups | 1 | 1970.282 | 7.11 | 0.010 |
| | Within Groups | 54 | 276.981 | | |
| | Total | 55 | | | |
| Self-control | Between Groups | 1 | 144.773 | 1.28 | 0.262 |
| | Within Groups | 54 | 112.784 | | |
| | Total | 55 | | | |
| Self-motivation | Between Groups | 1 | 70.616 | 1.37 | 0.247 |
| | Within Groups | 54 | 51.597 | | |
| | Total | 55 | | | |
| Emotion regulation | Between Groups | 1 | 372.894 | 5.12 | 0.028 |
| | Within Groups | 54 | 72.802 | | |
| | Total | 55 | | | |
| FE total score | Between Groups | 1 | 13216.039 | 5.29 | 0.025 |
| | Within Groups | 55 | 2498.624 | | |
| | Total | 55 | | | |
| Index ADHD | Between Groups | 1 | 166.294 | 4.46 | 0.039 |
| | Within Groups | 54 | 37.325 | | |
| | Total | 55 | | | |
| FE Symptoms | Between Groups | 1 | 2338.169 | 5.13 | 0.028 |
| | Within Groups | 54 | 455.885 | | |
| | Total | 55 | | | |

When looking at the average values to see the direction in which these differences were significant, we observe that: the average score on the self-organization subscale for the depression group (M = 45.7, SD = 15.0) was higher than the alcohol dependence group (M = 37.4, SD = 13.1); the average score on the self-management in relation to time subscale for the depression group (M = 57.3, SD = 16.3) was higher than the alcohol dependence group (M = 45.4, SD = 16.9); the average score on the emotion regulation subscale for the depression group (M = 31.7, SD = 8.6) was higher than the alcohol dependence group (M = 26.5, SD = 8.5); the average score on the scale that measures the total EF score for the depression group (M = 196.3, SD = 47.4) was higher than for the alcohol dependence group (M = 165.5, SD = 52.1); as well as on the ADHD index, the average score for the depression group (M = 22.5, SD = 6.0) was higher than the alcohol dependence group (M = 19.0, SD = 6.2).

If we look at the subscales that measure the number of symptoms, the difference between the depression group and the alcohol dependence group is quite large (M = 31.4, SD = 22.1), respectively (M = 18.5, SD = 20.7). If we look at the significant differences found at the Corsi test, the average score of the depression group (M = 4.3, SD = 0.9) is higher than that of the alcohol dependence group (M = 3.5, SD = 1.7), here a higher score meaning better performance. At the Stroop and RT Choice tests, the differences between groups were insignificant, which shows that the two diagnostic groups had similar performances.

If we look at the total mixed psychopathology sample (table 7), the total EF score correlates positively with the total score on the RT Choice task (r=.294, n=65, p <0.05), high scores representing EF dysfunctions. The total BDEFS score does not correlate with the Corsi score, and correlates negatively and significantly with the total Stroop score (r=-.363, n=65, p <0.001). The total scores at Corsi and Stroop correlate positively and significantly (r=.338, n=65, p <0.001), and the total scores at Corsi and RT Choice correlate negatively and significantly (r=-.262, n=65, p <0.05), the total scores at Corsi and RT Choice correlate negatively and significantly (r=-.442, n=65, p <0.001).

**Table 7**. Spearman bivariate correlation coefficients between EF tests in the clinical population

| | 1 | 2 | 3 |
|---|---|---|---|
| 1. BDEFS total | | | |
| 2. Corsi scor final | -.117 | | |
| 3. Stroop scor final | -.363** | .338** | |
| 4. Rt choice scor final | .294* | -.262* | -.442** |

Note: **. Correlation is significant at the $p < 0.001$ level
*. Correlation is significant at the $p < 0.05$ level

We also compared the scores of the two gender groups at the BDEFS and CORSI subscales through a one-way analysis of variance (one-way ANOVA). Making a comparison within the clinical group, between 32 women and 33 men, statistically significant differences were observed at the Self-organization/ Problem solving [$F(1, 65)= 9.27$; $p=.003$], Self-management [$F(1, 65)= 15.14$; $p<.001$], Self-control [$F(1, 65)= 0.048$; $p<.048$], Emotion regulation [$F(1, 65)= 14.09$; $p<.001$] subscales and the total EF score [$F(1, 65)= 12.58$; $p=.001$]. The differences in mean scores for these subscales were quite large, with all women reporting higher average scores than men. No significant differences were observed on the Self-motivation scale [$F(1, 65)= 3.56$; $p=.064$] (or they were marginally significant) although, women reported higher scores than men. Therefore, significant gender differences emerged at four of the five subscales, and in the case of the fifth subscale, the result approached the threshold of statistical significance. Also, the examination of mean differences showed that there are relatively significant differences. By comparing the two gender groups, it is observed that when speaking of self-report scales, the women in the clinical sample tend to self-evaluate more poorly, having lower performances than the value obtained in the performance test (objective value). By comparing the average scores on the subscales, as well as the scores on the total EF, we notice that women report a higher score, meaning a lower performance. But if we take into account objective performance measurements, that is, if we look at the scores on the performance scales, respectively the scores on the CORSI subscales and the final score, we observe that there are no statistically significant differences here. Therefore, the discrepancy appears to be related to self-perception, not objective performance.

## DISCUSSIONS AND CONCLUSIONS

Assessing EF in clinical environments presents challenges, given patient resistance, unfamiliarity with computers, and other variables that could affect outcomes (Toplak, West, & Stanovich, 2013). There's a gap in research comparing EF in those with depression and alcohol dependence.

Traditionally, EF measurement relies on performance-based cognitive tests. They provide standardized stimulus presentation, ensuring every participant undergoes the same experience. Moreover, these tests emphasize response accuracy, speed, and time-constrained reactions. In contrast, self-assessment scales of EF attempt to gauge one's competence in real-life situations. Ideally, if these self-assessment scales and performance-based tests tap into the same construct, they should show a strong positive correlation (Toplak, West, & Stanovich, 2013).

Although both metrics are meant to gauge the same construct— a fundamental aspect of convergent validity— they often don't correlate as expected, various studies revealing a significant dissociation between the two. While performance-based tests evaluate cognitive abilities under controlled settings, self-assessment scales provide insights into how individuals function in everyday, unstructured situations.

In our study, it was observed that out of the three computerized tests employed to gauge EF, only one did not show a significant correlation with self-assessment scores. Specifically, while the Stroop and RT Choice tests both demonstrated significant correlations with participants' self-assessments of their EF, the Corsi task did not. Such a divergence in correlation might reveal the unique nature of each test. The Corsi task predominantly evaluates visual-spatial working memory. It's plausible that individuals may not consistently recognize or assign significant relevance to their visual-spatial working memory capacities in the context of daily activities, thereby resulting in an incongruence between the task's outcomes and self-assessment scores.

The clinical group, as expected, displayed poorer performance across both evaluation methods compared to the non-clinical group. Educational background might be a confounding factor, given that 87.8% of the non-clinical group had a higher education compared to only 13.8% of the clinical group. Past studies have linked higher education with enhanced cognitive test performance (Godard, Grondin, Baruch, & Lafleur, 2011; Stordal et al., 2005).

Delving into the subgroup with depression, there's a tendency towards negative self-assessment, suggesting a distorted perception of their actual capabilities. This tendency aligns with the well-documented predisposition of depressive individuals towards negative biases (Rude, Krantz, and Rosenhan, 1988; Beck, 1963; Orth, Robins, Meier, and Conger, 2016; Wisco, and Nolen-Hoeksema, 2010).

The literature provides separate insights into the EF impairments seen in depression and alcohol dependence. For instance, a 2021 meta-analysis confirmed individuals with depression showed decreased EF performance across tasks (Nuño, Gómez-Benito, Carmona, & Pino, 2021; Snyder et al., 2015). Factors like medication, depression subtype, age, and the number of episodes can influence EF (Hinkelmann et al., 2009; Tavares et al., 2007; Cataldo, Nobile, Lorusso, Battaglia, & Molteni, 2005; Matthews, Coghill, & Rhodes, 2008; McClintock, Husain, & Cullum, 2010; Porter, Bourke, & Gallagher, 2007; Lane and O'Hanlon, 1999).

For patients with alcohol dependence, cognitive deficits persist even after prolonged sobriety (Brion et al., 2017). These patients often show signs of denial, which is rooted more in cognitive failure than defensive mechanisms

(Rinn, Desai, Rosenblatt, & Gastfriend, 2002). Analogies have been drawn between alcoholic denial and the unawareness of deficits seen in anosognosia (Heilman, 1991; Levine, Calvanio, & Rinn, 1991).

In our research findings, individuals with alcohol dependence tended to report superior EF in self-assessment measures when contrasted with individuals diagnosed with depression. Nevertheless, this enhanced self-perceived EF did not correspondingly align with their performance outcomes in objective cognitive tasks.

In sum, our research underscores the diverse EF performances across clinical and non-clinical groups. Both patient subgroups— depression and alcohol dependence— exhibit unique cognitive characteristics. Future research needs to dive deeper into the underlying mechanisms of these EF deficits to better aid these patient groups. The complexities noted here emphasize the necessity for thorough and multi-faceted analyses of EF across different psychopathological conditions.

## LIMITATIONS

One of the primary limitations of our study is the extensive age range of the participants (23-75 years). Given the shifts in EF across different age groups it's imperative to consider the inherent complexities and nuances associated with the evolution of EF across the lifespan (Zelazo, Craik, & Booth, 2004). The wide age range of participants in our study, the multifaceted nature of EF, combined with developmental intricacies, might introduce a degree of variability that could influence our findings. The changes in EF due to aging could potentially mask or amplify the observed effects of psychiatric conditions.

Conducting studies within inpatient settings poses inherent challenges. The controlled environments can introduce potential biases due to the institutionalized nature of care. Securing large sample sizes from inpatient populations presents substantial challenges. Individuals are often undergoing intensive treatment and may have acute symptoms, therefore recruitment for research purposes can be limited. Additionally, ethical considerations, and the temporary duration of inpatient stays further constrain the potential pool of participants. As a result, achieving expansive sample sizes in such settings is difficult, which may impact the generalizability of findings derived from inpatient-based studies.

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# Fake News and the Individual. Personal Characteristics Which Influence What We Choose to Believe

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**ABSTRACT.** As the phenomenon of fake news continues to increase and spread throughout the world, there is a need to understand how individual characteristics influence the propensity to believe in fake news. In this systematic review, we performed a search of relevant databases for scientific studies published starting with 2016, the year this term became mainstream, 2024. After applying inclusion and exclusion criteria, we selected ten studies, which showed that higher extraversion is related with an increased belief in fake news, while agreeableness, conscientiousness, and open-mindedness tend to protect against believing in fake news. A heightened state of emotionality (either negative or positive) is another individual characteristic which predisposes people to believe fake news. High intelligence individuals, but especially individuals with high analytical skills, who often use deep reflection (instead of their intuition/gut feeling) when processing information and making decisions, are the most protected when it comes to believing news that is not true.

**Keywords:** fake news, intelligence, personality, analytic thinking, emotions

## I. INTRODUCTION

### *1. A short history of the Fake News phenomenon*

The creation of news events that are simply not true has happened in tabloids and magazines since the last century, but with the advent of the Internet and the proliferation of social media, anyone can create a professional

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looking web page and publish fake news that could reach millions of people (Lazer et al., 2018). However, the term in its current form became mainstream with the US presidential elections in 2016 (Sindermann et al., 2021), when political candidates used it heavily in their discourse and to advance their agendas.

The explosive growth of online social media coupled with the decline of "conventional", reputable news channels, have speeded the transition towards the online information, and with it came the explosion of news stories with questionable validity (Cerf, 2017). Fueled in part by a hyper-pervasive, omnipotent social media, it has reached proportions which could not have been imagined a decade ago. In trying to analyze the emergence, and especially the global acceptance and continued propagation of fake news, it is important to identify the individual characteristics which predispose people to gravitate and ultimately immerse in this phenomenon.

### *2. Fake News: Definitions and consequences*

There are many forms of fake news and the definitions of this phenomenon cover this broad field of existence. Being a special subgenre of misinformation, fake news possesses certain characteristics which differentiate it from other untrue news.

Allcott and Gentzkow define fake news as news in media (both traditional media and social media) presented as facts, but not based on facts (Allcott and Gentzkow, 2017). These researchers exclude from fake news the statements of politicians that are deliberately false, instead classifying them as political manipulation (Ibid.).

Researchers Vargo, Guo and Amazeen (2018) state that fake news is media reports and stories which are not based on facts but are presented as news resembling real news and are distributed to attract attention and produce financial gain. The definition centers on the financial motivation of producing the fake news and the authors note that fake news can appear without the express intent of its creator(s) (Ibid.).

Lazer et al. (2018) posits that fake news is the information that mimics the output of the news media in form, but not in organizational process or intent, thus it is ultimately lacking editorial norms and processes to weed out the untrue in favor of the truth. Therefore, fake news is a subgenre of the broader category of misinformation, representing incorrect information about the state of the world.

Egelhofer and Lecheler sums up the various definitions of fake news and conclude that information needs to show the following characteristics in order to be classified as fake news: low facticity; creation with intention to deceive; presentation in a journalistic format (Egelhofer & Lecheler, 2019).

Fake news has been blamed for a lot of negative things, from influencing the election results in different countries of the world (Neuman, 2018, Parks, 2017), to negatively impacting activist movement (Sydell, 2017, Lewandowsky et al., 2013). The broad consensus is that the fake news is a serious problem, and despite multiple efforts to limit its spread and/or to curtail its negative effects, the phenomenon keeps spreading and increasing (Mitchell, Gottfried, Stocking, Walker and Fedeli, 2019). As a matter of fact, it was found that engagement on social media sites that present unreliable news (computed as likes/shares/ comments on Facebook or Twitter regarding the US top 100 news sources) nearly doubled from 2019 to 2020 (McDonald, 2020). Research has also demonstrated that fake news spreads faster, further and more broadly on Twitter than true stories, and that political fake news reaches more people in a specified period of time than all the other types of false stories (Vosoughi et al., 2018). Moreover, not only fake news spread further and faster, but people being exposed to them usually believe them to be true (Silverman and Singer-Vine, 2016). What is even more troublesome, the action of merely being exposed to a fake news headline increases the later belief in that headline (Pennycook and al., 2018). As such, fake news can sometimes represent a serious threat even to a country's democracy, because citizens can not access factual information to evaluate the public policies and also can not build their preferences using this factual information (Kuklinski et al., 2000).

## II. METHOD

### *1. Eligibility criteria*

Papers were restricted to peer reviewed journal papers published since 2016. As we have shown in the introduction, this is the year when the term "fake news" became mainstream, due to the US presidential election taking place in that year. We reckon that was the signal which started an intense scrutiny of the phenomenon of fake news, resulting in an increased number of studies, which analyzed and tried to develop a sound theory about the subject. Papers included were the ones written in English, as we believe the main body of research concerning this subject was done in this language. Moreover, there were instances where articles written in a different language were provided with an English translation for publication in an international journal and they appeared in our search. Therefore, we are confident that the language criteria did not affect the quality of our selection significantly.

### *2. Search strategy*

The search was conducted starting with February 2023. We initially used Google Scholar and ResearchGate. As an index of all articles ever published on the world wide web, Google Scholar provides fully customized searches using a plethora of variables. On the other hand, ResearchGate is the largest academic social network in terms of active users (Matthews, 2016). From here we have obtained many papers directly from the authors. After exhausting this search, a second subsequent search was done at a later date using the articles' references formerly selected from Google Scholar and ResearchGate.

The search was undertaken for papers that explored the relationship between fake news and personal characteristics which prompt the individual to believe/not believe the message presented in so called fake news. The aim was to find relevant papers published in the last eight years that explore a direct causality which is strongly backed by statistical data.

### *3. Type of studies*

Included in the selection were studies with relevant conclusions based on statistical models which addressed the way in which personal characteristics of the individual determine what we choose to believe. The main focus was on randomized controlled studies, but we have also included experimental, correlational and exploratory studies, if they fulfilled the other requirements.

Excluded from the selection were studies which did not address directly the fake news phenomenon, but instead focused on other closely-related variables such as misinformation, direct propaganda or persuasive advertising. Also excluded were studies in which the propensity for the belief in fake news was determined by extraneous factors such as peer group pressure, media consumption or cultural proclivities. Even if some of these extraneous factors were mentioned in the introduction – to better underline the fact that the individual is shaped both by his/her personal determinants and by his/her environment – ultimately solely the studies which included factors intimate to the one's self were included in this systematic review.

Simple literature reviews pertaining to the subject matter were also excluded. In so far as they contained references to other individual studies which satisfied the criteria for inclusion, care was taken to include these studies in this theoretical review.

### *4. Type of participants*

Only studies conducted with adults (age>18 years) were selected. The gender, race or any other demographic information of the participants did not constitute a reason for exclusion.

### *5. Selection process*

The first search was conducted on Google Scholar at scholar.google.com. After selecting the English language, the search after the general query "fake news and individual personal characteristics" yielded 345,000 results. Adding 2016-2023 as a publishing period reduced it to 132,000 results. Selecting only for scientific articles further reduced it to 20,800 results.

This was deemed still too broad, so we started the search again, this time using a Boolean search. We used "Personal character*" OR "Individual differen*" OR "Fake news*" anywhere in the text, for the period 2016-2023, and we got 16,800 results. When we selected only scientific articles, there were 6,410 results. If searching for any of the three terms in the title instead of the whole body of the article, we obtained 325 results.

Research Gate was the second source at www.researchgate.net. For the query "Personal character*" OR "Individual differen*" OR "Fake news*" anywhere in the text, for the period 2016-2023, we got 1000++ results. Even when we added the condition that all results must be scientific articles, we still got 1000++ results. At this point we must mention that each source had different search options, for example ResearchGate had no option of searching for terms just in the title. In the end we conducted the search for "Fake News" AND "Individual", only scientific articles published between 2016-2023. We obtained 22 results.

In total, we screened 347 articles (325 from Google Scholar and 22 from ResearchGate) by title. We excluded 6 due to duplicates and a further 295 due to the title not meeting the above-mentioned criteria. These 295 articles were either not looking for a connection between personal individual characteristics and the propensity to believe in fake news, or analyzing extraneous factors shaping the belief in fake news, or were simply opinion pieces.

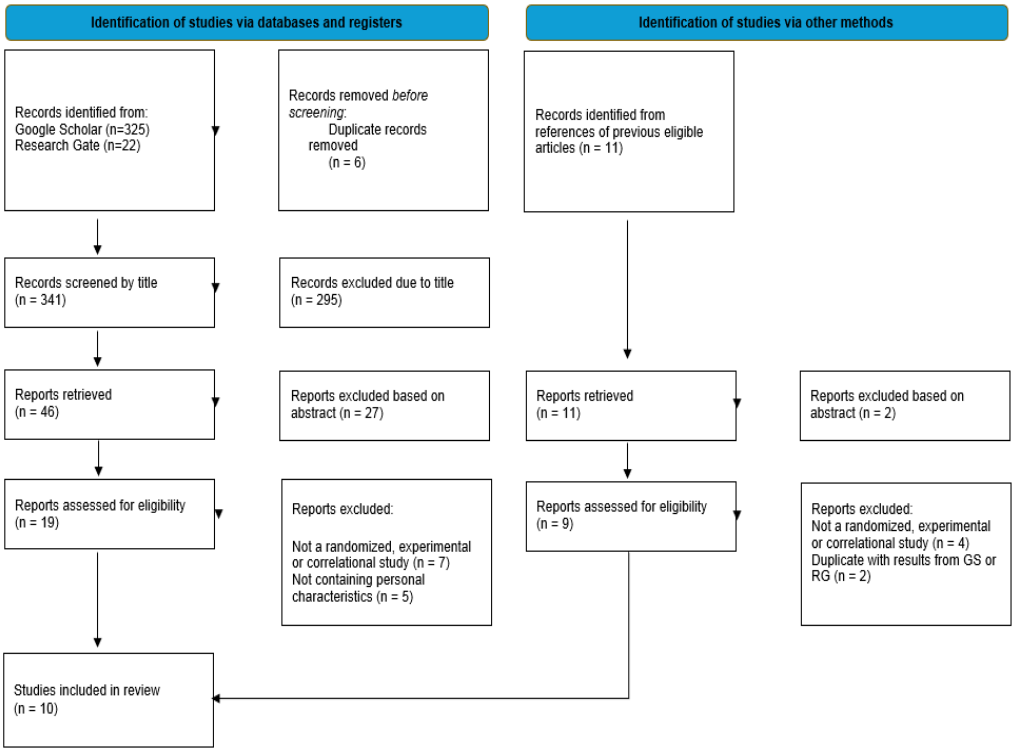
We retrieved the remainder of 46 reports. Of these, 27 were excluded based on the abstract. After assessing the 19 reports left, we eliminated another 7 because they were not a randomized controlled, experimental, correlational or exploratory study. Another 5 were not analyzing the effect of individual personal characteristics on the belief in fake news or used altogether other variables (like news consumption habits or the use of snacking while reading fake news). In the end, in this first stage of the search, we obtained 7 studies to be included in our review which satisfied the above-mentioned conditions.

In the second stage of the search, we screened for articles indicated in the references of the 46 reports that we previously worked with. From these we selected by title 11 reports which we retrieved. We excluded 2 based on the abstract. After assessing for eligibility, we further excluded 4 reports because they were not a randomized controlled, experimental, correlational or exploratory study and 2 reports because they were duplicate of the articles found in the first stage of our search.

In the end, we obtained 10 studies that met all the above-mentioned conditions and could be included in our review.

### *6. PRISMA diagram of the selection process*

The flow diagram of the search process is presented below in a 2020 PRISMA standardized form (Page, McKenzie, Bossuyt, Boutron, Hoffmann, Mulrow, 2021):



## III. FINDINGS

### *1. Fake News, Intelligence and Personality Traits*

The most prominent theory of intelligence is the one which divides it into two components: fluid intelligence (gf) and crystalized intelligence (gc) (Brown, 2016; Hebb, 1942). There are different models which have been constructed during the last century exploring the gf-gc divide, and they were all integrated in the Cattell-Horn-Carroll (CHC) theory (McGrew, 2005). According to this theory, fluid intelligence (gf) includes sequential/deductive reasoning (where one starts with a given rule and finds the solution to a new problem) and inductive reasoning (where one discovers the underlying rules) (Flanagan, 2008). On the other hand, crystallized intelligence (gc) can be defined as the "breadth and depth of a person's acquired knowledge of a culture" (Flanagan, 2008, p.373). As such, crystallized knowledge comprises one person's lexical knowledge, general information and information on culture, as the main components (Ibid.).

Probably the most accepted model of personality is the Five-Factor Model or Big Five, in which personality can be described based on five broad domains (Fiske, 1949). These five domains are now widely accepted as being Openness, Conscientiousness, Extraversion, Agreeableness and Neuroticism (Goldberg, 1990, Tupes and Christal, 1992).

A 2021 German study published in English conducted by Sindermann, Schmitt, Rozgonjuk, Elhai and Montag analyzed how intelligence – fluid and crystalized intelligence –, as well as personality traits influence the belief in fake news. The study used a convenience sample (free participation of anyone over 18 years old who could read and understand German) of N=530 participants (n=396 men, n=130 women and n=4 non-binary). Mean age was 41.82 years (SD=13.07), with a range from 18 to 78 years. N=259 participants reported a university degree and n=122 reported a high school diploma as their highest educational degree. Most participants reported being employed, n=339 (Sindermann et al., 2021).

In order to assess the propensity of the participants to believe in fake news, they were presented with 29 news headlines, of which 16 included incorrect (not 100% accurate) information (fake news) and 13 included fully accurate information (true news). The topics selected included topics such as national and international politics, economics, health, climate and celebrities. Care was taken to select headlines which were not overall biased in a particular political direction (Sindermann et al., 2021). In order to obtain a tendency to believe in fake news, the authors calculated the number of misclassified fake news headlines as true. Participants' tendencies to disbelieve true news were

measured by the number of misclassified true news headlines as false. Finally, a news discernment score was calculated as the z-score of the accurately classified true news headlines minus the z-score of the misclassified fake news headlines ("hits" – "false alarms") (Ibid.).

The confounding factor of Social Desirability was assessed using The Short Scale on Social Desirability – Gamma, which comprises two scales with three factors each (abbreviation **KSE-G**, based on the German original name of the scale). Scores were from 1 to 5 for each scale, with higher score indicating higher socially desirable responding (Sindermann et al., 2021). Fluid Intelligence was measured with a test comprising ten items, constructed by the International Cognitive Ability Resource (**ICAR**) project (The International Cognitive Resource Team, 2014). Crystalized Intelligence was assessed using the Short Version of the Berlin Test of Crystallized Intelligence (**BEFKI GC-K**, abbreviation of the German name). This test comprises ten items assessing knowledge in 12 domains such as medicine, religion, art and finances (Schipolowski et al., 2014). Personality traits were assessed using the German version of the Big Five Inventory **(BFI**), which allocated a score for each of the five traits, Openness, Conscientiousness, Extraversion, Agreeableness and Neuroticism (Rammstedt and Danner, 2017).

Age, gender, education and both KSE-G scales were included as control variables in the main analysis. Education and intelligence might be confounded and social desirability could be associated with personality (Bensch et al., 2019). Descriptive statistics and Pearson Correlations are presented in Annex 1. Regression models were calculated in order to test the association between the three scores derived from the Fake and True News Test (misclassification of fake news, misclassification of true news, news discernment score) and intelligence, as well as personality scores (Sindermann et al., 2021). It was found that the Big Five traits were mostly not associated with misclassifying fake news as true or with misclassifying true news as fake. However, Extraversion had a significant negative association with news discernment, i.e., higher Extraversion is associated with lower abilities to discern truth from fake news (Ibid.). Regarding intelligence, it was found that individuals with higher crystallized intelligence are better at correctly classifying true news, while individuals possessing higher fluid intelligence are more protected against believing fake news (Ibid.). However, these findings must be interpreted with caution, as the authors point to many limitation of their research: participants were presented just with news headlines instead of whole articles; the focus was not on political headlines, so that the answers are not influenced by individual political interest; short measures to assess crystallized and fluid intelligence were used so that the study was kept as short as possible in order to increase participation (limitation evident by the low correlation between gf and gc); the effect sizes found were mostly small; the probability

that some participants checked the headlines online before answering; the sample was not representative of the general German population; and finally, German-specific news headlines limit the generalizability of the present study (Ibid.).

Another study by Wolverton and Stevens (2019) has focused specifically on how personality characteristics could explain the individual's ability to identify fake news. The authors collected the data using a snowball sampling methodology starting with 73 students enrolled in a Management Information Systems course, who were asked to distribute the survey to another person belonging to a different generation. (Wolverton and Stevens, 2019). From the total of 146 possible participants, 117 completed the web-based survey (Ibid.).

Scores for each of the five personality factors were recorded, while the belief in fake news was calculated using a questionnaire with 9 headlines, out of which 5 were fake and 4 true (Wolverton and Stevens, 2019). Besides personality factors, other independent variables included were gender, age and highest educational degree attained. (Ibid.).

Two effect sizes were calculated: $\eta^2$ (proportion of variance in the dependent variable that is explained by the independent variable (with ranges of 0 to1) and the effect size index f, with f=sqrt ($\eta^2$/ (1- $\eta^2$)) (Wolverton and Stevens, 2019). Results are presented in Annex 7 and show that all five personality traits (extraverted, critical/quarrelsome, open to new/complex, sympathetic/warm, disorganized/careless) have at least a medium effect size for correctly identifying disinformation (Ibid.). For other variables, age had a small effect f=0.12, school degree completed had a medium effect f=0.27 and gender had almost no effect with f=0.06 (Ibid.).

Another metric used was the percent of individuals that correctly identified three or more of the five fake news stories (results presented in Annex 7, shows how the trait influences the perceived accuracy of the fake news) (Wolverton and Stevens, 2019). Partially in line with the other studies, it was found that introverted/less critical/not open to new experiences/not sympathetic or warm/disorganized people performed better at identifying disinformation (Ibid.).

A 2022 study by Ahmed and Tan investigated if personality traits influence the perceived accuracy of fake news and its sharing intention, and if cognitive ability further moderates this relationship (Ahmed and Tan, 2022). The authors look at three research objectives to be studied: the way personality traits are associated with the belief in fake news; the way personality traits are associated with the process of fake news sharing; and finally, the way cognitive ability moderates the association between personality traits and a) fake news and b) sharing of this fake news (Ibid.).

There were 750 participants in the study who were selected by Qualtrics and care was taken to match this sample with the general population for age and gender, but the authors admitted that the sample is more educated and earns a higher income than the average US citizen, so generalizing the results of the study to the US population cannot be made (Ahmed and Tan, 2022). Belief in and sharing of fake news was determined using 10 fake news headlines (5 pro-conservative and 5 pro-liberal) which were rated for accuracy (1-not at all accurate, 5-extremely accurate) and for the propensity to be shared (again scored 1 to 5, with 5 representing a higher intention to share) (Ibid.). Then an index of perceived accuracy was calculated by averaging the responses to the five fake news headlines (pro-conservative: M=2.19, SD=1.15, $\alpha$=0.89; pro-liberal M=2.21, SD=0.89, $\alpha$=0.79) and also an index of sharing intention by averaging the response to the questions (pro-conservative M=1.61, SD=1.08, $\alpha$=0.94; pro-liberal M=1.62, SD=1.09, $\alpha$=0.95) (Ibid.).

The scores for the five personality factors were computed using the Big Five Ten Item Personality Inventory (Gosling et al., 2003). Cognitive ability was determined for each participant using the wordsum test, which shares high variance with general intelligence and is often used to operationalize individual cognitive skills (Brandt and Crawford, 2016). The test presents 10 questions having a target word and the participants must select the closest matching word from five possibilities (i.e., target word "Space", possibilities school/noon/captain/ room/board) (Ibid.). An index of cognitive ability was computed using the answers to this test (M=6.19, SD=2.46, $\alpha$=0.76) (Ahmed and Tan, 2022).

Four hierarchical regression analyses were used to determine how personality traits influence the perceived accuracy and the inclination for sharing fake news, with the models including demographics and motivational control; furthermore, moderation analysis was conducted to determine the moderating effects of cognitive ability on the relationship between personality traits and perceived accuracy and the inclination for sharing fake news (Ahmed and Tan, 2022). Results for the regression analyses examining the main effects of the predictor variables are presented in Annex 8, Tabel 1.

Regarding the first research objective, the way personality traits are associated with the belief in fake news, it was found that for pro-conservative misinformation, agreeableness ($\beta$=-0.124, $p<0.01$) and extraversion ($\beta$=0.081, $p<0.05$) were significantly related to perceived accuracy (Ahmed and Tan, 2022). Regarding the second research objective, the way personality traits are associated with the propensity of sharing fake news, it was found that agreeableness (pro-conservative: $\beta$ =-0.120, $p<0.01$; pro-liberal: $\beta$ =-0.095, $p<0.05$) and conscientiousness (pro-conservative: $\beta$ =-0.131, $p<0.001$; pro-liberal: $\beta$ =-0.129, $p<0.001$) are negatively related to sharing intention (Ibid.).

Moreover, cognitive ability is negatively associated with the perceived accuracy of fake news (pro-conservative: $\beta$ =-0.206, $p$<0.001; pro-liberal: $\beta$ =-0.096, $p$<0.001) and sharing intention (pro-conservative: $\beta$ =-0.252, $p$<0.001; pro-liberal: $\beta$ =-0.205, $p$<0.001) (Ibid.).

The third and probably the most important objective of the research, the way cognitive ability moderates the association between personality traits and fake news and sharing of this fake news, it was determined that in the case of pro-conservative fake news, the interaction between cognitive ability and openness was statistically significant ($\beta$=-0.474, $p$<0.05), while for pro-liberal misinformation, the interaction between cognitive ability and conscientiousness ($\beta$ =0.548, $p$<0.05), agreeableness ($\beta$=0.556, $p$<0.05), and emotional stability (neuroticism) ($\beta$=-0.539, $p$< 0.05) are statistically significant (Ahmed and Tan, 2022). Regarding the propensity of sharing the fake news, the relationships that are significant are between cognitive ability and openness to experience (pro-conservative: $\beta$=-0.470, $p$ <0.05; pro-liberal: $\beta$=-0.558, $p$<0.01), agreeableness (pro-conservative: $\beta$=0.526, $p$<0.01; pro-liberal: $\beta$=0.745, $p$<0.01), and emotional stability (neuroticism) (pro-conservative: $\beta$=-0.451, $p$<0.05; pro-liberal: $\beta$ =-0.510, $p$<0.05). (Ibid.).

To sum up, in the case of pro-liberal fake news, individuals with low cognitive ability and higher consciousness, as well as individuals with low cognitive ability and higher agreeableness, are associated with lower belief in fake news; individuals with high cognitive ability and a high degree of emotional stability (low neuroticism) are also associated with a lower belief in pro-liberal fake news (Ahmed and Tan, 2022). Conversely, in the case of pro-conservative fake news, for individuals with low cognitive ability, only higher levels of the trait openness increase the belief of these people in fake news (Ibid.).

The authors identified some limitations to their study: no causal relationship between personality traits or cognitive ability can be inferred on the long-term propensity to believe fake news; the sample used is not truly representative of the US population; as the study used only political fake news, it is possible that in the case of other types of fake news, the results will be quite different (Ahmed and Tan, 2022).

In another study by Sindermann, Elhai, Moshagen and Montag (2020), the authors investigated how personality, ideological attitudes and demographics influence the number of news consumed, the latter being an inverse proxy for the susceptibility to be caught in the so-called “filter bubbles” or “echo chambers”. While not necessarily a direct relationship between filter bubbles and fake news, consuming news just from a singular source (or a small number of sources) can lead to a skewed/predetermined reinforced view of the current events which might

not be the correct one. With the wide proliferation of online news consumption and the advancement of "tailored" news feed programs implemented by social media giants, this danger is more acute than ever.

The term "filter bubble" refers to the consequences of implicit personalization (preselection) of the web pages visited by an individual while surfing the Internet (Thurman and Schifferes, 2012; Zuiderveen, Borgesius et al., 2016). This personalization is done through the use of algorithms which permanently analyze the habits/interests of the individual and then create different sets of information tailored for each of us. This tailored information presents the following problems: people are alone in their bubble and the bubble is invisible, so in general, people do not know it exists; this in turn leads to the belief that the information is unbiased; people enter the filter bubble actively, but eventually they find themselves in one passively (Pariser, 2011). On the other hand, the term "echo chamber" relates to the fact that an individual is exposed to the same information again and again, thus reinforcing one's beliefs and attitudes when the same information is repeated ad nauseam, while the counter attitudes are missing (Jamieson and Cappella, 2008).

The study had a final sample of N=1681 German-speaking participants (n=557 males and n=1124 females), with the mean age of the sample being 34.44 years (SD=15.09), range from 12 to 81 years and median of 33 years (Sindermann et al., 2020). The German version of the Big Five Inventory (BFI) was used to assess the personality traits, while in order to asses the number of different news sources, participants were first asked if they watch/read/listen to news on TV, in print media, on the radio, on online news websites, on their Facebook news feed, on the news feeds of other social networking sites, and then, for every positive answer, they had to further state on the Likert-scale how often they did it (Ibid.).

The regression showed that age (positively), gender (negatively, meaning higher score for males) and Openness (positively) are significant predictors for the number of news sources one individual is prone to using regularly (Sindermann et al., 2020). More specifically, the regression weights indicated that the predicted number of news sources used in total increases by 13% if age increases by one standard deviation, decreases by 19% for being female and increases by 4% if Openness is increased by one standard deviation (Ibid.). For a binomial model predicting the number of news sources consumed by age, gender and the Big Five, see Annex 2.

As limitations to this study, participants were not asked which kind of news sources they consumed, as the content of the news read could be political but also geared towards entertainment; also, the content of news most probably

differs between online and offline sources; the actual existence and size of "echo chambers" and "filter bubbles" could not be investigated but merely presumed; results could not be generalized as they are derived from a German-speaking sample; as the research design was of a correlational nature, it is not possible to prove causal directionality (Sindermann et al., 2020).

A 2021 study by Calvillo, Gracia, Bertrand and Mayers sought to determine the way personality factors and political news consumption predict susceptibility to political fake news. The study had two objectives, first to determine how personality factors are influencing the belief in fake news and second to determine if there is a relationship between news consumption and news discernment (Calvillo et al., 2021).

Participants were selected in two batches from Mechanical Turk (with the prerequisite of being residents in the US) and were provided monetary compensation (N=351, 179 women, 173 men and 1 declined to declare the gender, age 19 to 78 years old, median 37) (Calvillo et al., 2021). Belief in fake news was determined using 24 news headlines with photographs (12 true and 12 false, equally divided between pro-conservative and pro-liberal), which the participants had to rate (1-not at all accurate, 4-very accurate); personality factors were operationalized using the Big Five Inventory-2-S (BFI-2-S, Soto and John, 2017), which has 30 statements which individuals rate on a scale from 1 (disagree strongly) to 5 (agree strongly); news consumption was determined by asking the participants from which sources they obtain their news (a list with 45 sources) and how many hours per week they use that source; finally, participants had to answer questions regarding their age, gender, political party affiliation and political ideology (1-extremely liberal to 7-extremely conservative) (Ibid.).

Descriptive statistics for the variables are presented in Appendix 9, Table 1. The variable news discernment was calculated as the difference between the perceived accuracy of true news and false news encountered; news consumption biased was calculated using the news' source bias rating reported by Allsides.com; number of leanings was determined by placing the news sources in groups based on their political leaning (left, lean left, center, lean right, right) and calculating how many groups an individual used when searching for news (scores 1 to 5) (Calvillo et al., 2021).

The correlation matrix for variables analyzed is presented in Appendix 9, Table 2. Of note is that news discernment is positively correlated with conscientiousness ($p=0.006$), open-mindedness ($p<0.001$) and agreeableness ($p<0.001$), but not significantly correlated with extraversion or negative emotionality (Calvillo et al., 2021). An unexpected finding was that more news consumption was negatively related to news discernment ($p<0.05$) but that appeared to be driven by the consumption of the news that leans right (Ibid.).

A multiple regression was conducted in order to determine the relationship between news discernment, the five personality factors, participants' ideology, and the number of hours reported, the results being presented in Appendix 9, Table 3. The model explained a significant variance in news discernment, $F(7, 345) = 15.80$, $p<0.001$, $R^2 = 0.24$ (Calvillo et al., 2021). Agreeableness, conscientiousness, and open-mindedness were positively related to political news discernment and extraversion, political conservatism and the number of hours participants consume political news were negatively related (Ibid.).

The authors identified as limitations of their studies the following: the sampling of materials, as the headlines used in the study appeared on the Internet prior to their data collection; the sampling of participants was not representative of the general population regarding their personality, ideology and news exposure; there was a strong probability that the news consumption reported was exaggerated, as there were cases with reported over 384 hours/week; finally, the effect sizes presented in the study were small (Calvillo et al., 2021).

### *2. Fake News and Cognitive Modes of Thinking*

There are many cognitive factors which influence if information received is perceived as true or untrue. Almost one century ago it was found that individuals who had been previously exposed to a rumor tended to believe it more if they encountered it a second time (Allport and Lepkin, 1945). Continuing the work on the illusory truth effect, it was found recently that simply reading a fake news headline once is sufficient to increase the later perception of its accuracy, and that in fact the fraction of the participants rating it as accurate doubled after only one prior exposure, while the effects compounded after multiple exposures (Pennycook et al., 2018). The explanation for this mechanism is that repetition encourages rapid and fluent processing, which subsequently creates the belief that the repeated statement is true, and thus, this heuristic plays a great role in accuracy judgements even for highly implausible, partisan or entirely fabricated news stories (Ibid.). However, it was also found that giving the participants reasons to be skeptical/wary of fake news in the form of an explicit warning did decrease later perceptions of fake news (Pennycook et al., 2017). It is therefore important to determine if the tendency to believe in fake news is influenced by the individual's cognitive mode of thinking, namely if one is easily accepting of a wide variety of claims – the so called reflexive open mindedness (Pennycook et al., 2015) or if one is deliberate and questions his/her intuition – the so called reflective open mindedness (Baron, 2018).

The most accepted theory regarding the cognitive mode of thinking is the dual process theory, in which human cognition is divided into autonomous,

intuitive processes (Type 1) and deliberate, analytical processes (Type 2) (De Neys, 2012; Evans & Stanovich, 2013; Kahneman, 2011). Based on recent research, it was found that the propensity to engage in Type I or Type II thinking (that is, relying on gut feeling/intuition versus relying on deliberate reasoning) is associated with a variety of beliefs and behaviors (Pennycook et al., 2015a).

A 2020 study by Pennycook and Rand explored the relationship between fake news, the cognitive mode of thinking, bullshit receptivity and overclaiming. The authors defined bullshit material as being different from lies, in the way that bullshit is constructed without concern for the truth, but with the goals of garnering attention, increasing advertising revenue or achieving social and/or political gain (regardless of its truthfulness) (Pennycook and Rand, 2020). Overclaiming refers to the disposition of individuals for overstating their familiarity/expertise with a certain subject/knowledge, when in fact that piece of knowledge does not exist at all (Ibid.). There is a great deal of evidence that non-analytical (intuitive) individuals tend to be overconfident and rate themselves as being reflective, even if they rely primarily on gut feeling (Pennycook et al., 2017a).

The above-mentioned study started with 447 participants enlisted through Amazon Mechanical Turk, in the end complete data was retrieved for N=402 participants (205 males, 196 females, one did not state the gender) with mean age of 37.7 years (Pennycook and Rand, 2020). In order to quantify the belief in fake news, participants were presented with six news headlines that all have been identified as false by an independent fact checker. The cognitive mode of thinking was calculated using two versions of the Cognitive Reflection Test (CRT), the original worded version by Frederick (2005) (via Shenhav et al., 2012) and the non-numerical CRT from Thomson and Oppenheimer (2016). The bullshit receptivity task was operationalized using ten randomly generated sentences filled with abstract buzzwords (for example, "We are in the midst of a high-frequency blossoming of interconnectedness that will give us access to the quantum soup itself") and had to rate on a 5-point Likert scale the profundity of that statement (Pennycook and Rand, 2020). The overclaiming variable was measured using the method created previously, where the participants had to rate on a 6-points Likert scale (0 – Never heard of, 6 – Very familiar) their familiarity with a set of items which ranged from easy (e.g. "Bible" or "Bill Clinton") to impossible (e.g. the name of a researcher's neighbor) (Paulhus et al., 2003).

The correlations among the variables analyzed in the study can be seen in Annex 3. The perceived accuracy of fake news was positively correlated with receptivity to bullshit and the willingness to overclaim, and correlated negatively with CRT performance (i.e., analytical thinking) (Pennycook and Rand, 2020). The authors then conducted an exploratory factor analysis using the iterated

principal factor method of the four scales and it showed that there was a single factor (eigenvalue = 1.33, 95% of variance explained) onto which all four scales loaded heavily in the expected direction: perceived fake news accuracy = 0.58, CRT = -0.55, bullshit receptivity = 0.51, overclaiming = 0.67 (Ibid., p.7). This shows that there is a common factor underlying these four variables, and the authors concluded that most probably that factor was *reflexive open mindedness*, i.e., the tendency to trust one's intuition and come to a conclusion quickly (Ibid.).

Two limitations were identified in the above-mentioned study. First, the participants were offered just the news headlines and asked to identify if they were fake, so they had no chance of seeing the actual body of the article, in order to be better informed. Thus, the generalizability of the results can not be stated (Pennycook and Rand, 2020). Second, because the participants were specifically asked about the truthfulness of a headline, this could have prompted them to reflect about that matter in a way in which normally they would not do it. It is thus unclear the extent people would believe fake news if not specifically asked to reflect on that matter (Ibid.).

In another study by Bronstein, Pennycook, Bear, Rand and Cannon, the authors studied how the belief in fake news is associated with delusionality, dogmatism, religious fundamentalism and reduced analytic thinking (Bronstein et al., 2018). People who are delusional usually endorse unusual ideas related to conspiracy theories (Dagnall et al., 2015), tend to believe in paranormal phenomena (Pechey and Halligan, 2011), and side with absurd explanations for ambiguous events (Bronstein and Cannon, 2017; Zawadzki et al., 2012). The authors wanted to find out if delusional individuals were more inclined to ascribe truthfulness to fake news, in part because analytic thinking capabilities of these individuals are reduced – either because of a lower cognitive ability or a lower willingness to engage in analytic thinking, favoring instead the type of thinking based on intuition.

Another factor that could increase the belief in fake news is a reduced actively open-minded thinking (**AOT**; Baron, 1985). Actively open-minded thinking refers to the use of evidence (such as opinions of others or information that disconfirms one's beliefs) when an individual is forming or updating its own beliefs (Stanovich and West, 1997) and also to the tendency to actively search for alternative explanations (Campitelli and Gerrans, 2014). Prior studies have demonstrated that reduced AOT is associated with belief in conspiracy theories (Swami et al., 2014) and paranormal phenomena (Svedholm and Lindeman, 2013).

Besides delusionality, the study also explored how dogmatism and religious fundamentalism influence the belief in fake news. Dogmatic people generate less evidence against their judgements in the process of reaching a

conclusion (Davies, 1998) and engage in less analytic reasoning during syllogism evaluation tasks that feature conflicting cues regarding syllogism validity (Martin, 2008). Therefore, the evidence strongly suggests that more dogmatic individuals tend to use less open-minded thinking and engage less in analytical thinking. Religious fundamentalists are another group of individuals which may exhibit these traits, considering that religious fundamentalism is strongly correlated with dogmatism (Altemeyer, 2002).

The study tried to determine if delusion-prone individuals, dogmatic individuals and religious fundamentalist are more inclined to believe fake news and to test if the two inter-related mechanisms of reduced analytic and actively open-minded thinking are contributing to this vulnerability (Bronstein et al., 2018). Participants (over 18 years old and living in the USA) were recruited in two waves via Amazon's Mechanical Turk, with N=948. Belief in fake and real news (carefully selected to be as politically neutral as possible) was determined using 12 fake and 12 real news headlines in random order, which the participants had to rate on a four-point scale (1-Not al all accurate, 4-Very accurate); delusion-like ideation was measured using the 21-question Peters et al. Delusion Inventory (PDI; Peters, Joseph, Day and Garety, 2004, sample question: "Do you ever feel as if there is a conspiracy against you?"); actively open-minded thinking (AOT) was calculated using the version by Stanovich and West, 2007 (example: "A person should always consider new possibilities", 1-Strongly disagree to 6-Strongly agree); analytic thinking was calculated using the Cognitive Reflection Test (CRT; Federick, 2005); dogmatism was measured using the 20-item DOG scale (Altemeyer, 2002, example item: "The things I believe in are so completely true, I could never doubt them" with 1-Strongly disagree and 9-Strongly agree); finally, religious fundamentalism using the 20-item Religious Fundamentalism Scale (Altemeyer and Hunsberger, 1922, sample question: "The basic cause of evil in the world is Satan, who is still constantly and ferociously fighting against God", 1-Strongly disagree, 9-Strongly agree) (Bronstein et al., 2018).

Descriptive statistics and zero-order correlations are presented in Annex 4, Table 1 and Table 2. Delusion ideation, dogmatism and religious fundamentalism were all positively correlated with belief in fake news; on the other hand, delusion ideation, dogmatism, religious fundamentalism and belief in fake news were all negatively correlated with analytic and actively open-minded thinking (belief in real news was positively correlated with analytic and actively open-minded thinking) (Bronstein et al., 2018). Moreover, both cognitive style measures were correlated with media truth discernment (the difference between standardized real and fake news accuracy ratings, as in "hits"-"false alarms") (Ibid.).

Furthermore, a mediation analysis was conducted to test if the relationship between the belief in fake news and delusion ideation, dogmatism and religious fundamentalism could be explained by the mode of thinking (analytic and actively open-minded thinking) (Bronstein et al., 2018). A summary of all the statistics for the regression models in the mediation analysis is presented in Annex 4 - Table 3 and Figures 3, 4, 5. Results showed that delusional individuals, dogmatic individuals and religious fundamentalists are more inclined to believe fake news, and these relationships can be partially explained by the individuals' cognitive mode of thinking, i.e., by exhibiting reduced engagement in actively open-minded thinking and in analytic thinking (Ibid.).

A 2021 study, more specialized, by Calvillo, Rutchick and Garcia, looked at the factors that could have influenced the belief in fake news about voter fraud in the week after the 2020 U.S. election. Besides cognitive reflection (a personal characteristic that is important in our review), the authors also analyzed the political ideology of the participants, the approval of the outgoing president, trust in mainstream media, education, susceptibility to conspiracy narratives and news consumption (Calvillo et al., 2020). Participants were selected from Mechanical Turk, in the end there were N=376 people (198 females, 175 males, 3 did not respond), with age 19 to 75 (median=40) years old, with 221 having a college degree and 155 having not (Ibid.).

In order to determine belief in fake news, participants rated the truthfulness of 15 election-related headlines (5 true, 10 false) on a 6-point Likert scale (1-definitely false, 6-definitely true); cognitive reflection was measured on the 6-item cognitive reflection measure; conspiracy ideation was measured with a 15-item conspiracist belief scale (Brotherton, 2013); trust in the mainstream media coverage of the election was measured with a created 5-item questionnaire (e.g. main question: "Mainstream media coverage of the election…" + "has been fair"/ "has been accurate"/ "has been unbiased"/ "has told the whole story"/ "can be trusted", with answer varying from 1-strongly disagree to 5-strongly agree) (Calvillo et al., 2020). Then participants answered questions regarding about demographics, their political ideology (1-very liberal to 7-extremely conservative), who they voted for in the election and the approval of the former president (1-strongly disapprove, 4-strongly approve) and stated their news consumption habits with regard to quality (from a 45 news sources provided, each having a bias rating an the website Allsides.com) and quantity (for each source selected, how many hours of election news they consumed in a week) (Ibid.).

Descriptive statistics and bivariate correlations are presented in Annex 6, Table 1. Belief in false election news was positively correlated with political ideology, approval of the outgoing president and conspiracy beliefs, and

negatively correlated with cognitive reflection and media trust (all $p<0.001$), while having a college degree was not significantly related (Calvillo et al., 2020). Many of the predictors were also intercorrelated among themselves (Ibid.).

The multiple linear regression analysis yielded the results presented in Annex 6 Table 2. Conspiracy beliefs, political ideology and approval of Trump were positively associated with belief in fake news and cognitive reflection was negatively associated with the belief in fake news, the model accounting for a significant proportion of variation for the belief in false news ($F(6,369)=98.31$, $p<0.001$, $R^2=0.62$, adjusted $R^2=0.61$) (Calvillo et al., 2020). On the other hand, media trust was not significantly related to the belief in election fake news, even if it had a significant bivariate correlation with it (Ibid.). The relation between news consumption and the belief in fake news was calculated in another regression, but because this does not relate to our review (non-personal individual characteristic) we do not present it here.

Limitations identified by the authors of this study were related to the fact that the sample was not representative (as Mechanical Turk sample tend to be more politically liberal than the representative samples); people holding strong conspiracy beliefs tend to be underrepresented in this study; small number of false headlines about election fraud (Calvillo et al., 2020).

A 2020 Polish diagnostic survey by Brzóska and Rosińska explored the impact of analytical thinking on the ability to detect fake news. A sample of 303 people was selected from Facebook using the snowball method (Brzóska and Rosińska, 2020). Belief in fake news was measured with the responders rating on a 6-point Likert scale (1-definitely not accurate, 6-definitely accurate) 14 real news from popular Polish sources and 14 fake news identified as being so by Polish fact-checkers (Ibid.). Three indicators were then calculated: 1 – the perceived accuracy of fake news (average of responses to all fake news), with a higher indicator pointing to a higher degree of belief in fake news; 2 – perceived accuracy of real news (average responses to all true news) and 3 – detection of fake news (measured by subtracting 2 from 1) (Ibid.).

Analytical thinking was measured using both a cognitive reflection test and a verbal cognitive reflection test (Brzóska and Rosińska, 2020). The final results were coded so that the first 25% of respondents who score the best were assigned to the group with high analytic thinking and the 25% of respondents who scored the worst were assigned to the group with low analytic thinking (Ibid.). Finally, demographic questions regarding gender, age, education and using Facebook as a source of news were distributed (Ibid.).

A simple diagnostic survey was then conducted, trying to present the connection between analytical thinking and the detection of fake news (indicator number 3). General results, as well as the results by gender, age, educational level

and using Facebook as a source of news are presented in Annex 10. It was observed that in general, Polish people who think more analytical are better at detecting fake news (Brzóska and Rosińska, 2020). Regarding gender, both males and females with high analytical thinking had similar accuracy when detecting fake news, but there was a marked difference between males and females in the low analytic thinking group regarding the detection of fake news; regarding age, people aged 25-34 scored highest at detecting fake news, irrespective of their high or low cognitive abilities, while for people aged 50+ there was no markable difference between low and high analytic thinkers (Ibid.). In the case of education, two problems appeared: first, there was no high analytical thinker in the Vocational cohort; second, in the Technical cohort, high analytical thinkers scored lower at fake news detection than low analytic thinkers, which is not in line with the accepted theories (Ibid.). These problems notwithstanding, it was observed that the higher the education, the higher the success in detecting fake news (Ibid.). Regarding the use of Facebook as the source of news, it is worth mentioning that the study had no person in the high analytical cohort who did not use Facebook; second, that the highest difference between high and low analytical thinking people in detection of fake news happened for people who used Facebook as their main source of information, which is counterintuitive and needs to be investigated further (Ibid.).

### *3. Fake News and Emotions*

The way emotions influence the belief in fake news was studied in a 2020 article by Martel, Pennycook and Rand. It comprised of two studies, in the first one (N=409) it was studied the way in which experiencing emotions modified the propensity to believe in fake news; in the second study (N=3884), the authors measured and manipulated reliance on emotion versus reason in four experimental studies (Martel, Pennycook and Rand, 2020).

Emotion plays an important role in the individual cognition and decision-making processes. It was found that anger elicits greater reliance on heuristic cues in a persuasion paradigm, while sadness elicits an opposite, decreased reliance on heuristic cues (Bodenhausen et al., 1994). Moreover, being in a negative mood increases skepticism, while being in a positive mood increases gullibility and decreases the ability to detect deception (Forgas and East, 2008). Regarding the way specific emotions are involved in the appraisal of fake news, it has been suggested that anger promotes politically aligned belief in misinformation while anxiety increases belief in politically discordant fake news (Weeks, 2015). Sad individuals could engage more in analytic thinking, therefore be more skeptical of fake news, with the opposite being true

for happy individuals (Forgas 2019). Faith in intuition ("gut feelings") are associated with belief in conspiracy theories and falsehoods in science and politics (Garret and Weeks, 2017).

The first study, which was exploratory, investigated the relationship between the state of emotionality and accuracy judgements of real and fake news (Martel, Pennycook and Rand, 2020). There were N=409 participants (M=35.18 years old, 227 women) selected via Amazon Mechanical Turk, who completed the 20-item Positive and Negative Affect Schedule scale (PANAS; Watson et al., 1988), which assessed on a 5 points Likert scale (1-Very slightly or Not at all, 5-Extremely) the extent one feels a certain emotion at that moment; belief in fake news was gauged by using 20 actual headlines that appeared on social media, 10 being factually accurate (real news) and 10 being entirely untrue (fake news), with each participant ascribing scores on a 4 points Likert scale (1-Not at all accurate, 4-Very accurate) to the question: "To the best of your knowledge, how accurate is the claim in the above headline?" (Ibid.).

The authors then performed linear mixed-effects analysis of the relationship between perceived accuracy, specific emotions (PANAS score) and the type of headline (true or false), with results presented in Annex 5 Table 1 (Martel, Pennycook and Rand, 2020). Results indicated that for almost all emotions present, increased emotionality also predicted decreased discernment between real and fake news, with only "interested", "alert", "determined" and "attentive" (which could easily be associated more with analytic thinking than with emotionality) not registering those effects (Ibid.). Moreover, *both* positive and negative emotions are associated with an increased belief in fake headlines, but the relationship is not clear in the case of true headlines (see Annex 5 Figure 2) (Ibid.). Effect sizes were also substantial, belief in fake news being nearly twice as high for participants with the highest aggregated positive and negative emotion scores compared to participants with the lowest aggregate positive and negative emotion scores, so it can be concluded that even if people experiencing a high emotion state are still able to discern between fake and true news, there is a notable increase in belief in fake news as one's emotional state increases (Ibid.).

There are two limitations identified by the authors pertaining to study 1. First, those results could be driven by floor effects, because most participants reported experiencing a relatively low level of emotion (Martel, Pennycook and Rand, 2020). Second, that participants with higher emotionality scores were most probably less attentive, and that could negatively influence the process of discrimination between real and fake news (Ibid.).

Study 2 was a continuation of the research conducted in the first study, the authors manipulating the extent to which individuals relied on emotion OR reason when judging the accuracy of news headlines (Martel, Pennycook and

Rand, 2020). It consisted of four experiments in which reliance on reason versus emotion was experimentally manipulated using an induction prompt taken for the work of Levine et al. (2018). For each experiment (with the exception of experiment 1, which had no control condition), participants were randomly assigned to one of the three conditions: *a reason induction* (i.e., "Many people believe that reason leads to good decision-making. When we use reason, rather than feelings, we make rationally satisfying decisions. Please assess the news headlines by relying on reason, rather than emotion"), *an emotion induction* (i.e., "Many people believe that emotion leads to good decision-making. When we use feelings, rather than logic, we make emotionally satisfying decisions. Please assess the news headlines relying on emotion, rather than reason") or *a control induction* (Martel, Pennycook and Rand, 2020). All these are summarized in Annex 5, Table 3. After the induction prompt, participants had to read a series of headline news, some which were true and others which were fake, and rate them on a 6-point Likert scale (1-Definitely false; 6-Definitely true), and after that participants (experiments 2, 3 and 4) had to answer several questions regarding how much reason or emotion used when assessing the accuracy of the news headline (1-None at all, 5-A great deal) (Ibid.). Finally, data was aggregated across all four experiments, in order to improve the statistical power and to determine if the effects of using emotion or using reason were consistent across a range of slightly different assessments (Ibid.).

The authors performed first a linear mixed-effects analysis with either self-reported use of emotion or self-reported use of reason and determined that the use of emotion is associated positively with belief in fake news (but not in real news), while the use of reason is associated positively with belief in real news (but not in fake news) (Martel, Pennycook and Rand, 2020). The results are summarized in Annex 5, Figure 3. Secondly, the authors performed a linear mixed-effects analysis of the relationship between news accuracy, induced experimental condition (emotion, reason or control) and type of news headline, in order to determine if there is a condition effect on the perceived accuracy of fake and real news across all four experiments (Ibid.). Results are presented in Annex 5, Table 4 and Figure 4. Again, participants in the emotion condition tended to believe more in the fake headline news presented (assign higher accuracy ratings), while participants in the control and reason conditions tended to believe less in the fake headline news presented (assign lower accuracy ratings) (Ibid.).

As limitations to this study the authors pointed to the fact that the induction manipulation used in those four experiments was heavy-handed, probably prompting experimenter demand effects; most individuals considered fake news headlines as being more likely to be false, even when relying on emotion; the

study did not find evidence that inducing reason improves the belief in fake news relative to the control; the study did not include/calculate the emotions produced by reading the news presented, as it is well known that fake news elicits strong emotions for its consumers; the study did not consider the precise mechanisms by which certain emotions might influence the ratings ascribed to news headlines; it was not determined the role of baseline emotional state (as a stable individual trait) in judging the accuracy of presented news; the sample used was a convenience sample; finally, the experiments only used a small number of contemporary fake and real news headlines (Martel, Pennycook and Rand, 2020).

## IV. CONCLUSIONS

### *1. Summary of obtained results*

We synthesized the last eight years of research into the association between fake news and individual personal characteristics. This review found that the most important traits affecting the belief in fake news are personality, intelligence, cognitive modes of thinking and emotions.

All five personality traits (extraverted, critical/quarrelsome, open to new/complex, sympathetic/warm, disorganized/careless) have at least a medium effect size for correctly identifying disinformation. However, across multiple studies, higher Extraversion was associated with lower ability to discern fake news. On the other hand, agreeableness, conscientiousness, and open-mindedness were associated with higher ability to discern fake news.

Higher intelligence is another trait that safeguards against the belief in fake news, but the mechanism of action is intricate: individuals with higher crystallized intelligence are better at correctly classifying true news, while individuals possessing higher fluid intelligence are more protected against believing fake news. When cognitive ability moderates personality traits, individuals with high cognitive ability and a high degree of emotional stability (low neuroticism) are associated with a lower belief in fake news. On the other hand, individuals with low cognitive ability and higher consciousness, as well as individuals with low cognitive ability and higher agreeableness, are associated with lower belief in fake news.

Regarding the belief in fake news and cognitive modes of thinking, reflexive open mindedness (the tendency to trust one's intuition and come to a conclusion quickly) can predispose an individual to believe more in fake news. Reflective open-mindedness, or analytical thinking, protects an individual against the belief in fake news. Moreover, actively open-minded thinking (the use of evidence such

as opinions of others or information that disconfirms one's beliefs) when an individual is forming or updating its own beliefs plays a positive role in protecting against the belief in fake news. Its opposite, represented by delusional individuals, dogmatic individuals and religious fundamentalists, represent individuals who are more inclined to believe fake news, and these relationships can be partially explained by the individuals' cognitive mode of thinking, i.e., by exhibiting reduced engagement in actively open-minded thinking and in analytic thinking.

Finally, it was determined that increased emotionality predisposes to belief in news. This is true for a wide range of human emotions (the notable exceptions being those emotions that are intimately related to cerebral thinking like interested, alert, determined and attentive). Moreover, both positive and negative emotions are associated with an increased belief in fake headlines when their intensity is higher.

### *2. Limitations*

Prior work regarding the relationships between the belief in fake news and personal individual characteristics has yet to obtain broad consensus among scientists. There were studies – especially those regarding personality – which obtained non-congruent results: in some of the studies some personality traits played a role in the belief in fake news, while in other studies those same traits registered no statistical significance and vice versa.

What is probably even more important, one can not draw a definite conclusion encompassing the whole human nature, as the majority of the studies were done at the country level, and the influence of cultural differences in tackling fake news have not been factored in. Moreover, many authors pointed towards the lack of representativity for their chosen sample, even at this level of country research.

Another shortcoming present in many of the studies analyzed was that no long-term conclusions could be extracted from the research. The experiments were done "here and now" and offered just a glimpse into the momentary state (emotional and cognitive) of the participants.

### *3. Future implications*

The fake news is here to stay, with all its negative consequences affecting people, institutions and states. There are already moves initiated by state-actors to curtail the spread of this phenomenon, but this action can limit the freedom of speech, and, moreover, raises another complicated question: who gets to decide what constitutes fake news?

A different avenue – albeit much harder and probably more resource consuming – would be to combat the spread of fake news through the implementation of educational programs aimed at teaching people how to better identify fake news and what skills they could develop in order to properly process this type of truncated information. In this respect, of use would probably be teaching people to rely less on emotions and employ reflective thinking more often, while avoiding the pitfalls of overconfidence and/or dogmatism. This could be a direction for future research, what skills would an individual learn that would work best to protect against false beliefs, which in turn could produce detrimental actions.

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# Undergraduate Students' Opinion on Digital Learning in a Post-pandemic Era: A Case Study

**Bianca Doris BRETAN**[1]

**ABSTRACT.** The current article aims to investigate learners' post-pandemic attitude towards digital learning in Higher Education with a specific focus on a group of undergraduate Law students at Babes-Bolyai University from Cluj-Napoca, Romania. To achieve its purpose, the article focuses on answering two research questions: Do post pandemic undergraduate students recognize the benefits of digital learning? Is e-learning currently a reasonable choice for them? The research is designed as an exploratory case study that uses three data collection tools: a questionnaire, an interview, and a classroom observation protocol. The article links information from literature related to the use of digital learning during the pandemic with results revealed by the data collected in the case study. The results suggest a steady trend towards a growing acceptance rate of digital learning by the targeted student population and a lower approval rate of e-learning.

**Keywords:** higher education, digital learning, online learning, pandemic, good teaching practices.

**ZUSAMMENFASSUNG.** Der aktuelle Artikel zielt darauf ab, die Einstellung der Lernenden nach der Pandemie zum digitalen Lernen in der Hochschulbildung zu untersuchen, wobei der Schwerpunkt auf einer Gruppe von Jurastudenten im Grundstudium an der Babeş-Bolyai-Universität aus Cluj-Napoca, Rumänien, liegt. Um sein Ziel zu erreichen, konzentriert sich der Artikel auf die Beantwortung zweier Forschungsfragen: Erkennen Studierende nach der Pandemie die Vorteile des digitalen Lernens? Ist E-Learning derzeit eine sinnvolle Wahl für sie? Die

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Forschung ist als explorative Fallstudie konzipiert, die drei Datenerfassungstools verwendet: einen Fragebogen, ein Interview und ein Beobachtungsprotokoll im Klassenzimmer. Der Artikel verknüpft Informationen aus der Literatur zum Einsatz digitalen Lernens während der Pandemie mit Ergebnissen, die sich aus den in der Fallstudie erhobenen Daten ergeben. Die Ergebnisse deuten auf einen stetigen Trend hin zu einer steigenden Akzeptanzrate des digitalen Lernens durch die Zielgruppe der Studierenden und einer geringeren Zustimmungsrate von E-Learning hin.

**Schlüsselwörter**: Hochschulbildung, digitales Lernen, Online-Lernen, Pandemie, gute Lehrpraktiken

## INTRODUCTION

The year 2020 made history in education by adopting an unexpected and abrupt passage to online teaching. The Covid 19 pandemic created the needed context and occasion to test the efficiency of digital teaching and learning in a worldwide hub where specialists tried to give solutions and to find adequate educational tools. Studies conducted in that period researched the potential and the outcome of using digitalization in education at all levels, Further and Higher Education included.

Among them, the conclusions of an official EU (European Union) document on how the pandemic's impact has been valued for digital and online learning practices.

"The COVID-19 pandemic has cultivated a new cohort of students who were not interested in fully online learning previously, representing a sizable new source of online learners" (Capranos et al.:2021),

Therefore, it was concluded that teaching needed to pursue this trend and offer a fair level of knowledge necessary in students' future careers.

However, opinions and attitudes are changing variables if they are linked to specific situations such as the pandemic. In a study issued in 2022, Nikolopoulou focused on university students' opinions and preferences on different modes of education (Nikolopoulou:2022). The findings reveal a steady trend towards in-person learning while compared to the online alternatives, a choice that is supported by the results of other research performed in different geographical areas of the world (Finlay et al.:2022; Iqbal et al.:2022; Pongkendek et al.:2021; Khan at al.:2022; Zapata-Cuervo et al.:2021). The current study's aim is to contribute to existing discussions on the topic with a point of view based on academic inquiries from Babes-Bolyai University in Cluj-Napoca that could be

used for other studies. The importance of these studies for higher education is significant as students' attitude towards modes of education is a relevant factor in deciding educational policies in Higher Education.

## LITERATURE REVIEW

Digital learning or D-learning is "any type of learning that is facilitated by technology or by instructional practice that makes effective use of technology" (Basak et al.:194). In this article the term *digital learning* is used with the meaning of a teaching method based on the use of digital tools to enable students to learn in different formats, whether it be face-to-face, distance learning (asynchronous or synchronous) or blended learning.[2] Therefore, *digital learning* is regarded not in a simplistic manner, considering it a tool employed in digitizing educational content but as a set of educational methods (such as the virtual classroom, serious games, the MOOC (Massive Open Online Courses), SPOC, mobile learning, social learning, and adaptive learning).[3] *Digital learning* encompasses any type of learning that uses technology in a broad sense, involving the use of digital platforms, tools, systems, and applications by learners. Examples include taking online courses, watching educational videos online or using digital devices and tools in a traditional face-to-face lesson in the classroom.

*E-learning* is one of the many pedagogical approaches of digital learning, which encompasses all online learning methods and techniques. To be more specific, *e-learning* is a fully virtual learning experience where students and teachers do not have face-to-face interaction.

In other words, *digital learning* is about a learning experience used across various contexts (corporate meetings with professionals, education) combining digital tools with learning formats (blended, online or in-person) while *e-learning* is associated with fully online learning experiences focusing solely on online tools in a remote environment, etc.[4]

As the focus of the current study is on university students, next this section will provide information on the approach to Higher Education put forward by European institutions. *The Future of Digital and Online Learning in Higher Education handbook 362* is a reflective document from 2022 edited by the European Commission that offers "a systematic overview of the current debate on how the impact of the pandemic has been valued for digital and online learning

[2]What is digital learning? https://www.ipag.edu/en/blog/definition-digital-learning
[3] Ibidem.
[4] Ibidem.

practices and adaptations" (Humpl and Andersen 2022:5). The document's crucial point is the implementation of the Digital Education Action Plan (2021-2027) that has the following requirements:

- "Digital and online learning needs accessible digital technology. It involves the development of a high-performance digital education ecosystem in the EU (European Union) through supporting the improvement and expansion of digital infrastructure, connectivity, and equipment" (European Commission:2021a).
- "Digital and online learning needs digital skills and competences. This part aims to launch a framework of practical guidelines on how to implement effective and inclusive distance, online and blended learning" (European Commission:2021a). It focuses on the development of digital education as part of teachers' professional development, including initial teacher education. Educators need to learn how to tailor digital technology to specific subjects, goals, and activities.
- "Digital and online learning needs a digital learning culture: a key factor for sustainability is the development of a digital learning culture that requires the cultivation of new forms of participation. Therefore, students, educators, and administrators need to work together to examine the emerging challenges and to support implemented changes due to digitalization." (Carolan et al.:2020).
- "Digital and online learning needs financial support: to develop and deliver high-quality online courses regularly is not necessarily cheaper than face-to-face courses; it requires faculty members to be trained in online teaching. And they need to spend sufficient upfront time to design and develop online courses in collaboration with a team of instructional designers, production specialists, multimedia specialists, and other support staff" (Ortagus:2020).

In the year 2020 Babeș-Bolyai University, the host of the current research, displayed a pro-active attitude towards digitalization by adopting a strategy that aimed to make a step-by-step transition to a digital future.

However, there was a discrepancy between the intention towards digitalization at an institutional level and the readiness of the educational environment. An article based on the results of an in-house questionnaire (Felea: 2020) describes the following situation: out of the 22 professors that took part to the study (all of them with at least 15 years of experience in teaching undergraduate students), most participants (68.2%) reported medium ability in using digital technology before the pandemic (pg.19). The institutional response to the crisis

was perceived as insufficient at macro-level by most participants who felt abandoned and emphasized the lack of preparedness in terms of decision-making and management/coordination, lack of infrastructure and support for teacher training (pg.21). However, the SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis described in the second part of the article reveals a fair future of online pedagogy: in terms of strengths all participants agreed that developing new competences for teaching in the 21st century, experimenting with new methods, and adapting to online teaching are important and very important (pg.22) whereas in relation to opportunities, ranking high in participants' options for important and very important were flexibility and diversity of teaching strategies and developing alternative formats for teaching/ delivering and assessing students (86-88%). Next on the list of opportunities appreciated by a large majority of participants was collaboration with other teachers/ colleagues and building a community of practice (77%) (pg. 24).

Lack of training in teaching digital lessons sometimes resulted in teacher-centered lessons that had little in common with 21st century pedagogy (Pozo et al.:2021). However, the study reveals a connection between the earlier use of ICT (Information and Communication Technologies) with its better use during the pandemic.

Nemes (2001) reported on a small-scale survey completed by 56 undergraduate students about some of the challenges and affordances of online learning as perceived by students (pg. 103). The results show that most students appreciated the flexibility offered by online classes in terms of timetable. They expressed preference for shorter lessons combined with a reasonable load of asynchronous tasks (pg.115). Moreover, students expressed their preference towards project work including it on the list with assessment techniques used in the end of term exam. The results also show that efficiency in teaching is associated with prompt feedback from the teacher and incorporation of a wide variety of different digital materials and apps in the lesson (pg. 115). The problems mentioned by the survey takers are all connected to technical difficulties related to the internet connection or technical devices (pg.114).

The same type of problems is described in a study from 2020 conducted by Agung et al. that concludes "most English students are not ready for this rapid shift in terms of teaching and learning style. Several reasons were identified, and they can be categorized into three factors: the first is availability and sustainability of internet connection, the second is accessibility of teaching media, and the last is compatibility of tools to access the media." (2020:234).

## RESEARCH METHOD

The current article is based on the results of small-scale research conducted as a case study. The following is a description of its method and design.

- Research question: Do post pandemic undergraduate students acknowledge the benefits of digital learning? Is e-learning currently a reasonable choice for them?
- Case choice: The focus of the case is a group of first-year students in the Faculty of Law at Babes-Bolyai University, Cluj-Napoca, Romania. In 2020, Babeș-Bolyai University embraced digitalization by implementing a progressive strategy to transition towards a digital future. In October 2022, BBU accessed EU funding from the Recovery and Resilience Facility program available for expanding broadband and high-speed internet access for educational institutions in EU member states. The project is scheduled for execution from September 2022 to December 2025. Subsequently, the university showed keen interest in research and initiatives concentrating on artificial intelligence, with a recent emphasis on Intelligence for Connected Industries.
- Type of case study: It is designed as an exploratory case study, trying to get a grasp of the attitude of a specific group of undergraduate students towards digital and online learning two years after returning to classroom.
- Scope and boundaries: The scope is to measure the approval rate for employing digital learning and the degree of willingness to further employ online learning. The boundaries are related to the size of the group, the specific course they take, and the time span.
- Data collection method: there are three data collection tools employed, one questionnaire that aimed to gather quantitative data that measure their opinion on the researched topics, an interview with predetermined questions to understand students' attitude as expressed in the questionnaire, and teacher conducted classroom observations to record the efficiency of employing digital tools in the lesson.
- Data collection plan: The case study covered two months from the first semester of the academic year 2023-2024 (from October 16 to December 15). The teacher conducted classroom observations regularly. The questionnaire was given in October, the first month of the study, in a pen-and-paper format. The interview took place in the first two weeks of November 2023. All students that took part in the study agreed to do so voluntarily.

- Rigor of the study is achieved by triangulation, i.e., using multiple data sources (survey, interview, classroom observation)
- Data analysis approach combines qualitative analysis of interviews with quantitative analysis of surveys.

### *Participants*

The study included forty participants. All of them were first year undergraduate students at the Faculty of Law, Babes-Bolyai University from which 30 were females and 10 were males, the age range was 19-21. All participants were informed about the study and assured that their input and comments would remain anonymous. All the respondents were enrolled in an ESAP (English for Specific Academic Purposes) course that, according to the Language policy promoted by Babes-Bolyai University[5], was meant to prepare them to conduct research in their specialized area and communicate with international members of the same professional community.

There are two limitations of the study that derive from the characteristic of the population sample: one is the major in Law that all the undergraduate student responders have. The other is caused by the size of the group of respondents. Forty students are a small number compared to the total number of undergraduate students majoring in Law. Thus, data cannot be generalized.

### *Data collection tools*

The questionnaire given was written in Romanian (as this was the respondents' mother tongue) to avoid a lack of answers due to a low level of English. Students completed it anonymously, and each student could fill it in only once. Before completion, students were fully informed about the study's aim and agreed to take part voluntarily. All questions were mandatory, and no exclusion criteria were set. The questionnaire had four questions requiring yes or no answers.

Classroom observation was performed by the teacher throughout the research and was based on an observation sheet for teacher's use and a Likert scale form for students' use. The aim for designing this research instrument was to assess various aspects of the lesson: the impact of student engagement with digital learning, the alignment of activities involving digital tools with Legal English syllabus' aims and relevance of using digital learning in Legal English classes. (Figure 1).

[5] https://senat.ubbcluj.ro/wp-content/uploads/2013/10/Politica-lingvistica-UBB.pdf

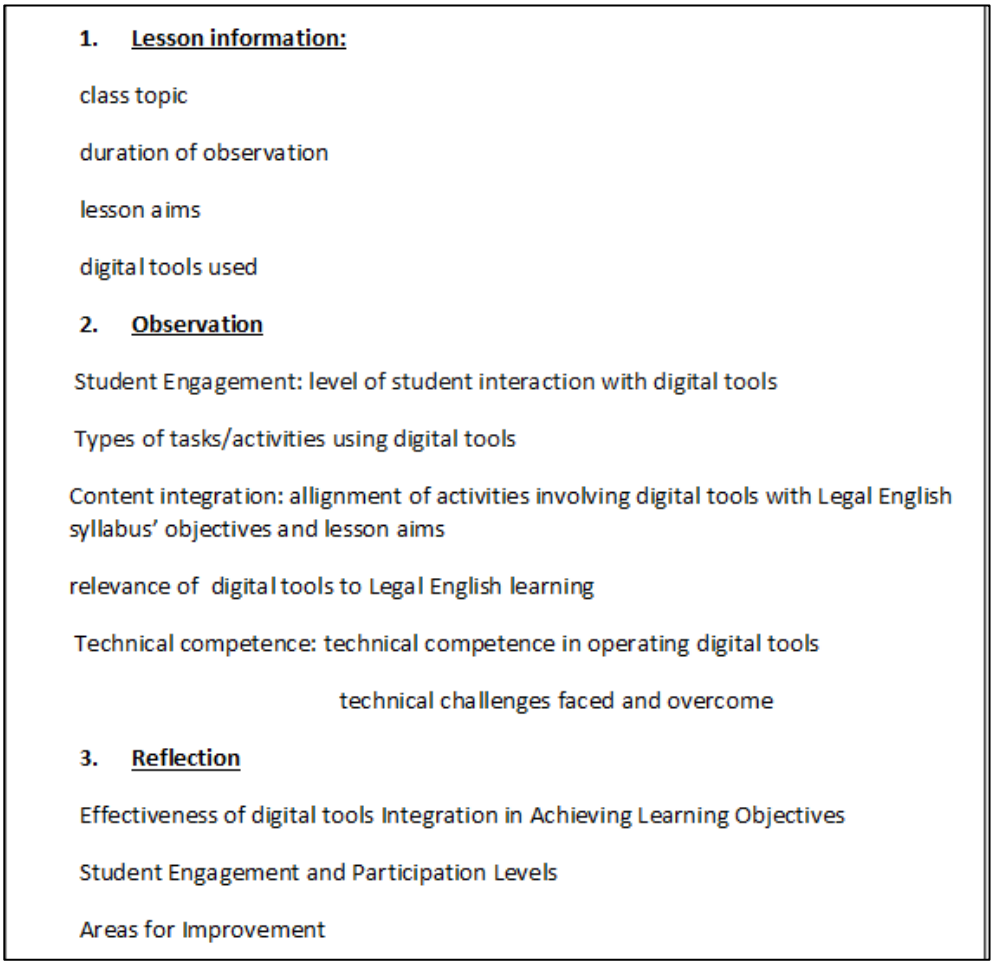


**Figure 1.** The structure of the class observation protocol

The teacher collected the data provided by the observation sheet. Throughout the period of the study there were three types of activities performed in the classroom that were seen by the teacher using the protocol:

a) Listening tasks. Students were asked to watch and listen to some video clips. The videos were posted using Nearpod, an educational App that allows the teacher to design tasks embedded in the video.

b) Vocabulary tasks. Students were asked to do individual tasks created on Wordwall, an educational App that offers creative vocabulary practice.
c) Tests. Students were asked to take concise review tests designed and shared on MS Teams.

The teacher offered feedback on task achievement at the end of each activity. Part of the feedback, students were asked to fill in a short form with one question (Figure 2). The third stage of the lesson observation protocol is the teacher's reflection on the effectiveness of digital tools in achieving learning goals and student participation.

On a scale from 1 to 3 how would you rate your degree of satisfaction in using digital tools to complete the task?

1. Very satisfied

2. Quite satisfied

3. Not satisfied

**Figure 2.** Respondents' level of satisfaction in using digital tools for task completion

The interview taken in the first two weeks of November 2023 consisted of asking all the subjects in the study the same three questions and recording their answers. As in the case of the questionnaires the language of communication was Romanian. All the students were informed that their answers were recorded, and they agreed beforehand.

## RESEARCH RESULTS

This section describes the results provided by the three research tools: the questionnaire, the interview, and the observation protocol.

The questionnaire is made up of four questions that can be grouped according to their purpose in the following way:

- Two questions have the aim to check respondents' level of familiarity with digital learning, and to reveal their earlier experience (if any) in using it (Table 1, 2);

- One question wanted to show respondents' opinion towards the use of digital learning in education (Table 3);
- One question aimed to provide the respondents' current opinion towards e-learning (Table 4).

The pre-coded answers (yes or no) within closed questions were analyzed in a quantitative manner using the functions provided by Google forms.

**Table 1.** The rating of the degree to which respondents were familiar with the concept of digital learning

| **Are you familiar with the concept of using digital learning?** | n (%) |
|---|---|
| Yes | 40 (100%) |
| No | - |

**Table 2**. Rating of the earlier use of digital learning

| **Have you previously used digital learning?** | n (%) |
|---|---|
| Yes | 40 (100%) |
| No | - |

**Table 3.** The rating of respondents' opinion towards the use of digital learning

| **Do you think digital learning is effective?** | n (%) |
|---|---|
| Yes | 40 (100%) |
| No | - |

The results from this set of questions show that the unanimity of participants corresponding to a majority of 100% were already familiarized with the concept of digital learning in education. These figures are logically correlated with the results in Table 2. All the participants in the study had previously used digital learning. Consequently, the results in Table 3 provide a sign of the number of subjects in the study that agree to the use of digital learning: forty, corresponding to 100%. In conclusion, the figures between Table 1,2 and 3 are aligned.

In the case of question number four, the results clearly show that the number of students who felt positive towards using e-learning is quite low (12%). An explanation for this situation is provided in the interview that went with the questionnaire.

**Table 4**. Indication of respondents' current opinion towards e-learning

| **In your opinion, should e-learning be used in your education?** | n (%) |
|---|---|
| Yes | 5 (12%) |
| No | 35 (88%) |

The interview's purpose was to collect more information about the results revealed in the questionnaire. Each interviewee answered three open-ended questions in Romanian in a ten-minute session. One question wanted to find the explanation for respondents' current opinion about the use of digital learning in education as resulted from the questionnaire. The second question is related to respondents' attitude towards e-learning and to understand the reason behind the small number of students that approve it. The third question was aimed to find out the most appreciated elements of online learning. Some of their answers are provided here. They are written down word-for-word, and our translation is provided in footnotes.

To the first question "why digital learning should be used in education?" some of the answers were[6]:

> [deoarece tehnologia face parte din viaţa noastră de zi cu zi si ar fi păcat sa nu o folosim in educaţie]
> [instrumentele digitale facilitează învăţarea deoarece ajuta la înţelegerea mai buna a lecţiei]
> [lecţiile care conţin elemente de digitalizare au numeroase beneficii: sunt mai interesante, mai interactive, studenţii sunt concentraţi pe ceea ce învaţă si nu simt nevoia sa utilizeze telefoanele in alte scopuri]
> [deoarece platformele educaţionale, de exemplu, ajuta la o mai buna organizare a materialelor într-un singur loc]

[6] [because technology is part of our everyday life, and it should be a waste not to use it]; [digital tools help learning because they facilitate a better understanding of the lesson]; [the lessons that use digital tools are interesting, interactive, students are more focused and are not distracted by their mobile phones]; [because the educational platforms, for instance, provide a better management of learning materials].

To the second question "is e-learning a realistic educational choice now? Some of the answers were[7]:
[personal cred ca învăţarea faţă in faţă este mult mai eficienta deoarece in clasa suntem mult mai activi iar profesorul ne poate ghida mai uşor activităţile]
[la predarea faţă in faţă profesorul poate alterna mai uşor activităţile]
[consider ca predarea online este utila in anumite situaţii când întâlnirile faţă in faţă nu sunt posibile]
[predarea online nu este o opţiune buna deoarece studenţii nu sunt atenţi 100%]
[nu o consider o opţiune eficienta deoarece conexiunea umana pe care o oferă predarea faţa in faţă este foarte importanta].

To the third question "mention some of the elements from online teaching that you consider as useful "some of the answers were[8]:
[diferitele platforme educaţionale], [testarea online], [aplicaţiile folosite] [prezentările online].

The classroom observation protocol was designed to record valuable information on students' ease of using digital tools while doing different tasks, on student collaboration and interaction while using those tools, and on the relevance of using digital learning in Legal English. The information provided by the teacher's observation sheet throughout the study points towards a large familiarization and ease in employing digital tools in performing different tasks. Pair work encouraged collaboration offering support for those students who were hesitant or unsure how to use it. The feedback stage at the end of a task helped the students to understand better the aim of employing digital tools and their benefits. The short feedback forms filled in at the end of every activity that embedded digital tools offered the ranking of the three types of tasks included in the study: vocabulary exercises came as the first choice, listening activities the second, and tests took the last place in their preferences.

[7] [I think that in-person teaching is more efficient because we are more active in the classroom and the teacher can organize the activities better]; [the teacher can use a wider range of activities while instructing in-person]; [online teaching is useful in those situations when in-person meetings are not possible]; [online teaching is not an efficient teaching modality because students are not 100% involved, they are distracted by different things]; [I don't think it's a realistic option because the human connection provided by in-person teaching is very important].

[8] [the use of different educational platforms], [online tests], [the Apps], [online presentations].

## DISCUSSION OF RESULTS

The aim of this study is to answer the following research questions: *Do post pandemic undergraduate students acknowledge the benefits of digital learning? Is e-learning currently a reasonable choice for them?*

To achieve its aim, the study focuses on a specific case at the Faculty of Law, Babes-Bolyai University in Cluj-Napoca. According to the University's Language policy, students undertaking legal studies must attend an ESAP course, English for Legal Purposes that is supposed to help them conduct research in their specialized area and communicate with international members of the same professional community. To achieve this, the course focuses on both carrier content and real content by providing law-related context to equip students with relevant knowledge and understanding of the law in the English legal system and, at the same time, developing language skills. Therefore, in this case legal English is the carrier content while the four language skills are the real content.

The information for the study was gathered from three sources that completed one another to offer a reliable picture. The discussion of the results should begin with revealing the strategy behind data collection. The first questionnaire and the interview provided information on the students' feelings and opinions on using digital learning. The results of the questionnaire show that all respondents were familiarized with the use of digital tools learning in education (100%). The explanation for this situation lies in the fact that they were in high school during the pandemic and had all their courses online. E-learning in their case involved the use of educational platforms combined with other educational Apps. Moreover, they unanimously approved their use. The reason is explained by the answers to one of the questions in the interview that reveals the fact they enjoyed using them and considered them as a natural part of the learning process. Summarizing these results, one might conclude that all the students in the research were familiar with the idea of using digital learning and all of them had tried it. They give credit to this type of instruction because it offers an interactive environment, instant access to a large variety of learning resources, and information. In addition, lessons are more interesting and motivating because the pace is changed and activities are more varied, teaching is more entertaining (as students are involved in activities in which they watch videos or do pair work with Bing copilot). Unexpectedly, digital tools help students to focus more on the lesson, being less distracted by their mobiles.

The information from the class observation protocol helped to understand how effective digital tools integration is in achieving learning goals. It also revealed the level of student participation and engagement in performing class tasks using digital tools. The observation sheets recorded the gradual progress students made in using different Apps and cooperating to work on different tasks.

Collaboration and digital tools helped students to finish the task in time, to talk in the target language while working and to apply peer correction where necessary.

To sum up, the answer to the first research question is the following: students are fully aware of the benefits provided by digital learning and are willing to keep using it as a natural extension of everyday life.

However, the situation is different in case of the second question. E-learning is not seen as an option by 35 respondents, standing for 88 %. The most common reasons offered for this choice are the following: lack of focus, distraction, lack of social relations. E-learning is more seen as an alternative for unexpected situations, a reliable "plan B" in case in-person meetings are not possible for several reasons. The most appreciated elements of online teaching are the educational platforms (MS Teams, Google classroom or Moodle) which, in the research participants' opinion offer the opportunity to have easy and permanent access to the information taught in the classroom; this way materials are better organized offering an excellent opportunity to keep updated with the learning process.

These findings contrast with the results of an earlier study performed two years before on a similar group of first-year undergraduate law students from UBB whose attitude was favorable to online education, 59.5% of them considering that it was quite important for universities to include online study programs in their offer (Bretan:2022). The same trend was noticed in a study performed on ESP (English for Specific Purposes) students from Romania enrolled at the Faculty of Natural and Agricultural Sciences from "Ovidius" University of Constanta (Chirobocea-Tudor:2021). The results showed that 52% of the respondents were not looking forward to returning to the regular in-person format. A different attitude is described in a study performed in April 2022 on students from different universities in Greece after the return to face-to-face classes (Nikolopoulou:2022). According to those results only 2 out of 24 respondents showed preference for online education while most respondents were in favor of face-to-face and blended instruction.

Therefore, the answer to the second research question is the following: two years after returning to classroom and to in-person instruction students are not as enthusiastic as they were about e-learning. This might be a consequence of the fact that they rediscovered the benefits of being part of a learning community that puts emphasis on social interaction and direct communication.

## CONCLUSION

The aim of this study is to offer an updated view on the state of digital and e-learning in a post-pandemic era by focusing on a case study performed at Babeş-Bolyai University from Cluj-Napoca, Romania. Despite its reduced scale

the research wants to add another piece of information to the broader topic of digital and online learning by providing relevant data for a local student population.

The paper examines the opinion that university students have towards digital learning to point professors towards efficient teaching strategies. One suggestion derived from the results of the study could be to fully maximize the potential of digital aids and guide students to complement classical instruction with the digital one. Moreover, the information revealed by the study shows that students are already part of a post-pandemic teaching paradigm that incorporates digital learning in lessons in which in-person activities are potentiated in their outcome by digital tools.

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# Personality Traits and Work Values as Predictors of Vocational Interests Among University Students

**Anna VERES[1,*], Tünde PÓKA[1]**

**ABSTRACT.** Many organizations and career guidance professionals are curious about what personality traits can tell them about a person's potential, qualities and attitude to work.

This study assessed the personality traits, work values and vocational interests of university students. The relationships between these three constructs were investigates, and more specifically, the extent to which personality traits and work value can predict vocational interest. Vocational interest determines one's career development and work choice.

The study included 304 participants with a mean age of 25.4 years (SD=8.11). In our analysis, we used the HEXACO personality questionnaire, the Work Value Questionnaire measuring 15 subcategories and the RIASEC Vocational Interest Questionnaire. The aim of this study is to get a clearer picture of the relationship between personality traits, work values and vocational interests. The results show that personality traits are also predictive, but together with work value, they are stronger predictors of vocational interest. The results are presented in the light of career development.

**Keywords**: personality traits, vocational interest, work value, university students

## INTRODUCTION

Success in the world of work depends to a large extent on the availability of human resources, where qualities such as skills, experience, expertise and commitment are displayed. In addition, an optimal personality trait is also

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essential for certain jobs (Effron et al., 2003). We can use personality as well as values to characterize fundamental individual differences (Parks-Leduc et al., 2015).

Personality, work values and occupational interests play an important role in individual career development, as our individual differences and occupational choices are the pillars on which our career paths are based. When examining career development, there are a number of factors that can be targeted to examine in order to facilitate an individual's career or explain their behavior over the course of their life course. Most studies measure the personalities, values and interests of people already working in order to get a more accurate picture of their profile and to operate appropriately with groups of people in the institution or company (ex.: Kotler & Keller, 2016; Brouwer & Veldkamp, 2018)

The importance of personality and having the right skills in the selection process is not disputed (Mitev, 2016), so the earlier their interrelationships are examined, the more certain that both companies and job seekers can fill the right positions.

In what follows, we look at personality, work value and professional interest one by one, how important they are for career development, and then discuss their interaction.

An individual's personality is a complex arrangement of individual dispositions that are relatively stable. These complex and colorful arrangements or dispositions shape our experiences. These experiences are expressed in the perception, evaluation and interaction of objects and events. In addition, they are our inner thoughts, feelings and perceptions (Hogan, 1991).

In another definition, personality is the dynamic organization of psychophysical systems within a person that produces patterns of behavior, thought, and emotion characteristic of that person (Allport, 1961). More accurately personality traits themselves are distinctive ways in which we think, feel and behave. They are characteristics that predict or can predict our behavior. They are more clearly expressed in interactions with people and are determined not least by both biological and environmental factors (Allport, 1961, 1985).

Despite the fact that most research still uses the 5-factor personality models and that they work very well, Ashton et al. (2014) and Lee and Ashton (2007) consider the HEXACO model to be more robust. HEXACO may also prove to be more culturally and linguistically appropriate (Lee and Ashton, 2007, 2009).

The HEXACO is an acronym for the following factors: honesty-humility, emotionality, extraversion, agreeableness, conscientiousness, and openness to experience (Lee & Ashton, 2014). The HEXACO introduces the honesty-humility factor, which can also be used to screen for anti-social manifestations and

behaviors, thus providing more than the 5-factor models (Lee, Ashton, Morrison, Cordery, & Dunlop, 2008; Lee, Gizzarone, & Ashton, 2003).

Special skills and abilities play a big role in coping with the difficulties of starting a career and staying on track, in addition to expectations and perceptions of work. D. E. Super has developed a complex model of professional personality development based on humanistic psychology and applying Rogers' theory of personality (Super, 1970).

Work values themselves can be defined as the set of qualities that people seek in their work, profession or career. Conversely, vocational interest can be defined as the activities through which work value is realized. For example, if someone values independence in their work, they have a strong interest in managerial activities.

In Super's view, the work value questionnaire should be used to help in the selection of occupations and jobs, but a single questionnaire alone may not provide enough information to help a person make the right decision or to help a counsellor make the right steps with the client information (Super, 1970, Zytowski, 1994).

Work values are essentially workplace characteristics that we perceive as important, as they also largely determine our individual career choices and career development. The work values that come to the fore at any given age can vary greatly, even across generations (Glass, 2007; Sullivan & Baruch, 2009; Cennamo & Gardner, 2008). In many cases, in order to get a clearer picture of an organization's values, it is worthwhile to assess work values, and of course, assessing personal needs is also extremely useful in individual career counselling.

Work value is a list of several values, which have the following elements (Szilágyi, 1987; Super, 1970):

Creativity: the work that allows you to invent new things, try out ideas, develop and design products.

Management: the work that allows us to plan, organize, delegate work.

Achievement: the work that makes us feel that we have achieved something, that we have accomplished our goal. The feeling that we are doing our job well.

Surroundings: work that takes place in conditions favorable to the individual.

Supervisory Relationships: work that takes place under supervision. A supervisor is fair and gets along well with you.

Way Of Life: work that enables the worker to live the life he or she chooses and to express him or herself as the person he or she wants to be.

Security: work which provides one with the certainty of having a job (work that is secure) even in difficult times.

Associates: work that brings you into contact with people you like and feel comfortable with.

Aesthetic: the work that allows us to create beautiful, aesthetic things and contribute to making the world a more beautiful place.

Prestige: work which gives one standing on the eyes of others and evokes respect.

Independence: work which allows the worker to work at his own pace and in his own way.

Variety: work which provides an opportunity to do different types of tasks.

Economic return: work that pays well and allows you to get the things you want.

Altruism: work that allows us to contribute to the well-being of other people.

Intellectual stimulation: work which provides opportunity for independent thinking and for learning how and why things work.

Studies have obtained the following results when examining the value of work: the preferred value of work reflects the development of students' professional identity, but also gives an idea of the training and the profession. Super (1970) found that social relationships were more important for lower skilled workers than for highly skilled workers, but Szilágyi (1987) found the opposite tendency among apprentices, with material values dominating. Work value is mostly considered in selection and profiling to provide more suitable staff for certain positions (Juhász, 2022). Super empirical research has shown that people with higher education do not consider human values important in their work, this tendency was proved in the German sample.

The main aim of our research is to get a clearer picture of the values that university students, in the absence of active work experience, currently consider important for them to be motivated and effective in their future work. In addition, we were also interested in how Super's work value questionnaire could be discussed in relation to HEXACO and RIASEC, as the importance of work value has been highlighted by several studies on these variables (Berings et al., 2004, Berings and Adriaenssens 2012).

According to Holland's career choice theory, our careers are determined by the interaction between our environment and our personality. The theorist maintains that in our careers, we want to work with or be surrounded by people who are similar to us. He argues that people want to be and work in an environment where they can use their skills, express their attitudes and values. Meanwhile, they enjoy problem solving and empowerment in the same environment. So behavior is determined by the interaction between personality and environment. It defines six personality types, professional interests: realistic, investigative, artistic, social, enterprising, conventional.

Holland (1997) has consistently emphasized the need to delineate personality and occupational interest in his theory of RIASEC, where he defines the six types through the relationship between occupational personality and

work environment. Holland theorized that "what we have called 'vocational interests' are an important aspect of personality" and that "interest inventories are personality inventories" (1997, p. 8). Holland's (1997) RIASEC personality types are characterized by a unique set of vocational preferences, or interests, as well as personality traits.

A brief description of the six types is given below by Holland (1973, 1997):

1) Realistic - For people with this interest, it is important that their work has a tangible, visible result within a foreseeable period of time. They are keen on solving practical problems. Activities of interest to them may require physical dexterity and effort. They are people of practical solutions. They enjoy working with tools or machines. They like to repair or produce various objects using specific methods. It is important for them to understand how certain objects and tools work. Associated fields: nature, environment (including agriculture), transport, transport, industry (small and large industry, manufacturing).

2) Investigative: People with this interest are exploring and investigating the connections and relationships between things in the world. They like to gather information and research. It is important for them to have enough time and opportunity to go deeper, to analyze problems in detail, to develop theoretical solutions. They like to work with abstract concepts and are interested in science, design, analysis and reasoning. In their work processes, they like to get to the bottom of things and to arrive at solutions to problems by theoretical or experimental means. Related careers: technical careers (development, applications, communications engineering), sciences (social sciences, life sciences, natural sciences, political science).

3) Artistic: People with this interest are attracted to activities where they can use their previously acquired knowledge, skills and abilities to invent new solutions to various situations, issues and problems, which may not yet be known to others. They may also feel that it is important to show their own personality in some creative activity. It is important for them to work independently and to be exposed to new experiences and varied tasks. In their work they like to use their imagination and feelings to create. Related fields: arts, crafts, entertainment, sport (leisure).

4) Social: People with these interests consider it important to be able to do something useful, important, helpful or service-oriented for others. They are happy to interact with others, whether for business or as a helper. They like to initiate conversations, to help identify the needs of others, to help solve their problems. They thrive in tasks where they can work in company, in a team or in a working group. They like jobs that require personal contact. Related fields: education, society, communication, human services, lifestyle.

5) Enterprising: people with this interest thrive in situations where there is always a task to be done and can take the initiative, lead and organize. They seek situations where they can be confronted with varied and constantly new challenges. They are quick to grasp the demands of different situations and are willing to act to solve them, mobilize others, inspire them and organize the solution. Above all, it is their ability to grasp the bigger picture of tasks that is their main source of pleasure at work. They prefer to think in broad terms, leaving the details to others. They like to organize their own and others' activities, and are independent and autonomous. Related careers: trade, marketing, tourism, catering.

6) Conventional: People with this interest find it important to work within a well-defined framework, following precise rules. They feel secure knowing what they are doing and reassured by knowing exactly how far their responsibilities extend. They are happy to work within well-defined limits on detailed tasks that require a high level of concentration, and they like well-organized work and logical solutions. Deadlines, rules and precise descriptions help them to work well. They seek secure, predictable tasks free from unexpected surprises. They are happy to work to instructions and accept direction and supervision from others. They like to finish the work they have started, and are disturbed if the work process has to be interrupted. They tend to use familiar solutions, preferring tasks that are predictable and predictable. Related fields: economics, finance, business/administration, administration, law, defense.

Of course, these types do not appear purely and simply in individuals. The presence of a combination of different types can often be a puzzle for the individual, especially if they lack career knowledge, and appropriate career counselling is key.

In the following, we will discuss the interrelationships of the constructs (personality, work value, vocational interest) discussed in detail above

There is much debate about the relationship between personality and professional interests, how they might be related or how they might overlap. Several studies have concluded that there is a meaningful relationship between the two variables (e.g., Larson, Rottinghaus, & Borgen, 2002), but from a conceptual point of view, we are talking about two different domains (Darley & Hagenah, 1955; Holland, 1997; Waller, Lykken, & Tellegen, 1995) Most comparative studies have focused on the five factor model despite the fact that the HEXACO model – that has demonstrated empirical advantages over the FFM by accounting for more variance in important criteria (Ashton & Lee, 2007).

In Berings et al. (2004) study as a result of stepwise hierarchical multiple regression analysis show that work values have incremental validity over and above the five factor personality model-traits to predict enterprising and social vocational interests. Another study found out similar results for the social vocational interests (Berrings & Adriaenssens, 2012).

So it can be seen that efforts are being made to define professional identity, how much it is predicted by personality traits and work value. Our study examines all six occupational interests, and we also use the six-factor dimension for personality traits, HEXACO, rather than the 5-factor dimension, which is an innovation.

Some studies support that both personality and values play an important role in determining individual differences (Parks-Leduc et. al, 2015; Roccas et.al, 2002). However, it is important to highlight that while personality is a pattern of our behavior, feelings and thoughts, values are a broader view and judgment about what is good or important in life (Bilsky & Schwartz, 1994). The question is, where do our personality traits and work values intersect?

It is also important to bear in mind that work value plays a prominent role in job satisfaction, motivation, organizational commitment, performance and, in turn, career development (Dose, 1997; Meglino & Ravlin, 1998; Roe & Ester,1999). Satisfaction with life and work depends on the appropriate channels through which a person can assert his or her abilities, personality and values (Super, 1953), so work value can also play a crucial role in career interest. The role of personality and work value in career development is not disputed, however, previous studies have mostly used the 5-factor personality model (e.g.: Leuty &Hansen, 2012).

All in all one of the main purpose of this study is to revisit the association between vocational interests and personality by relating Holland's six RIASEC interest variables to the six personality dimensions of the HEXACO model.

Another aim of the study is to investigate the incremental validity of work values to predict vocational interest (RIASEC) over and above personality traits (HEXACO) among university students.

## METHOD

Subjects: The study included 304 participants with a mean age of 25.4 years (SD=8.11); university students from Romania (UBB, Faculty of Psychology and Educational Sciences). The students completed the questionnaires during seminars. The sample included 58 males (19,1%) and 246 females (80,9%).

## INSTRUMENTS

The assessment battery included questions regarding personal data, inventories to assess personality traits (HEXACO-60), vocational interest (RIASEC) and work values.

### *HEXACO-60 – Personality test*

Ashton and Lee (2009) developed a shorter version of the HECAXO-PI-R which would be suitable when the assessment time is short. HEXACO-60 has six scales, each scale contains 10 items. The personality test measures the following dimensions (Ashton & Lee, 2009; Ashton & Lee, 2007; Ashton, Lee, & De Vries, 2014): Honesty-Humility, Emotionality, Extraversion, Agreeableness, Conscientiousness, and Openness to experience. Each dimension has subscales, they are presented in Table 2. In our research we used the Hungarian version (Szirmák & De Raad, 1994). The Cronbach alpha estimates were in range of .73-.89.

**Table 1.** The facet-level scales of each dimension (Ashton & Lee, 2009)

| | |
|---|---|
| Honesty-Humility | Sincerity, Fairness, Greed Avoidance, Modesty |
| Emotionality | Fearfulness, Anxiety, Dependence, Sentimentality |
| Extraversion | Social Self-Esteem, Social Boldness, Sociability, Liveliness |
| Agreeableness | Forgivingness, Gentleness, Flexibility, Patience |
| Conscientiousness | Organization, Diligence, Perfectionism, Prudence |
| Openness to experience | Aesthetic Appreciation, Inquisitiveness, Creativity, Unconventionality |

HEXACO-60 (Ashton & Lee, 2009). This inventory consists of 60 self-report items measured on a 5-point Likert scale ranging from strongly disagree (1) to strongly agree (5).

### *Vocational Interest*

The most used model of vocational interest is Holland's Hexagonal framework (Holland 1997). This model includes six primary dimensions of interests; (1) Realistic; (2) Investigative; (3) Artistic; (4) Social; (5) Enterprising; and (6) Conventional. In this study we used a Hungarian adaptation is the inventory which consisted 24 items (Mező, 2015).

### *Work values*

Super published the Work Value Questionnaire in 1962, and it was adapted to Hungarian in 1968/69, which measures the 15 value domains using 45 items. Each value category of the Super-questionnaire can take values ranging from 3 to 15 points.

## RESULTS

First, the correlations between the different items were investigated

**Table 2.** Correlation between HEXACO and Work values

| | H | E | X | A | C | O |
|---|---|---|---|---|---|---|
| Altruism | .26** | .15** | .12* | .18** | .16** | .10 |
| Economic return | -.43** | -.03 | -.00 | -10. | -.06 | -.05 |
| Aesthetic | .08 | .07 | .09 | .11* | -.02 | .44* |
| Surroundings | -.07 | .10 | .03 | .00 | .04 | -04. |
| Independence | -.05 | -.10* | .13* | -.04 | .05 | .11* |
| Hierarchy | -.04 | .02 | -.01 | .00 | -.00 | -.09 |
| Management | -.26** | -.19** | .26** | -.15** | .09 | -.06 |
| Creativity | .03 | -.08 | .24** | .12* | .14** | .35** |
| Achievement | -.09 | -.13** | .06 | .02 | .09 | .00 |
| Security | -.04 | -.03 | .08 | .00 | .12* | -.02 |
| Way of life | -.02 | .05 | .18** | .00 | .02 | .20** |
| Prestige | -.27** | -.00 | .17** | -.11* | .03 | .00 |
| Intellectual stimulation | .05 | -.17* | .26** | .11* | .19** | .32** |
| Associates | -.09 | .12* | .06 | .11* | -.07 | -.13** |
| Variety | .04 | -.09 | .19** | .10* | .01 | .22** |

*N=304*
** P<0.05; ** P<0.01; *** P<0.001.*
*Note: H: Honesty-Humility, E: Emotionality, X: Extraversion, A: Agreeableness, C: Conscientiousness, O: Openness to experience*

The correlation between HEXACO personality traits and Work Values are low to moderate, and are maximally .44. Among personality traits, extraversion and agreeableness correlate with the highest number of work value, followed by openness to experience.

**Table 3.** Correlation between RIASEC and work values

| | R | I | A | S | E | C |
|---|---|---|---|---|---|---|
| Altruism | -.28** | .08 | -.01 | .57** | -.02 | -.08 |
| Economic return | .10 | -.03 | -.00 | -.19** | .13* | .16* |
| Aesthetic | -.05 | -.04 | .51** | .29** | -.13* | -.21** |
| Surroundings | .02 | -.13* | -.05 | .01 | .02 | .26** |
| Independence | .00 | .08 | .17** | .03 | .07 | -.07 |
| Hierarchy | .06 | -.09 | -.12* | -.03 | .10 | .25** |
| Management | .06 | -.15 | -.09 | -.05 | .43 | .14 |
| Creativity | -.06 | .07 | .30** | .20** | .05 | -.12* |
| Achievement | .13* | .04 | -.09 | -.07 | .03 | .24** |
| Security | .07 | .03 | -.10 | -.03 | -.00 | .23** |
| Way of life | -.10 | .00 | .20** | .09 | .03 | -.10 |
| Prestige | .06 | -.02 | -.13* | -.026 | .16** | .18** |
| Intellectual stimulation | -.13* | .17** | .21** | .20** | .04 | -.20** |
| Associates | .01 | -.14* | -.11* | .05 | .07 | .08 |
| Variety | -.06 | .01 | .076 | .21** | .15** | -.05 |

*N=304*
** P<0.05; ** P<0.01; *** P<0.001.*
*Note: R: Realistic, I: Investigative, A: Artistic, S: Social, E: Enterprising, C: Conventional*

The correlation between RIASEC vocational interest and Work Values are low to moderate, and are maximally .57. Among vocational interest, Artistic and Conventional correlate with the highest number of work value.

**Table 4.** Correlation between HEXACO and RIASEC

| | **H** | **E** | **X** | **A** | **C** | **O** |
|---|---|---|---|---|---|---|
| **R** | -.14* | -.09 | -.18** | .01 | -.12* | -.15** |
| **I** | .00 | -.08 | .03 | .10 | .05 | .08 |
| **A** | -.01 | -.06 | .01 | .10 | -.03 | .45** |
| **S** | .17** | .10 | .32** | .10 | .06 | .17** |
| **E** | -.10 | -.10 | .29** | -.16** | .03 | -.11* |
| **C** | -.02 | .02 | -.14* | -.01 | .18** | -.22** |

*N=304*
** P<0.05; ** P<0.01;*

*Note: H: Honesty-Humility, E: Emotionality, X: Extraversion, A: Agreeableness, C: Conscientiousness, O: Openness to experience, R: Realistic, I: Investigative, A: Artistic, S: Social, E: Enterprising, C: Conventional*

The correlation between HEXACO personality traits and RIASEC vocational interests are low to moderate, and are maximally .45.

The results of the regression analysis, regressing the 5 RIASEC items on the 6 HEXACO personality traits, are reported in Table 5. Inspection of the $R^2$ shows that for 5 of the RIASEC vocational interests, except I (investigative), 13% or more if the variance is explained by the HEXACO traits. Realistic, Artistic, Social, Enterprising, Conventional interests are explained up to 14%, 24%, 26%, 17%, 13%, respectively. On average, near to 16% of the variance in vocational interest is explained by the HEXACO personality traits.

**Table 5.** Hierarchical multiple regressions predicting RIASEC interests from HEXACO personality variables

| | **R** | **I** | **A** | **S** | **E** | **C** |
|---|---|---|---|---|---|---|
| **H** | -.13* | -.03 | -.04 | .15** | -.05* | -.05 |
| **E** | -.14* | -.06 | -.01 | .20*** | -.08 | -.03 |
| **X** | -.15** | -.03 | -.07 | .31*** | .32 | -.12* |
| **A** | .04 | .09 | .11* | .09 | -.16 | -.02 |
| **C** | -.02 | .02 | -.10* | -.07 | .04* | .27*** |
| **O** | -.08 | .05 | .48*** | .08 | -.18 | -.21*** |
| **$R^2$** | .14** | .04 | .24*** | .26*** | .17*** | .13*** |

*N=304*
** P<0.05; ** P<0.01; *** P<0.001.*

Note: H: Honesty-Humility, E: Emotionality, X: Extraversion, A: Agreeableness, C: Conscientiousness, O: Openness to experience;
R: Realistic, I: Investigative, A: Artistic, S: Social, E: Enterprising, C: Conventional

We did regression analysis for predicting each subscales of RIASEC (vocational interest). In total, six hierarchical regression analyses were performed, each subscale of RIASEC was defined as a dependent variable, while gender, age, academic achievement were inserted as independent variables in the first step. In the second step, six items of the HEXACO personality test were entered as independent variables, while in the third step, 15 items of work values were entered as independent variables. Thus, we were interested in the extent to which the subscales of vocational interest were predicted by the baseline data, personality and work values. And how much explanatory power the sum of these items has on the prediction of vocational interest.

**Table 6**. Summary of hierarchical multiple regression analysis for predicting ***Realistic, Investigative and Artistic*** vocational interest (from RIASEC)

| | ***Realistic*** | | | ***Investigative*** | | | ***Artistic*** | | |
|---|---|---|---|---|---|---|---|---|---|
| | Step 1 | Step 2 | Step 3 | Step 1 | Step 2 | Step 3 | Step 1 | Step 2 | Step 3 |
| Constant | 4.175** | 13.61*** | 14.93** | 12.06*** | 9.55 | 11.30 | 12.13*** | -7.11 | -.25 |
| Gender | -2.31*** | -1.75* | -1.93** | -.33 | .17 | -.27 | -.42 | -.50 | -.24 |
| Age | -.03 | -.02 | -.04 | .03 | .02 | .00 | .01 | .04 | -.00 |
| Academic achievement | 1.35*** | 1.11** | .48 | -1.61* | -1.50* | -1.42* | -.91 | -.19 | -.24 |
| Humility-honesty | | -.07* | -.05 | | -.03 | -.05 | | -.05 | -.05 |
| Emotionality | | -.06 | -.00 | | -.07 | -.02 | | -.01 | -.02 |
| Extraversion | | -.08* | -.06 | | -.03 | .00 | | -.08 | -.04 |
| Agreeableness | | .02 | .05 | | .11 | .11 | | .14* | .11 |
| Conscientiousness | | -.01 | -.01 | | .02 | -.05 | | -.12 | -.01 |
| Openness to experience | | -.05 | -.09 | | .06 | .03 | | .60*** | .28*** |
| Altruism | | | -.38** | | | .09 | | | -.42 |
| Economic return | | | -.06 | | | .00 | | | .28 |
| Aesthetic | | | .20 | | | -.45* | | | 1.19*** |
| Surroundings | | | .01 | | | -.30 | | | -.21 |
| Independence | | | .04 | | | .31 | | | .37 |
| Hierarchy | | | -.02 | | | -.17 | | | .13 |
| Management | | | -.02 | | | -.62*** | | | -.12 |
| Creativity | | | -.00 | | | .18 | | | .02 |
| Achievement | | | .28 | | | .30 | | | -.29 |
| Security | | | .07 | | | .36 | | | -.19 |
| Way of life | | | -.28 | | | -.01 | | | .25 |
| Prestige | | | .09 | | | .32 | | | -.46* |
| Intellectual stimulation | | | -.12 | | | .75** | | | .26 |
| Associates | | | -.09 | | | -.44 | | | -.21 |
| Variety | | | .17 | | | -.36 | | | -.32 |
| R | .34 | .40 | .47 | .17* | .21 | .42** | .08 | .49 | .65 |
| **$R^2$** | **.11** | **.16** | **.22** | .03* | .04 | .17** | .00 | .24*** | .42*** |
| Adjusted $R^2$ | .11 | .13 | .15 | .01** | .01 | .10** | -.00 | .21 | .38 |

Note N=304. Standardized regression coefficients (β) are shown.

* p < .05. ** p < .01. *** p < .001.

**Table 7**. Summary of hierarchical multiple regression analysis for predicting ***Social, Enterprising and Conventional*** vocational interest (from RIASEC)

| | ***Social*** | | | ***Enterprising*** | | | ***Conventional*** | | |
|---|---|---|---|---|---|---|---|---|---|
| | Step 1 | Step 2 | Step 3 | Step 1 | Step 2 | Step 3 | Step 1 | Step 2 | Step 3 |
| Constant | 12.53*** | -6.37 | -2.71 | 14.64*** | 19.20*** | 10.24 | 7.09* | 16.89** | 9.68 |
| Gender | 2.43** | 1.51 | 1.37 | -1.08 | -.22 | .02 | .65 | .89 | .30 |
| Age | .02 | .02 | .04 | -.08 | -.10* | -.10* | -.02 | -.06 | -.05 |
| Academic achievement | -2.29*** | -1.82*** | -.79 | -.35 | -.02 | -.18 | 1.55* | 1.14 | .40 |
| Humility-honesty | | .12** | .01 | | -.05 | .01 | | -.07 | -.01 |
| Emotionality | | .14** | .04 | | -.09 | -.06 | | -.05 | -.02 |
| Extraversion | | .23*** | .18*** | | .31*** | .20*** | | -.13* | -.14* |
| Agreeableness | | .08 | .00 | | -.19** | -.16 | | -.03 | .00 |
| Conscientiousness | | -.07 | -.06 | | .04 | .02 | | .31*** | .24*** |
| Openness to experience | | .06 | .02 | | -.21** | -.11 | | -.26*** | -.12 |
| Altruism | | | .97*** | | | .16 | | | -.00 |
| Economic return | | | -.06 | | | .20 | | | -.03 |
| Aesthetic | | | .24 | | | -.29 | | | -.30 |
| Surroundings | | | -.02 | | | -.12 | | | .61** |
| Independence | | | -.02 | | | -.11 | | | -.33 |
| Hierarchy | | | .00 | | | .32 | | | .15 |
| Management | | | .05 | | | .92*** | | | .18 |
| Creativity | | | .12 | | | .15 | | | .22 |
| Achievement | | | -.18 | | | -.29 | | | .38 |
| Security | | | .04 | | | -.33 | | | .20 |
| Way of life | | | -.21 | | | .01 | | | -.49 |
| Prestige | | | -.04 | | | -.22 | | | .26 |
| Intellectual stimulation | | | -.29 | | | -.24 | | | -.85** |
| Associates | | | -.08 | | | .14 | | | -.21 |
| Variety | | | .08 | | | .29 | | | .50* |
| R | .37 | .51 | .67 | .10 | .41 | .56 | .15 | .37 | .54 |
| **$R^2$** | .14*** | .26*** | .45*** | .01 | .17** | .31** | .02 | .13*** | .29*** |
| Adjusted $R^2$ | .13 | .24 | .41 | .00 | .14 | .25 | .01 | .11 | .23 |

Note N=304. Standardized regression coefficients (β) are shown.

* p < .05. ** p < .01. *** p < .001

Hierarchical multiple regression analysis indicate that the examined variables succeed in accounting for up 22 % of the total variance of *Realistic* vocational interest (Step 3, Table 6). Realistic vocational interest was significantly predicted in Step 3 by Altruism (as work value) (β=-.38, p<.01).

Hierarchical multiple regression analysis indicate that the examined variables succeed in accounting for up 17 % of the total variance of *Investigative* vocational interest (Step 3, Table 6). Investigative vocational interest was significantly predicted in Step 3 by Aesthetic (as work value) (β=-.45, p<.05) Management (as work value) (β=-.62, p<.001) and by Intellectual stimulation (as work value) (β=.75, p<.01).

Hierarchical multiple regression analysis indicate that the examined variables succeed in accounting for up 42 % of the total variance of *Artistic* vocational interest (Step 3, Table 6). Artistic vocational interest was significantly predicted in Step 3 by Openness to experience (β=28, p<.001), Aesthetic (as work value) (β=1.19, p<.001), Prestige (as work value) (β=-.46, p<.05).

Hierarchical multiple regression analysis indicate that the examined variables succeed in accounting for up 45 % of the total variance of *Social* vocational interest (Step 3, Table 7). Social vocational interest was significantly predicted in Step 3 by Extraversion (β=.18, p<.001), Altruism (as work value) (β=.97, p<.001).

Hierarchical multiple regression analysis indicate that the examined variables succeed in accounting for up 31% of the total variance of *Enterprising* vocational interest (Step 3, Table 7). Enterprising vocational interest was significantly predicted in Step 3 by Extraversion (β=.20, p<.001), Management (as work value) (β=.92, p<.001).

Hierarchical multiple regression analysis indicate that the examined variables succeed in accounting for up 29% of the total variance of *Conventional* vocational interest (Step 3, Table 7). Conventional vocational interest was significantly predicted in Step 3 by Extraversion (β=-.14, p<.05), Conscientiousness (β=.24, p<.001), Surroundings (as work value) (β=.61, p<.01), Intellectual stimulation (as work value) (β=-.85, p<.01).

## DISCUSSION

From the correlation results of HEXACO and work values, it is nicely outlined that all work values except surroundings and hierarchy are correlated with at least one personality factor. This also highlights the importance of the relationship between personality and values in the world of work (Berings et al., 2004). Despite the fact that Berings et al. (2004) only examined two items in more detail (Social and Enterprising), the correlation between RIASEC and work

values also seems to be vital, since here, with the exception of the Management work value, the other 14 work values correlate with at least one vocational interest for our sample.

Our results in examining the predictive power of HEXACO for RIASEC are encouraging, as each personality type predicts vocational interest to some extent, which is supported by the literature, although the extent of overlap between the two constructs is debated (Larson, Rottinghaus, & Borgen, 2002)

The results of the hierarchical multiple regression analysis suggest that personality types together with work values have a very high percentage of predictive power for vocational interest, but when looking at the work values individually, we see that few work values individually predict vocational interest significantly.

In conjunction with personality traits only 7 of 15 work values (Altruism, Aesthetic, Management, Intellectual stimulation, Prestige, Surrounding and Variety) significantly predicts vocational interest, even though in terms of correlation, the relationship between work values, the personality traits and vocational interest is significant. One explanation could be that since the study population (university students) does not have sufficient work experience, they do not have the work values formulated in their minds to give them the exact importance they would like to attach to them. On the other hand, it could also be explained by the fact that the students belong to generation Y, whose work habits are also very different from those of generation Z and X, so it would be wise to use a different, more up-to-date type of work values questionnaire.

## CONCLUSION

The correlation results of work value and personality traits are partially consistent with previous research, i.e. extroversion and openness are more strongly related to work value (Leuty &Hansen, 2012; Anglim et. al, 2017). When examining the correlations, a very interesting result emerged in our sample, as openness shows a strong correlation with the social interest and the enterprising variable. This may be explained by the fact that in our sample we studied university students in the helping professions, where openness is essential, as there are many large ranges of clients with whom they have to work, showing understanding and empathy towards them.

Regression analyses yielded similar results to those obtained in studies that examined the relationship between RIASEC and personality types in students (Berings and Adriaenssens, 2004, Berings et al. 2012, McKay and Tokar, 2012). When examining the separate elements of vocational interest, similar results were obtained for Enterprising and Social vocational interest as in previous

research where only these two factors were examined (Berings and Adriaenssens, 2004), but it is noteworthy that Artistic vocational interest also predicted in a very high percentage by personality and work value.

Our results suggest that HEXACO alone is predictive of RIASEC, since one or even three personality traits are significant predictors of all other professional interests except Investigative. This suggests that the 6-factor model is predictive of professional interest rather than being consistent with it. But despite this, it can be deduced from our results that vocational interest can be predicted in a much larger percentage with the combination of work values, thus confirming the fact that personality types in themselves may not be sufficient predictors.

In order to make a meaningful contribution to the career development of university students, it would be worthwhile to introduce other variables and see how predictive RIASEC is in that case. Several studies and comparisons have separately compared RIASEC and HEXACO with work values or personal values. For a more accurate picture, it is worth looking at these elements as well.

In addition, differences between university majors could be investigated, e.g. STEM and nonSTEM, or more specifically between certain majors e.g. engineering and helping professions.

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# Colombian Teachers' Network on STEM: Approaching Concepts and Strategies for Collaborative Work and Educational Innovation

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**ABSTRACT.** The article analyses the strategies and concepts that configure the accompanying process provided to teachers by the Secretariat of Education in Bogotá, Colombia, through a Continuing Professional Development Program. The content analysis performed in this article is meant to evaluate the conceptualization of a national program on continuing professional development of primary and secondary school teachers in Bogotá, a program estimated to impact on teaching collaboration and educational innovation. The STEM + TRANSFORMS Teachers Network is where this process is carried out, with teachers who have pedagogical initiatives in educational innovation with a STEM (Science, Technology, Engineering and Mathematics). The content analysis was carried out by examining two reference documents for STEM networks and programs in Colombia and Latin America, and conducting an interview with the institutional support coordinators of the Network. The findings will enable an understanding of approaches and challenges related to educational innovation through STEM processes and cooperative work.

**Keywords:** Collaboration, accompanying, STEM, innovation

**ZUSAMMENFASSUNG.** In diesem Artikel werden die Strategien und Konzepte analysiert, die den Begleitungsprozess für Lehrer gestalten, den das Bildungsministerium in Bogotá, Kolumbien, im Rahmen eines Programms zur beruflichen Fortbildung anbietet. Die in diesem Artikel durchgeführte Inhaltsanalyse soll die Konzeption eines nationalen Programms zur beruflichen Weiterbildung von Lehrern der Primar- und Sekundarstufe in Bogotá bewerten, ein Programm, von dem angenommen wird, dass es sich auf die Zusammenarbeit im Unterricht und die Bildungsinnovation auswirkt. Das STEM + TRANSFORMS Lehrernetzwerk ist der

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Ort, an dem dieser Prozess durchgeführt wird, mit Lehrern, die pädagogische Initiativen in der Bildungsinnovation mit einem STEM (Science, Technology, Engineering and Mathematics) haben. Die Inhaltsanalyse erfolgte durch die Untersuchung von zwei Referenzdokumenten für MINT-Netzwerke und -Programme in Kolumbien und Lateinamerika sowie durch ein Interview mit den institutionellen Unterstützungskoordinatoren des Netzwerks. Die Ergebnisse ermöglichen ein Verständnis der Ansätze und Herausforderungen im Zusammenhang mit Bildungsinnovationen durch MINT-Prozesse und kooperative Arbeit.

**Schlüsselwörter:** Zusammenarbeit, Begleitung, STEM, Innovation

## 1. INTRODUCTION

The organization of teacher networks in Colombia and Latin America has been a strategic response to the socio-educational challenges of the region and implies environments for sharing knowledge, strategies, and resources, to inspire teachers to improve their pedagogical practices and develop solutions that meet the specific needs of each educational community.

This article analyzes how the Red STEM + Transforms Network brought together teachers from primary and secondary public education sectors in Bogotá, Colombia to form a team with Latin American teachers. This team of teachers was trained and supported by the Bogotá Education Secretariat (hereinafter referred to as SED), which is the government institution responsible for administering the public education system in Bogotá.

The promotion and accompaniment program for researchers and innovative teachers is conducted by SED through a strategic university alliance. The STEM Network's institutional configuration and responsibilities, which are designed to be a professional learning community (PLC), table 1 provides a continuing professional development (CPD) opportunity and contextual explanations about the STEM Network.

**Table 1.** The institutional context

| | |
|---|---|
| ADMINISTERING ENTITY | The Secretariat of District Education (SED) is a government agency that is part of the administrative structure of the Capital District of Colombia. It was created in 1955, by the Council of Bogotá, Mayor's Office. The SED is the responsible body for the childhood education (pre-school), basic (primary and secondary) and the average public sector in the city of Bogotá. |

| | |
|---|---|
| An administrative division of the SED is accompanying the STEM network of teachers | The Directorate of Science, Technology, and Educational Media of the District Education Secretariat, responsible for CPD and promoting educational strategies related to the fields of science, technology, and educational media within the educational system of the city of Bogotá. |
| Interinstitutional agreements have been created to offer training and assistance to the Network. | UNNO Institute is the Scientific Park of Social Innovation (Parque científico de innovación social) at Universidad Minuto de Dios (Hereinafter Uniminuto). |

Source: (Secretaría Distrital de Educación, 2019)

According to Yemail (2022), the STEM Teachers Network was established with a group of teachers who were previously associated with the Science and educational technologies projects. The projects in mention are listed below:

i. *Plan saber digital (Digital Knowledge Plan):*
   The aim of this strategy is to enhance the learning environments in Educational Institutions that are focused on STEM, through an accompanying program specialized in science and technology, is part of the framework of educational policy in Bogotá for the integration of technologies. (Secretaria de Educación de Bogotá, 2020).

ii. *The SED-CISCO Academies program*, which has been established, is aimed at training 15,000 young graduates from public schools in Bogotá in technology and innovation, using a methodology that promotes leadership, creativity, and problem-solving.

In 2021, the STEM Teachers Network was constituted with 40 teachers who had taken part in Plan saber Digital and other from the Cisco Academy programs. In 2022, 22 additional teachers were added who were trained in bilingual teaching in United States with the support of the SED, particularly in English and STEM aspects, resulting in a total of 62 teachers participated in this network.

The STEM team and SED support worked together in 2021 to establish a mission, vision, and governance framework, which was created through a participative process articulating aspects of the Sustainable Development Goals of the United Nations. Precisely, the objective of this strategy is to promote educational environments that emphasize STEM, according to Deaza (2022), precisely the network's official call to associated more teacher´s occurred in the year 2022, after completing the procces in mention.

The process of organizing the Network and institutional support for the team of teachers was also associated with the strategy called Bogotá STEM territory launched in 2021, which are the specifical public policies strategies from providing equal access to STEM in the city; through this strategy, the educational system of Bogotá will be connected to SIEMENS network of 17 STEM territories in Latin America for a collective impact in education, which ranged experiences to creating institutional structures and long-term public policies. (Redacademica, 2022; Siemens Stiftung, 2022)

To comprehend how the CPD for teachers involved in the STEM Network was anticipated and outlined in the program's background documents, a content analysis was performed, and it will be illustrated in the following sections of the article, guided by the following questions:

- ✓ What strategies are implemented in the training and accompaniment process to promote collaborative work among teachers?
- ✓ What strategies are used to ensure the sustainability and development of the network?
- ✓ What are the main ideas guiding the institutional support the District Education Secretariat (SED) offers to the STEM Network?

## 2. THEORETICAL FRAMEWORK

Teacher collaboration is the main category of analysis, according to Navarro and Pérez (2023), Soares et al. (2020), and Prenger et al. (2020), while talking about networks as PLCs. Teaching collaboration in networked PLCs is an approach that involves active and coordinated interaction between educators with the aim of promoting, creating, or consolidating pedagogical or didactic processes (Vangrieken, 2017). This involves collaborating on lesson plans, sharing educational resources, reflecting on pedagogical practices, and creating a collaborative environment to address educational challenges.

One of the components of collaboration is leadership. Ahumada and Pino-Yancovic (2020), Provan and Kenis (2008), and Mellado et al. (2020) affirm that leadership processes are essential for defining, updating, and clearly and explicitly concretizing the goals and action plan of collaborative work in teacher networks. Professional development can be promoted through participation in formal and informal leadership roles, as well as engaging in different forms of interaction.

The creation of management processes for solving problems identified in school contexts can be achieved through collaboration between teachers. In this way, teachers learn together through a process of inquiry and collective management that relies on analysis of specific classroom situations (Horn and Little, 2010; Butler and Schnellert, 2012; Krichesky et al., 2018)

The second category of analysis is innovation. Barraza (2005) and Rivas (2000) indicate that the process of curricular innovation is divided into three distinct categories: 1) Diagnostic development practices include the definition of models and the creation of strategies for collecting information. 2) The definition of models and approaches, as well as curricular evaluation practices, are part of curriculum structuring practices. 3) Didactic innovation emphasizes that an innovation derived from reform involves curricular restructuring, which arises as a response to problems identified in schools.

Based on research findings highlighting the benefits of networks as PLCs for teachers (Vangrieken, 2017), the SED conceptualized in their strategic development documents the establishment and support of a teachers' network starting as an opportunity for CPD.

In this context, the next sections present the research focus, methodology, and findings with the aim of identifying how CPD for teachers was conceptualized to occur within the STEM Network.

## 3. METHODOLOGY

Krippendorff (2004) and Paramo (2011) define content analysis as a systematized approach to examining and comprehending document content, considering data as carriers of meaning. A systematic process is followed for content analysis that involves several steps, starting with collecting the sample of data to be analysed through codification involves identifying and classifying the various categories or topics present in the content.

To comprehend the concepts that are part of SED in relation to teacher CPD within the networked PLC approach, a content analysis of the SED-adopted institutional and public policy documents, as well as the discourse from interviews with the STEM Network Program coordinators, was conducted.

Below are presented the corpus, categories, and sub-categories of content that were identified, along with the methodological parameters and criteria that were considered for conducting the interview.

### *3.1. Selection of the body of information*

The Ministry of Education's website and virtual documentary repositories were used as starting points for data collection to identify the guideline documents for the STEM Network and the accompanying documentation generated at the institutional level.

The research categories were classified qualitatively; latent content analysis relies on the researcher's inferences from the document corpus. The interpretation of agency and association within the texts results in an indirect content analysis. Therefore, it is framed in an open model, as described by Páramo (2011) and Pérez-Serrano (1994). Below is the list of specifications for the documentary corpus:

**Table 2.** The documentary corpus.

| *Document Code* | *Reference* | *Document Type* |
|---|---|---|
| D1-STEM G-Colombia-STEM G-Colombia | Ministerio de Educación Nacional. (2022). Visión STEM, Educación expandida para la vida. Bogotá, D.C., Colombia | Book national guidelines for STEM education in Colombia |
| D2- STEM G-Latinamérica-STEM G-Latinamérica | Gras, M. (coord) y C. Alí (2023). Educación STEM y su aplicación. Una estrategia inclusiva, sostenible y universal para preescolar y primaria. Movimiento STEM | Guidelines of Networking teachers STEM Latin America |
| D3-Interview-Interview | Semi-structured interviews | Interview transcript |

Source: Own elaboration

### *3.2. Semi-structured interview*

Considering that Uniminuto operates the institutional support of the STEM Network's SED, two semi-structured interviews lasting one hour were conducted with the coordinators of the accompaniment for the two instances mentioned.

Data gathering in research and qualitative analysis is accomplished through the use of semi-structured interviews. This approach combines open and structured interviews with a reflexivity component and the process of researchers being conscious and critical of their influence, perspective, and position in the investigative process (Ibrahim & Edgley, 2015) is referred to as the latter.

The process of deriving meanings from data is inductive, subjective, and recurring (Krippendorff, 2004). A framework with pre-defined questions or topics serves as the starting point, but the interviewer can explore specific areas in greater depth based on the interviewee's responses. By utilising these themes, conceptualizations can be obtained and meanings can be expanded (Hernández, Fernández, and Baptista, 2010).

The interview was based on two purposes: 1) to identify strategies, lines of action, and the results derived from their implementation, understanding how the coordinators for the STEM Network program translated the stipulations of the policy documents and the expectations about the program. 2) Identify opportunities for cooperation and educational innovation in institutional support.

The participants consented to the recording of the interview, and transcription was performed with the transcription in *Transkriptor software* of the audio recording into text. The interviews were performed online in Spanish, in december of 2023, and the translation into English, for the purposes of the article, was done by the author, in the process of the analysis.

### *3.3. Definition of subcategories*

Considering the indirect content analysis method, the categories presented below were selected during the revision of the documentary corpus, they were identified as fundamental to the structure of the programme:

**Table 3.** Categories and subcategories

| Categories | Sub-categories based on the review of the documentary corpus |
|---|---|
| Educational collaboration and innovation | Quality of education |
| | Educational management |
| | Accompaniment |
| | Social innovation |

Source: Own elaboration

## 4. RESULTS

The results of the content analysis are organized in two parts: The first part is dedicated to analyzing and contrasting the conceptualizations of the subcategories related to the previous item. The second part is descriptive and presents the strategies of formation and accompaniment of the STEM Network that were identified in the interviews with the coordinators.

### *4.1. Analysis of conceptualizations:*

The first part of the analysis focuses on examining the concepts that constitute the accompanying process, which are part of the subcategories of analysis. It is based on the question *How are the most relevant elements of the teaching collaboration conceptualized in the institutional accompaniment carried out by the District Education Secretariat (SED) for the STEM Network*? For this purpose, the following tables present the identified concepts from the documents corpus.

#### *4.1.1. Conceptualizations of the subcategories*

**Table 4**. Accompanying concept

| *Documentary corpus* | *Conceptualization* |
|---|---|
| D1-STEM G-Colombia | The Ministry of Education in Colombia (MEN) defines it as a component of the programs for teachers and managers in the public education system to evaluate classroom practices, improve them, and promote collaborative work.<br><br>Document 1 outlines the need for accompaniment to encourage the revision of the 'Index of Educational Innovation' and the 'Synthetic Index of Educational Quality'. (Institutional aspects are to be expanded in the ITEM DE concept analysis.). |
| D2- STEM G-Latinamérica | The concept of accompaniment in the Latin American STEM Network is situated in the World Bank's Coach model, which promotes teacher professional development through different forms, such as individual and group sessions, in person or at a distance. |
| D3-Interview | Institutional accompaniment to the STEM Network was defined by the interviewees as dynamization to empower teachers in processes of management of pedagogical projects based on STEM, collaborative work, and participation in city scenarios - country, as evidenced by the training and support strategies of the previous ITEM. |

**Table 5**. Conceptualization of innovation

| *Documentary corpus* | *Conceptualization* |
|---|---|
| D1-STEM G-Colombia | The Ministry's innovative approach is to promote collaborative and transdisciplinary work in the education system to transform five areas: governance and institutional management, curriculum and pedagogical practices, teacher capacity development, management of pedagogical knowledge, and networks and alliances.<br><br>This approach promotes collaborative work, curricular integration, and teacher development with an emphasis on social innovation and proposes an ecosystem of relationships between institutions that promotes experiences, practice centers, and job opportunities in the logic of the Fourth Industrial Revolution. |
| D2- STEM G-Latinamérica | The conceptualization of innovation by the SIEMENS STEM Latin America Network, is based on the definitions of the Economic Commission for Latin America and the Caribbean is the agency of the United Nations which defined social innovation as forms of management, administration, execution, instruments and combinations of factors aimed at improving social and living conditions in the region. This concept has emerged as a response to persistent social problems of social diagnostics UN, UNESCO Latin America. |
| D3-Interview | Interviewed 1: "Todavía no tenemos una una definición colectiva de innovación, [...]<br>uniminuto, apoya mucho porque tienen un Parque de innovación social que le han metido muchísimo a lo que somos hoy, la innovación desde lo social. [...] estamos innovando desde lo social, nuestros proyectos transforman, pero después también desde el colectivo y desde las pensadas que tenemos al interior del colectivo nos dimos cuenta que no era innovación social, que es innovación educativa."<br><br>[A collective definition of innovation hasn't been established yet [...] Uniminuto offers a lot of support due to their Park of Social Innovation, which has played a significant role in social innovation [...] Our projects are changing as a result of our perspective of social innovation [...] But then, from the collective and the thought that we have within the collective, we realized that it was not social innovation, but rather educational innovation.] |

**Table 6.** Management education conceptualization

| *Documentary corpus* | *Conceptualization* |
|---|---|
| D1-STEM G-Colombia | The concept of educational management of the Ministry of Education in Colombia is based on the perspective of knowledge management through the involvement of various actors in the educational system and the investment of resources, and involves four areas: Management; pedagogical and academic management; community management; and administrative management. |
| D2- STEM G-Latinamérica | Alliances Management structures Exchange Coordination Shared objectives among actors and organizations in the territories to generate long-term sustainable organised process for knowledge management and innovation in order to build permanent monitoring to mobilise actions aimed at achieving the goals |
| D3-Interview | During the interview, no direct question was asked about the concept of management; however, in the process of narrating network structuring strategies, it can be deduced that the practice corresponds to the management vision of documents 1 and 2. |

*4.1.2. Conceptual correlations and discussions*

*a) The concept of quality education as a transversal axis of STEM processes in Latin America.*

In documents *D1-STEM G-Colombia* and *D2- STEM G-Latinamérica*, the concept of quality was found, but it was not mentioned in the interviews. This concept in the guidelines documents is understood as an aspect that underlies all processes of educational management and innovation.

According to Moyano and Rodrigo (2022), the lack of quality in Latin America is based on comparisons with other parts of the world as a sign of educational needs. Mostly, progressive sectors look at the American case and say that high rates of youth unemployment: a) "affirm that educational systems are inadequate to the needs of the production and service sectors"; b) unemployment in skilled labor sectors; and c) low levels of education.

A correlation can be observed between the parameters established by the World Bank and international organisations in the table of concepts of accompaniment and innovation; precisely, the alignment of the SDGs with

STEM development processes in the accompanying program aligns with this perspective of addressing social inequalities, the solution of contextual problems that affect public schools, and pedagogical actions aimed at sustainability.

According to Lacayo (2015), Moyano and Rodrigo (2022), and Bianchetti (2009) the paradigm of educational quality in Latin America has undergone a change due to society's economy, and the reformulation of educational content and institutional models connects economic principles with education and the theory of human capital.

The neoliberal project expanded the concerns raised by the United States by managing multilateral funding organisations in Latin American countries. Accurately, documents 1 and 2 show that the articulation of the Sustainable Development Goals in STEM processes in education presupposes the development of quality in education, and this concept is promoted by the World Bank and by international institutions that carry out socio-educational diagnoses in Latin America.

The use of this concept and its articulation in different educational processes by government bodies has been pointed out in various debates in Colombia as interference in the public education sector. The concept of educational quality has evolved in Colombia's educational policy, according to the social and political beliefs that were shaped by the educational reforms of the past 30 years, as Mejía (2015) emphasized. It initially had a Taylorist and Fordist approach, but currently it is using the Toyota production system and has been transferred to the educational system.

Mejía (2015) suggests that STEM's inclusion in the educational system is a new concept of human capital that prioritizes competencies and standards. These conceptual relations can be observed with recurrence in the conceptualization developed in documents 1 and 2. As stated by Mejía (2015), quality is considered a factor in reassembling the social outcomes of the school. It always appears to be related to equity as a justification to address the exclusion and vulnerability of social groups that are part of the public sector of education in Latin America.

*b) The idea of innovation and its connection to management.*

The documentation corpus identifies innovation as a recurring concept, and documents 1 and 2 define it as the body of knowledge. Practices and values that promote challenges and ideas to improve or transform school contexts, in addition to the cooperation and participation of various actors and permanent teamwork among the subjects and organisations involved, are key factors in creating innovative initiatives in public education.

In the process of institutional accompaniment to the structuring of the STEM Network, this way of conceptualising innovation can be evidenced in the involvement of teachers in workshops where problems were identified to generate work challenges based on the SDGs.

The documents *D1-STEM G-Colombia* and *D2- STEM G-Latinamérica* indicate that innovation is created through the education public policy strategy known as the Educational Innovation Ecosystem (Ecosistema de innovación educativa) and a monitoring and evaluation model known as the Educational Innovation Index (Indice de innovación educativa). The first term is about a network of networks between people and organizations that establish the conditions and interactions required to promote changes in the educational system.

Based on a shared understanding of transformations on the following levels: 1) Microsystems are useful for teachers, students, and directors of institutions. 2) Mesosystems are relationships that develop between several nearby environments, such as institutions, cities, and communities of the territory. 3) Macrosystems: long-term relations with government bodies and/or international entities, such as the Siemens Network of Latin America.

Considering the different areas of management of STEM Network support, the innovation horizon is framed in the ecosystem of educational innovation set out in documents *D1-STEM G-Colombia and D2- STEM G-Latinamérica*. The components of this ecosystem include research, experimentation, and dissemination of educational innovation practices. In the structuring of the STEM Network, these components were developed with the participation of teachers in the STEM Olympics, in academic events of dissemination of pedagogical projects, and in the creation of a research group between teachers and Uniminuto, registered before the Ministry of Science, Technology, and Innovation of Colombia.

Open educational management is associated with this perspective of innovation. According to Greco, Grimaldi, and Cricelli (2013) and Ramírez (2015), this perspective of management in education is a form of work that extends participation and interdisciplinary work to both internal and external experts of the organization leading it. As for new ideas, the push for open participation and the sharing of knowledge among many people suggests that this way of working can benefit from working with outsiders to make things run more smoothly and encourage open innovation spaces.

Thus, the support of the SED related to inter-institutional management addresses a process of formation and accompaniment to establish significant connections between teachers of the network and other institutions such as universities and public and private entities. This organization of accompaniment is

situated in the perspective of open education, which promotes the opening of knowledge and the facilitation of collaboration in the construction of knowledge and positions the need for reflective and practical spaces in educational communities.

Flores (2021), while describing educational management models in Latin America, refers to those related to the concept of global society, the information revolution, advances in communications, the fall of socialist systems, and the economic recession resulting from the neoliberal model, which in turn is reflected in educational policies and management structures and is legitimised in the quality discourse linked to the notion of social justice, and three management aspects: teacher training, curriculum reforms (contents, methods, and materials), and the management of the education system.

### *4.2. Strategies for teacher training and support in the STEM Network*

The second section emphasizes the following questions: What strategies are implemented in the training and accompaniment process to promote collaborative work among teachers? And what strategies are used to ensure the sustainability and development of the network?

The Ministry of Education of Bogotá accompanies the STEM + Transforms Teachers Network, through the Directorate of Sciences, Technologies and Educational Media, in agreement with the Scientific Park of Social Innovation (PCIS) of UNIMINUTO. UNIMINUTO is a university academic research entity focused on Regional Ecosystems of Science, Technology, and Innovation in Colombia.

> ***Strategy 1 of accompaniment****: Structure of the Network from workshops and conversations between the SED, Uniminuto and the teachers.*

Accompaniment promotes the *formation of teacher communities*, through open calls for voluntary participation. Teachers who participate have teaching contracts in the public and governmental education systems, and then the role of the coordinating team of the Ministry of Education is as facilitators:

> [For the teachers' network, to start organizing a accompaniment route pedagogical and methodological [...] we did not have such a clear vision, we had to go review other references and also start to see what happened when we met with teachers, we always perceive our support as dynamizers]. (Translation of textual transcriptions interviewed 1)

According to interviews, when the STEM Network began, the community of teachers was identified and formed by acknowledging similar pedagogical experiences at first meetings. Therefore, it became relevant to establish a shared identity or vision for the group.

> [The teachers were the ones who made the decisions about the mission, vision, governance, and everything else, we provided tools for them to make those decisions, just for that, the agreement between SED and Uniminuto was made.] (Translation of textual transcriptions interviewed 2)

The product of this process was the editing and diagramming of a document with mission, vision and brief reference of the network that was constituted as an advertising piece to summon other teachers to participate in the Network. In addition, to create a work plan, it was necessary to characterize pedagogical processes in common after calling teachers to workshops to organize the structure and strategic plan of the network. A description of the specific activities in the teacher workshops is provided based on the interests and pedagogical processes of the participating teachers.

> [One of the tasks in the workshops with the teacher´s involved sticking paper on the wall with questions intended, they were very participative [...] Our role involves moderating inquiries about Sustainable Development Goals: What are your thoughts on the SDG that aligns with your community's context?, What actions do you want to take to resolve a problem?, What are your ideas? [...] They selected the SDGs that were most relevant to their context, and from there, the 6 nodes with those 6 themes were created.] (Translation of textual transcriptions - Interviewed 2)

In this manner, the interviewees agreed that the first strategy to organize collaborative work was the dialogue between teachers for the formation of work subgroups (they were called Nodes), for the construction of a documentation sheet was done to identify key information related to classroom practice.

This fact sheet compiles general data on pedagogical practices. Some teachers say that they have implemented various practices in the classroom, but they have not had the opportunity to organize them in a structured manner.

***<u>Accompanying Strategy 2:</u> Promote the leadership of teachers belonging to the Network.***

The aim of the support is to establish and empower teachers as innovators in educational institutions, with diverse pedagogical processes. According to the interview conducted by the management team of the Network from the Education Secretariat, after the formation of the work teams (Nodes), the accompanying process in the consolidation of the network continued with the structuring of a work proposal.

During the interview, interviewees emphasized the importance of teachers being positioned and empowered as leaders in the network in order to guarantee the governance and sustainability of the network, therefore the steering node was conceived as a fundamental strategy.

> [Always with the intention that the teachers are the ones who do all the construction processes [...] We proposed two significant fronts during the dynamization and accompaniment process [...] Oversee the network's internal governance and facilitate knowledge-building scenarios. Concerns that there is a [...] steering node for network governance.] (Translation of textual transcriptions Interviewer 2)

In this process, teachers interested in leading the nodes applied through videos explaining their professional profile and motivations to represent the network. The SED support facilitators discussed how to organize meetings to consolidate the network and specific nodes during their meetings. Three types of network meetings were created after considering the participants' preferences for virtual or face-to-face meetings when choosing modalities: 1) Face-to-face meetings and general events where all teachers on the network participate, seeking to provide a comfortable and conducive space for interaction. Virtual meetings that are customized for each node. 3) The introduction of the concept of exploring other spaces and sharing experiences resulted in itinerant chairs that link other institutions in the process. The following item will provide additional information about the latter.

***<u>Supporting strategy 3</u>:*** *Connecting the network to institutional and inter-institutional management processes.*

Through the integration of another work strategy of the Bogotá Education Secretariat, the STEM Olympics, the next phase in the structuring of the Network involved consolidating pedagogical proposals, as a result, the pedagogical projects were developed and implemented by teachers who participated in the Red STEM.

For this, they had to form institutional teams of teachers and students who identified problems or socio-educational challenges and created creative solutions for STEM subjects. During the call and development of projects to participate in the STEM Olympics, the Science Directorate, Educational Technologies, and Media of the SED had manuals for the identification of challenges or problems and sequences for the creation of solutions and prototypes, aimed at encouraging teamwork and promoting the development of problem-solving skills and competencies in teacher-student teams.

As a result, the network's general organisation was established in 2021, and it was expanded in 2022 with an open call that brought together other teachers. Consequently, the accompaniment was focused on recognising and strengthening the management team of the STEM Network and the management of alliances with other institutions, universities, and companies with the purpose of strengthening teacher training processes, contributing to the systematization of pedagogical proposals, and participating in dissemination scenarios for pedagogical projects.

Finally, itinerant seminars (cátedras itinerantes) are the third space for dialogue, meetings, and training for teachers in the Network. These are experiences of training and dialogue between peer teachers and experts developed in strategic institutions for the development of STEM processes in Bogotá, Colombia (Universities, museums, technological institutes).

The methodology developed for each of these meetings made it possible to explore various thematic areas, based on the interests and requirements of training and professional development expressed by the founding teachers of the Network in 2021, particularly dialogues and training with experts revolve around STEM education, technology projects, and the integration of inter- and transdisciplinary curricular approaches.

### *Role of quality concept in STEM Networks and educational systems in Latin America*

The focus of this content analysis has been on the concept of quality as a factor that influences all management processes within STEM networks in Latin America. It concerns educational policy postulates that are specifically designed for the public education sector, specifically targeting populations in conditions of social vulnerability or poverty. Demographic assessments indicate that these populations require a range of interventions to improve educational quality.

The concept of quality and new models of educational management in Latin America have generated numerous analyses and discussions. The majority of these are derived from studies of popular pedagogy that concentrate on teachers

and students in the public sector, emphasizing the significance of comprehending public educational policy.

The economic system's challenges are connected to social development, which has an ideological meaning and intention. This aspect can be demonstrated by examining the correlations between the concept of quality and the parameters of institutions such as the World Bank regarding public policies in educational innovation and sustainable development. One of the research topics is the conceptual understanding of educational innovation and the involvement of teachers in STEM pedagogical projects.

## CONCLUSIONS

Through this content analysis, it has been identified that the implementation of STEM support programs promotes the empowerment and leadership role of teachers in promoting pedagogical proposals, fostering an environment where innovation can generate alternatives for intervention in educational contexts and collaborative work strategies that are consolidated through the network structure and that can reach from micro to macro contexts (school, city, country). However, in the conceptualization of innovation, it was identified that the empowerment work and leadership role of teachers are part of the results of accompanying social innovation.

Precisely, it was evidenced that the concept of social innovation is prominent in the STEM vision documents of the Ministry of Education of Colombia and the SIEMENS Latin America Network. However, the research possibility of investigating teachers' perceptions of the specific meanings of social innovation and educational innovation remains open, with the aim of better understanding their interpretations and implementation perspectives in the classroom. This reflection can also be incorporated into the exploration of educational research perspectives and the generation of knowledge about STEM educational processes.

Another significant aspect is understanding how teachers perceive their relationship with institutional support, the leadership dynamics, and their operational scope in educational institutions with STEM programs. This is significant because this network of educators generated the proposal with institutional support, encouraging various dialogues and reflections on the new benchmarks of STEM education and the development of educational policies surrounding these issues, particularly in relation to collaborative work.

The above is due to the contrast between the organizational perspective of the network and the established teacher networks in Colombia's public sector, which began in the 1980s as voluntary initiatives by primary and secondary school teachers. These networks were created to counter the education system,

influenced heavily by the ideas of Latin American popular pedagogy and have significantly impacted social movements and protests among this sector of teachers in Colombia from the 1990s to the present. It is necessary to continue identifying the changes and adaptations of teacher networks from their historical beginnings in Colombia with the National Pedagogical Movement to the dialogues generated with new references in public educational policy.

According to the content analysis, the network's success has been attributed to the collaborative work and leadership of teachers. The collaboration between educators and their leadership capacity have contributed significantly to the progress and development of the network, highlighting the relevance of these qualities in the educational field.

Finally, there are still challenges in establishing effective strategies for engaging educational institution managers in the STEM Network. This finding suggests that, despite the achievements in terms of collaboration between teachers, it is necessary to work on the implementation of strategies that promote the participation of the directors of educational institutions.

Even though the solutions of the educational institutions and policymakers in Columbia have undertaken are relevant to the international contexts, they can be informative for other educational institutions and leaders in the attempt to upskill the teachers to foster better educational quality and innovation in their pedagogical processes.

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# The Role of Emotionality, Self-efficacy, Rational- and Intuitive- Thinking Styles in Advanced Chess Expertise

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**ABSTRACT. Background**: Literature is scarce regarding the psychological predictors of chess expertise and A-level chess performance. **Methods**: A cross-sectional study was designed and conducted on a total number of 90 Hungarian and Romanian competitive chess players. More than half were males, the average age was 32.07 (SD=12.99). The study aimed to explore the predictive influence of age, gender, number of hours spent practicing, preferences for rational and intuitive thinking styles, self-efficacy, and emotionality on the likelihood of obtaining a publicly accessible ELO rating within the range of 1800-2500 (indicating at least A-level expertise or higher). Binary logistic regression was applied to examine the weight of each predictor. **Results:** The data evinced the statistically significant role of gender, and rational thinking style on A-level chess expertise and from all the conclusive predictors the most determinant was the rational thinking style which raised the chance of high expertise more than 60 times. **Conclusions**: Practice contributes positively to the development of A-level competence. However, the most crucial factor in predicting high chess expertise and performance is the preference for rational thinking style.

**Keywords:** chess expertise, ELO rating, A-level, emotionality, self-efficacy, rational thinking, intuitive thinking, practice, adults

**ZUSAMMENFASSUNG. Hintergrund**: Es gibt nur wenig Literatur über die psychologischen Prädiktoren für Schachkenntnisse und A-Level-Schachleistungen. **Methoden**: Es wurde eine Querschnittsstudie konzipiert und an insgesamt 90

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ungarischen und rumänischen Wettkampfschachspielern durchgeführt. Mehr als die Hälfte waren Männer, das Durchschnittsalter betrug 32,07 Jahre (SD=12,99). Ziel der Studie war es, den prädiktiven Einfluss von Alter, Geschlecht, Anzahl der Trainingsstunden, Präferenzen für rationale und intuitive Denkstile, Selbstwirksamkeit und Emotionalität auf die Wahrscheinlichkeit zu untersuchen, eine öffentlich zugängliche ELO-Bewertung im Bereich von 1800-2500 (was mindestens A-Niveau oder höher bedeutet) zu erhalten. Es wurde eine binäre logistische Regression angewandt, um das Gewicht der einzelnen Prädiktoren zu untersuchen. **Ergebnisse**: Die Daten zeigten die statistisch signifikante Rolle des Geschlechts und des rationalen Denkstils für die Schachkompetenz auf A-Niveau. Von allen schlüssigen Prädiktoren war der rationale Denkstil der bestimmendste, der die Chance auf eine hohe Kompetenz um mehr als das 60fache erhöhte. **Schlussfolgerungen**: Übung trägt positiv zur Entwicklung der A-Level-Kompetenz bei. Der wichtigste Faktor bei der Vorhersage von hoher Schachkompetenz und Leistung ist jedoch die Präferenz für den rationalen Denkstil.

**Schlüsserwörter:** Schachexpertise, ELO-Bewertung, A-Level, Emotionalität, Selbstwirksamkeit, rationales Denken, intuitives Denken, Praxis, Erwachsene

## INTRODUCTION

### *The role of rational thinking, deliberation and practice in chess expertise*

The significance of careful practice and rigorous learning in developing outstanding chess skills is crucial for achieving success in chess (Charness et al., 2005). Chess performance and competence are influenced by specific cognitive characteristics, including memory and attention abilities, theoretical knowledge, and the amount of time dedicated to practice (Bilalić et al., 2008). Moreover, the quantity of games played, the amount of time dedicated to practice, and the deliberate study of chess are highly associated with chess performance, indicating the educational process that contributes to achieving high scores (Howard's, 2011; Charness et al., 2005; Li et al., 2015).

Furthermore, research on neurocognition has identified specific brain regions involved in analytical thinking that are activated in chess players during gameplay (Saarilouma et al., 2004). EEG recordings of high-performance players revealed that during rapid and lightning chess games, the right hemisphere had greater activity than the left hemisphere. This asymmetry can be attributed to the involvement of visuospatial processing (Villafaina et al., 2021). Positron emission tomography (PET) was used to examine chess players with an average of 37 years of experience. The study found that the

temporal region of the brain was active during the memory test, while the frontal brain areas were involved in problem-solving activities (Saarilouma et al., 2004).

Additionally, empirical research demonstrated that individuals who exhibited superior performance in chess games engaged in a higher degree of logical analysis when considering their options (Bilalic, et al., 2008; Charness, 1981). The cognitive reflecting behaviors and planned actions that are linked to achieving good chess performance are predominantly rooted in logical and reasonable thinking. This notion is supported by various studies, including those conducted by de Groot (1978), Ericsson and Charness (1994), Cumming et al. (2005), and Gobet and Charness (2006).

### *The role of intuitive thinking in chess expertise*

In addition to examining deliberate and rational thinking, researchers have also investigated the role of intuition in the performance of chess masters. The findings indicate that both cognitive systems are present in high-stakes chess games (Dreyfus & Dreyfus, 1987; Kahneman & Frederick, 2005; Moxley et al., 2012). Chess players are regarded as being more intuitive than the general population, and greater expertise among chess players was linked to higher scores in intuition (Kelly, 1985).

The literature (Raab & Johnson, 2007) emphasized the connection between the "take-the-first" heuristic and intuition. Intuition is evident in the effortless identification of patterns and the rapid retrieval of associated methods. In the context of chess playing, intuition appears to be most apparent in straightforward issue scenarios. Intuitive and automatic thinking is driven by the unconscious activation of past experiences. The more knowledge and expertise a person has in a certain area, the more they may rely on it, even at a preconscious level. Previous research (Gigerenzer & Brighton, 2009; Raab & Johnson, 2007; Moxley et al., 2012) has demonstrated that this strategy serves as a mediator for enhancing expert chess decision making.

The cognitive processes that underlie intuition were previously associated with learning and recalling information, automatically integrating information from memory and current perception, and constructing stable mental representations (Glöckner & Witteman, 2010). Intuition is also associated with the process of acquiring knowledge (Betsch & Glöckner, 2010). Empirical evidence indicates that experts employ a combination of analysis and intuition in their decision-making process. Furthermore, it has been observed that the effectiveness of their intuitive decision-making is enhanced when they are afforded extra time to deliberate on their choices (Moxley et al., 2012).

Another viewpoint suggests that intuition may be cultivated by intentional practice and is based on knowledge gained from training (Betsch & Glöckner, 2010). According to studies by Chase and Simon (1973) and Gobet and Simon (1996), intuition is associated with the capacity to change gameplay and memory function quickly. It is considered that professionals are able to swiftly retrieve the appropriate action from memory due to intuitive processes that rely on pattern recognition. Based on these concepts, the expert is able to recognise specific characteristics that act as cues for recalling the correct actions by gathering a significant amount of knowledge related to familiar patterns.

### *The role of personality and self-efficacy in chess expertise*

Chess players who perform at a high level are more likely to have introverted tendencies compared to their colleagues with a lower ELO score. Regarding female chess players, it was found that those who were more skilled exhibited higher levels of extroversion and above the average in areas such as life satisfaction and performance orientation (Vollstädt-Klein et al., 2010). Many high-performance sport talents exhibit traits such as high emotional stability, conscientiousness, and sociability (Hackfort & Schinke, 2020; Steca et al., 2018). A study conducted by Allen et al. (2011) found that athletes who are more extroverted and emotionally stable tend to employ problem-focused coping strategies more frequently compared to their more introverted or emotionally unstable peers. According to Bilalić et al. (2008), highly skilled chess players are set apart from the normal population by their elevated levels of emotional stability and control.

Individuals with high levels of self-efficacy demonstrated notably superior performance in tasks that necessitated cognitive engagement. Furthermore, the combination of self-efficacy and confidence in one's self-efficacy proved to be predictive of cognitive performance in these tasks (Horcajo et al., 2022). The study conducted by Jianguo et al. (2018) emphasized that chess playing in an experimental environment had an effect on self-efficacy.

Based on the information provided, we can conclude that chess performance, high ELO scores, and overall consistency among chess players are connected to emotional stability and self-efficacy. These psychological factors play a crucial role in determining the outcome of chess games.

## AIM OF STUDY

The existing literature is limited in the exploration of the psychological factors that contribute to advanced chess expertise. This research was conducted to address this gap in knowledge. The main objective of the study was to investigate the predictive role of factors influencing A-class chess performance and expertise (ELO rating in the interval of 1800-2500). The exploratory approach focused on variables such as age, practice hours, gender, emotionality, self-efficacy, and self-declared thinking style (rational or intuitive). The current investigation was carried out on a population consisting of individuals with advanced chess skills from Romania and Hungary, a seldom-studied sociocultural context from this perspective.

## MEASUREMENT AND METHODS

### *Participants*

Totally 90 participants were eligible for the study. Male and female competitive chess players from Romania and Hungary were recruited online and directly in chess clubs, via the snowball method. Having at least a rating of 1000 points ELO publicly available was an eligibility criterion. After entering the study, participants were divided into two groups, based on the overall highest ELO rating one has ever reached. The chess rating system (Elo, 1978) divides the players into different classes, based on their ELO points and skills level. While the first group includes Class E, D, C and B players, the second group consists of players of Class A up to Senior Master level. Descriptive statistics of the two groups mentioned before are presented in Table 1.

## MEASUREMENTS

### *Demographic Information*

All data has been collected through an online survey. The questionnaire included items referring to general demographic information such as age, gender, education, and job profile, but also contained questions about ELO rating, tournament participation and training intensity. In the present study we focused on the highest ELO rating one has ever reached, instead of real time points. Furthermore, weekly practicing hours average was also asked for. The socio-demographic information is presented in Table 1.

**Table 1.** Descriptive statistics of participants divided into lower and higher ELO rating groups (Binary Regression Analysis Groups)

| | Group 1<br>(1000-1799 ELO rating)<br>(N = 56) | Group 2<br>(1800-2500 ELO rating)<br>(N = 34) |
|---|---|---|
| Age | 33.30 ± 13.27 | 30.85 ± 12.72 |
| Gender (N, %) | | |
| Male | 27 (48.2%) | 21 (61.8%) |
| Female | 29 (51.8%) | 13 (38.2%) |
| Education (N, %) | | |
| High school without graduation | 1 (1.8%) | 2 (5.9%) |
| Technical school | 2 (3.6%) | 1 (2.9%) |
| High school graduate | 21 (37.5%) | 8 (23.5%) |
| College graduate | 32 (57.1%) | 23 (67.6%) |
| Job profile (N, %) | | |
| non-STEM | 22 (39.3%) | 9 (26.5%) |
| STEM | 33 (58.9%) | 25 (73.5%) |
| Mixed | 1 (1.8%) | 0 (0.0%) |

### *Practicing hours and performance/expertise coding*

We collected self-reported data about the highest ELO rating the participants have ever reached to compare the skill levels of the players and create two separate groups based on this information. Expert chess performance can be objectively measured in ELO scores (Élő, 1978). This score is calculated depending on the results achieved against different opponents, with cumulative distribution function, so the players can not only add to the ELO point, but also lose from it in unfavorable cases. Based on the ELO score

thus obtained, the players are classified into the following categories: E (1000-1199 ELO), D (1200-1399 ELO), C (1400-1599 ELO), B (1600-1799 ELO), A (1800-1999 ELO), Expert (2000-2199 ELO), Master (2200-2399 ELO) and Senior Master (2400+) categories.

### *Rational and intuitive thinking style*

The studied information processing systems based on the cognitive-experiential self-theory (CEST) were measured via the Rational *Experiential Inventory.* This questionnaire has two main subscales, one concentrating on the rational style (e.g., "I prefer complex problems to simple problems.") and the other on the experiential/ intuitive style (e.g., "I believe in trusting my hunches.") (Bognár, Orosz & Büki, 2014; Epstein, Pacini, Denes-Raj & Heier, 1994; Reyna & Ortiz, 2016). The inventory consists of 40 items and the overall Cronbach's Alpha value is 0.87 for the rational scale and .86 for the experiential scale, consisting of 20 items each. Subscales, such as ability and engagement were not included in data processing.

The cognitive-experiential self-theory ("cognitive-experiential self-theory - CEST") refers to the presence of two types of information processing systems: a rational/analytical one and an associative/automatic/intuitive one.

The rational system is based on verbal reasoning and logical reasoning, uses higher-level cognitive processes and searches for the answer through analysis, which is why it is more time-consuming to rely on this processing system. On the other hand, during the use of the intuitive system, as can be seen from the previous definition, a fast, less demanding, automatic process takes place, which is based on association and preconscious information processing.

The two systems interact with each other, and the quality of information processing is influenced by both environmental and individual factors as well (Bognár & Orosz, 2014; Epstein, 2010; Epstein, Pacini, Denes-Raj & Heier, 1994).

### *Emotionality*

Emotionality was assessed through the specific subscale of the HEXACO-60 (Ashton & Lee, 2009). Out of the 6 HEXACO personality factors only emotionality (e.g., "I worry a lot less than most people do.", "Even in an emergency I wouldn't feel like panicking.") was measured, and it showed a good reliability level, with a Cronbach's Alpha coefficient of 0.72.

### *Self-efficacy*

The General Self-Efficacy Scale is a 10 item, self-report measure with a single scale of general self-efficacy (e.g., "I can always manage to solve difficult problems if I try hard enough.", "I can solve most problems if I invest the necessary effort.") was used for the assessment of general self-efficacy. (Kopp, Schwarzer & Jerusalem, 1995). Based on the reliability analysis the General Self-Efficacy Scale in the present study has a Cronbach's Alpha coefficient of 0.87, which implies a strong internal consistency.

## PROCEDURE AND DATA ANALYSIS

A cross sectional explorational study has been carried out starting from January 2022 until February 2023. Romanian and Hungarian chess player clubs were contacted, and the survey was distributed electronically. All data was gathered and stored anonymously. Data gathering took place also on different social media platforms, via snowball method, by distributing an online Google Forms survey. The survey contained a detailed informed consent, which included that all participants must be over 18 and that the obtained data will be processed and stored anonymously. Furthermore, the survey consisted of a demographic questionnaire, the Rational Experiential Inventory, the Emotionality Scale of HEXACO-60 and finally the General Self-Efficacy Scale. Completion of the survey took 15-20 minutes.

### *ELO rating and Chess Expertise*

Expert chess performance can be objectively measured in ELO scores (Élő, 1978). Above-average ELO score is a correlation of high degree chess expertise (Gobet & Ereku, 2016). The difference in expert chess performance between A-category and master-level players was more evident when the number of steps to keep in mind increased and the game became deeper (Campitelli & Gobet, 2005). This is the reason for which we divided the participants into two groups, namely the A level ranking (1800 +ELO) and below. All participants needed to have an official ELO ranking from former games.

### *Data screening*

To prepare the data file and to run the statistical analysis the authors used IBM SPSS (Statistical Package for the Social Sciences) Statistics software, version 20. The preliminary analysis was based on Pallant (2016). The data

screening showed no missing cases in the database. The authors assessed normality with a split file method based on the two groups of chess players. Skewness and kurtosis values fall between -1.15 and .715 which imply that our sample is normally distributed, (Tabachnik & Fidell, 2013) which is supported by the 5% Trimmed Mean value and the Kolmogorov-Smirnov and Shapiro-Wilk normality tests' non-significant results.

### *Data analysis*

First, descriptive analysis was conducted for both continuous and categorical variables (data is shown in Table 1.), then we calculated Cronbach Alpha's values for every scale presented before, with the aim to assess internal consistency. By using the Independent Sample T-test, we made sure that there is a significant correlation between our main variables. The authors included some of these variables based on previous literature, while the inclusion of others has explorational purposes. The significance of these variables was analyzed by using binary logistic regression, including the two previously presented groups of chess players as dummy variables. The variables included in the model are: age, gender and practice hours are emotionality, rational and intuitive thinking, and general self-efficacy scores. The model includes unstandardized regression coefficients (B), standard errors (S.E.), Wald statistics, odds ratios [Exp(B)], confidence intervals and Nagelkerke $R^2$ values.

## RESULTS

Binary logistic regression was performed to examine the impact of emotionality, the nature of informational processing style and self-efficacy on the level of chess expertise. The created model consists of seven independent variables and one dependent variable. The two groups of chess players were divided based on their ELO rating, which is an indicator of skills level and expertise – we used this dichotomous variable as our dependent variable in the model. Based on previous literature, age, gender, and practice hours are also included in the model, simultaneously with emotionality, rational thinking, intuitive thinking, and self-efficacy scores. Results of the binary logistic regression analysis are presented in Table 2.

**Table 2.** Binary logistic regression analysis on chess expertise, emotionality, rational and intuitive thinking, and self-efficacy

| | Model 1 | | | Model 2 | | |
|---|---|---|---|---|---|---|
| | B | Exp(B) | S.E. | B | Exp(B) | S.E. |
| Age | .03 | 1.031 | .026 | .092 | 1.096 | .041 |
| Gender | -.739 | .478 | .657 | -1.358 | .257 | .952 |
| Practice hours | .349* | 1.417* | .084 | .442* | 1.555* | .111 |
| Emotionality | | | | 1.158 | 3.184 | .944 |
| Rational thinking | | | | 4.143* | 63.02* | 1.297 |
| Intuitive thinking | | | | .125 | 1.133 | .873 |
| General self-efficacy | | | | -.039 | .961 | .131 |
| Nagelkerke $R^2$ | 0.59 | | | .73 | | |

N = 90. In Model 1 we entered control variables such as age, gender and weekly practice hours at the time of the highest ELO score. In Model 2 appear emotionality, rational thinking, intuitive thinking and general self-efficacy as predictor variables for level of chess expertise. *p ≤ .001, Statistically significant results are marked with bold fonts and stars.

The analyzed model, according to Nagelkerke $R^2$ value, explains 73% of the variance in chess expertise. Statistically significant contribution was detected in case of practice hours ($p < .001$), and rational informational processing style ($p < .001$). Rational thinking turned out to be the stronger predictor variable of the model with an odds ratio of 63.02, followed up by practice hours with an odds ratio of 1.55. In the case of age, gender, emotionality and self-efficacy no meaningful results were present.

## DISCUSSION AND CONCLUSIONS

The objective of this study was to investigate the factors that can predict advanced chess competence and expertise, specifically achieving a performance level of A class or higher. Our findings indicated that the logical thinking style, and the number of practice hours of the participants were the only statistically meaningful determinants of chess skill and performance expressed in ELO rating (1800+ ELO). The findings align with previous research that highlights the significance of deliberate practice and learning in relation to ELO rating (Charness et al., 2005; Bilalic et al., 2008, Gobet & Charness, 2006). Prior research has consistently highlighted the significant role of practice and learning hours in determining success in chess contests (Howard's, 2011; Charness et al., 2005; Li et al., 2015). Our findings indicate that the amount of practice hours have a positive and statistically significant impact on the likelihood of achieving a higher ELO rating (A class or above).

Previous research has extensively examined intuition and rational thinking styles and indicated that both are crucial factors in the performance of chess players (Dreyfus & Dreyfus, 1986; Kahneman & Frederick, 2005; Moxley et al., 2012). Our investigation found that the rational thinking style was the only predictor that had a statistically meaningful impact and increased the likelihood of achieving an A-class result by up to 63 times, in the case of the best performance ever registered. The study did not find any evidence to support the predictive role of intuitive thinking style on chess expertise. This finding contradicts previous research by Glöckner and Witteman (2010) and Betsch and Glöckner (2010), who suggested that intuitive thinking style could be a substantial predictor of high performance in chess play. In contrast to the findings of Allen et al. (2011) and Bilalić et al. (2008), the role of emotionality in predicting advanced chess performance was not identified. Contrary to prior research by Jianguo et al. (2018), self-efficacy did not serve as a predictor of A-class or higher performance in relation to the best ELO rating achieved in this sample. The possible explanation of our results can be that chess mastery and performance require a significant level of focus, heightened attentional capacity, and the refinement of gameplay tactics through error correction. This is accomplished by analyzing previous matches and expanding one's theoretical knowledge base, encompassing openings, middle, and endgame techniques, as well as strategic mastery. The rationality and analytical approach exhibit the highest level of predictability on ELO rating above 1800, even when including other previously significant psychological predictors such as self-efficacy and emotionality. The reason for this phenomenon can be attributed to the significant demand for strategic thinking and systematic analysis by players

(Bilalic et al., 2008; Charness, 1981). Additionally, players must possess cognitive reflection and employ planned actions in order to achieve success or emerge as winners in complex games (de Groot, 1978; Ericsson & Charness, 1994; Cumming et al., 2005; Gobet & Charness, 2006) (Campitelli & Gobet, 2005). The outcome is also consistent with neuropsychological findings that emphasize the significance of analytical cognitive processes in chess playing and expertise (Villafaina et al., 2021; Saarilouma et al., 2004). The absence of significance in the predictive role of self-efficacy may be attributed to the assessment scale's characteristics, which primarily evaluated general self-efficacy and may have a low sensitivity in detecting the variability among A+ level chess players. Regarding emotionality, the absence of noteworthy findings could be attributed to the large proportion of male participants in the study's sample, who typically present lower rates of emotional reactions (Ramirez et al., 2024).The conclusion of the present study is that to obtain at least an A class level ELO rating, chess players will present a strong preference for rational thinking style, which is based on reasoning, uses higher-level cognitive processes and searches for the answer through analysis. Furthermore, the intentionally dedicated hours spent training and the knowledge acquired over the course of several years will greatly enhance one's experience and chess expertise.

## LIMITATIONS AND FUTURE DIRECTIONS

In addition to the findings that enhance the existing body of knowledge about skilled chess players, it is important to acknowledge also the limitations that should be disclosed. The study was a cross-sectional, single-point measurement study and did not yield data regarding changes in the evaluated variables. The data was collected through self-reported surveys, which have the potential for bias. However, there were no measures in place to assess social desirability and screen for biased responses. The recruitment primarily utilized the convenience sampling strategy, which may not be appropriate for detecting small effect sizes due to the limited population size. The sample exhibits a lack of female representation, which can be attributed to the predominantly male-dominated nature of the chess sector. Furthermore, gaining access to highly skilled female players is particularly challenging. An effective resolution to the aforementioned issue would involve adopting a gender-specific methodology in chess research. Moreover, it is important to take into account the influence of cultural practices, norms, and gender roles on many psychological factors. Future research should prioritize the investigation of blitz chess games to examine the impact of intuitive thinking style on chess expertise. Additionally, to evaluate high-level performance-related self-efficacy or chess self-efficacy,

future studies may employ a more narrowly focused scale to measure self-efficacy. Further research may also consider replacing the assessment scale of the emotional component of personality with one that focuses more on neuroticism, which has been demonstrated to be more sensitive in identifying emotional traits that may hinder chess or athletic performance. These modifications have the potential to clarify some of the variables that the current research found to be statistically insignificant as predictors of high performance in chess.

### *Statements and Declarations*

***Data Availability Statement.*** The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found at: https://doi.org/10.6084/m9.figshare.22186144.v1

***Ethics Statement.*** The studies involving human participants were reviewed and approved by the Ethical Committee of Babes-Bolyai University (reference number 227/03.03.2023. Research Project: The Role of Emotionality, Self-efficacy, Rational- and Intuitive-Thinking in Chess Expertise). The patients/participants provided their written informed consent to participate in this study.

***Author Contributions.*** A.V., E.E.M. planning and conducting the research, A.V. recruiting participants, A.V., E.E.M. statistical analysis of data, A.V. writing up the results and procedure, E.E.M. writing the first version of the introduction and discussion, A.V., E.E.M. manuscript revision, and both authors approved the submitted version.

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***Conflict of Interest.*** The authors declare that the research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

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# The suicides among the Romanian police and public safety personnel in the period 2016-2021

**Bogdan MÎNJINĂ**[1]

**ABSTRACT.** There is an important concern of public and professional organizations in the police and public safety sector to identify the best practices for suicide risk management, especially in USA. The suicide phenomenon from 2016 to 2021 at the level of the Ministry of Internal Affairs of Romania[2], captured through the annual suicide rates, varied positively or negatively compared with the annual suicide rates from Romania and with those at the level of institutions with a similar activity profile from the international level, from the USA and Italy. Based on the socio-demographic data available, the self-murderers' profiles at the level of MIA were created, but in their use, the particular aspects of the suicidal phenomenon must be considered. The self-murderers from the Romanian police and public safety institutions used firearms in 45.7% of the cases during the analyzed period. The algorithm used to predict the annual suicide numbers in the period 2022-2025 at the MIA level revealed that they will follow an increasing trend. In the period 2016-2021, the annual number of suicides among Romanian police and public safety personnel was higher than the number of deaths among the same personnel caused by accidents during service and assaults.

**Keywords:** suicide, police and public safety institutions, suicide prevention

## INTRODUCTION

Suicide is an important global public health problem, ranked among the top twenty leading causes of death worldwide, causing around 800,000 deaths annually, and resulting in more deaths than those caused by malaria, breast cancer, war, homicide (World Health Organization, 2019), and motor vehicle accidents (CDC, 2014, and WHO, 2012, as cited by Franklin et al., 2016).

[1] Psychosociology Centre of Ministry of Internal Affairs of Romania, Bucharest, Romania
[2] Hereinafter referred as MIA

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Suicides and mental health problems that cause them have a significant negative effect on the productivity and well-being of workers (World Health Organization, 2006). Each death by suicide provokes a chain reaction, estimated to affect profoundly at least 6 to 14 relatives and close friends, and beyond the immediate group of family members and close friends, up to 135 people are in some sense affected by a single suicide (Westerlund, Hökby, & Hadlaczky, 2020).

Suicide is the most serious consequence of failure to treat mental disorders because post-traumatic stress syndrome, depression, and alcohol abuse are often present before suicide, each of these being associated with the opportunity to provide potentially life-saving treatment (Heyman, Dill and Douglas, 2018).

Age-standardized suicide rates estimated by the World Health Organization (2019) were, in 2016, 10.5 per 100,000 inhabitants worldwide and 12.9 per 100,000 inhabitants in Europe. The average annual suicide rate in Romania was 8.98 per 100,000 inhabitants in the period 2016-2021.

Suicide rates vary across occupational groups based on unique daily stressors that are characteristic of them, greater exposure to intensely stressful or violent incidents that can cause post-traumatic stress disorder, or rapid access to lethal means of suicide, such as firearms, drugs (in lethal doses) or pesticides (World Health Organization, 2006).

US law enforcement personnel are 54% more likely to die by suicide than all ordinary occupation decedents (Violanti & Steege, 2021). Suicide rates for police officers (including police and prison personnel) in the US, taken or calculated based on available data, are as follows:

- in 2016, there were 108 suicides among police officers, which means a suicide rate of 12 per 100,000 police officers (Heyman et al., 2018), and the overall suicide rate in the US was 13.4/100,000 (NIMH, n.d.);

- in 2017, there were 140 police suicides in the US (an increase of about 30% compared to 2016) (Heyman et al., 2018), which means a suicide rate of 15.55 per 100,000 police officers, and the overall suicide rate in the US was 14/100,000 (NIMH, n.d.);

- in 2018, there were 167 suicides among US police officers (Police Research Forum, 2019), which implies an estimated suicide rate of 18.55 per 100,000 police officers, and the overall suicide rate in the US was 14.2/100,000 (NIMH, n.d.);

- in 2019, there were 239 suicides among US police officers (Perine, 2021), which corresponds to an estimated suicide rate of 26.55 per 100,000 police officers, and the overall US suicide rate was 13.9/100,000 (NIMH, n.d.);

- in 2020, there were 116 suicides among police officers in the US (Nissim et al., 2022), which implies an estimated suicide rate of 12.88 per 100,000 police officers, and the overall suicide rate in the US was 13.5/ 100000 (NIMH, n.d.);

- in 2021, there were 61 suicides among US police officers (Nissim et al., 2022), which means an estimated suicide rate of 6.77 per 100,000 police officers.

Garbarino et al. (2021) presented the following data on suicides in the Italian State Police, which has a personnel of approximately 100,000 people aged between 25 and 65 years: 14 persons committed suicide in 2015, 7 in 2016, 13 in 2017, 10 in 2018, 18 in 2019, and 12 in 2020. In 2021, 8 cases of suicide were registered among Italian State Police personnel (Aumento alarmante dei suicidi "in uniform", 2022).

Maselli et al. (2022) stated that the mean annual suicide rate in the Italian State Police from 2016 to 2021 was 10.7 per 100,000 persons (95% CI = 9.54 – 11.86), the mean annual suicide rate between 2016 and 2019 was 12.10 per 100,000 persons (95% CI = 10.86–13.34), and the mean suicide rate between January 1, 2020, and October 31, 2021, was 7.88 per 100,000 persons (95% CI = 4.97–10.79).

According to data from high-income countries (that includes also Romania), where approximately 28% of all global suicides occurred, the hanging is used in 50% of suicides, and the use of firearms is the second most common method, used in 18% of suicides (World Health Organization, 2014). Among US law enforcement personnel, approximately 80 - 90% of suicides involved the officer's firearm (Violanti, 1996, 2007; Violanti & Aron, 1995, as cited by Chae & Boyle, 2013). In a study of suicides among police officers in the Italian State Police from 1995 to 2017, Grassi et al. (2019) found that suicide was committed using a firearm in 87.46% of cases (firearm service was used in 81.92% of cases and personal firearm in 5.54% of cases), and hanging was used in 7.01% of cases. At the level of the French National Police, in a study that covered all police suicides from 2008, Encrenaz et al. (2016) found that the firearm was used in more than half of the cases, 32 (65.3% of the total cases), the service firearm was used in 27 cases (55.1%) and the personal firearm in 5 cases (10.2%), 13 (26.5%) police officers hanged, and 4 (8.2%) used other methods.

The COVID-19 pandemic could have increased the number of suicide deaths due to affecting vulnerable groups through specific mechanisms such as increased anxiety, depression, alcohol use, or feeling trapped due to isolation, uncertainty, domestic violence, increased economic difficulties, and reduced social opportunities (Leske et al., 2021). However, the available data to date indicates that the COVID-19 pandemic has not increased suicide rates, as might have been expected, but acted in the opposite direction, both at the general population level, as revealed by Appleby (2021), and at the level of police officers, according to the results of research carried out by Garbarino et al. (2021) and Maselli et al. (2022).

The number of police officers who died by suicide each year in the United States (167 verified suicides in 2018) exceeds the number of those who are criminally or accidentally killed (55 criminally and 51 accidentally killed in 2018) (Police Research Forum, 2019). This situation suggests that mental health and well-being are an integral part of the police safety and well-being continuum and are essential to prevent their suicide (idem).

Being the state of research on suicide above mentioned and the lack of research about suicide of the Romanian police and public safety personnel, the present article aims to answer to the next research questions:

• What were the size and evolution of the suicide phenomenon during the period 2016-2021 at the level of the MIA personnel and the four major structures personnel, the Romanian Police, the Romanian Gendarmerie, the Romanian Border Police, and the Inspectorates for Emergency Situations?

• How did the suicidal phenomenon evolve at the level of the MIA personnel and its four large component structures during the Covid-19 pandemic compared to the previous period?

• What will be the likely evolution of suicide among the personnel of the MIA and the Romanian Police in the period 2022-2025?

• What were the methods of suicide used by the personnel of the MIA and its four large component structures in the period 2016-2021?

• Is the number of suicides higher/smaller than the number of deaths due to accidents and assaults at the MIA level in the period 2016-2021?

## METHOD

### *Data*

The data about the number of suicides from 2016 to 2021 at the level of four large structures with field missions/activities of the MIA, the Romanian Police, the Romanian Gendarmerie, the Romanian Border Police, and the Inspectorates for Emergency Situations, the suicide methods and the socio-demographics of the self-murderers (sex, professional body, type of activity carried out – field/support, age category) were provided by the mentioned large structures. The data related to the MIA as a whole was obtained based on the data from the four large structures mentioned previously. Also, data on the number of deaths as a result of work-related injury or assault were obtained from the same sources.

The data on the number of suicides in Romania between 2016 and 2021 was provided by the National Institute of Statistics from Romania.

Data on police suicide in other countries were collected from the scientific literature or public sources.

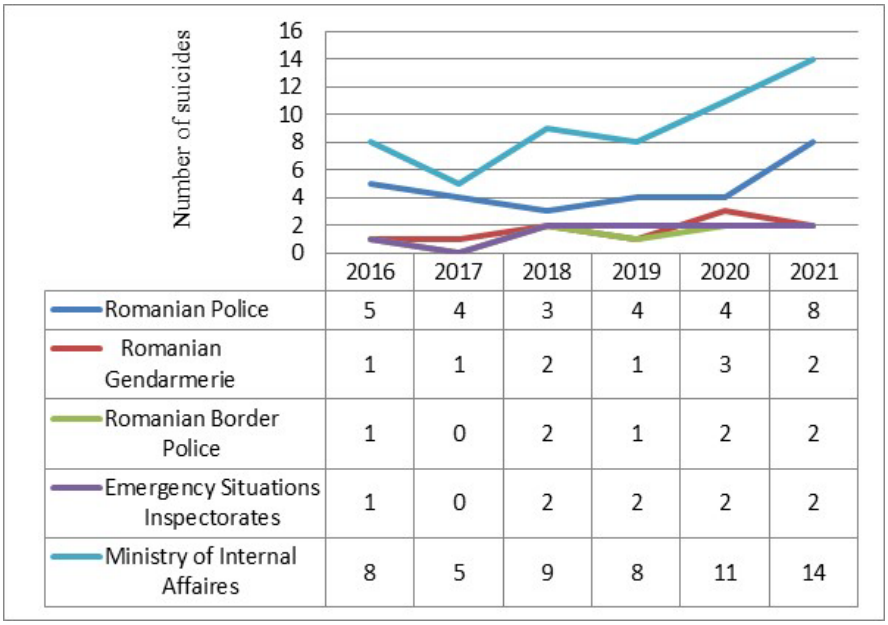
### *Analysis*

Suicide rates per 100,000 people were calculated for each year from 2016 to 2021. The calculated suicide rate was crude and obtained by dividing the number of suicides in a specific group/population by the number of people in the respective group/population, and the result was multiplied by 100,000.

To predict the evolution of the suicidal phenomenon based on the data available was used the Forecast Sheet tool from Microsoft Excel 2016, that applies FORECAST.ETS function, based on the AAA version of the Exponential Smoothing (ETS) algorithm.

## RESULTS

The annual numbers of suicides at the level of MIA and each of its large component structure are presented in Figure 1.

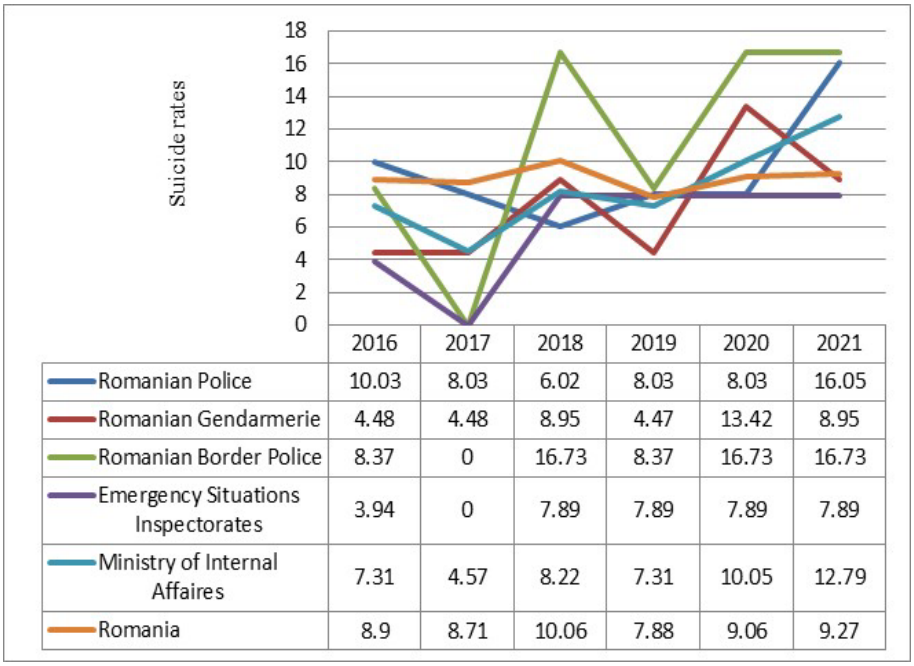



| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|
| Romanian Police | 5 | 4 | 3 | 4 | 4 | 8 |
| Romanian Gendarmerie | 1 | 1 | 2 | 1 | 3 | 2 |
| Romanian Border Police | 1 | 0 | 2 | 1 | 2 | 2 |
| Emergency Situations Inspectorates | 1 | 0 | 2 | 2 | 2 | 2 |
| Ministry of Internal Affaires | 8 | 5 | 9 | 8 | 11 | 14 |

**Figure 1.** The evolution of the number of suicides at the level of MIA and each of its large component structure in the period 2016-2021

During the entire analyzed period, most suicides occurred among the Romanian Police personnel (50.9%). In the other 3 structures, the annual numbers of suicides were lower, relatively similar. The annual modal numbers of suicides during the analyzed period were: 4 in the Romanian Police, 1 in the Romanian Gendarmerie, 2 in the Romanian Border Police, 2 in the Emergency Situations Inspectorates, and 8 in the MIA. The most suicides among MIA personnel during the analyzed period were committed in 2021, and the fewest in 2017.

To facilitate the comparison of data between structures and the understanding of their meaning, Figure 2 shows the evolution of the annual suicide rates during the analyzed period at the level of the MIA, the large component structures, and of Romania.




| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|
| Romanian Police | 10.03 | 8.03 | 6.02 | 8.03 | 8.03 | 16.05 |
| Romanian Gendarmerie | 4.48 | 4.48 | 8.95 | 4.47 | 13.42 | 8.95 |
| Romanian Border Police | 8.37 | 0 | 16.73 | 8.37 | 16.73 | 16.73 |
| Emergency Situations Inspectorates | 3.94 | 0 | 7.89 | 7.89 | 7.89 | 7.89 |
| Ministry of Internal Affaires | 7.31 | 4.57 | 8.22 | 7.31 | 10.05 | 12.79 |
| Romania | 8.9 | 8.71 | 10.06 | 7.88 | 9.06 | 9.27 |

**Figure 2.** The evolution of suicide rates in 2016-2021 at the level of the MIA, its large component structures, and of Romania

Broadly speaking, annual suicide rates show a slightly upward, oscillating trend in the analyzed period. At the level of the Romanian Border Police, although the annual numbers of suicides are low, the suicide rates are the highest among the four large structures that are components of the MIA in the period 2018-2021. Compared to the other structures, the Romanian Police

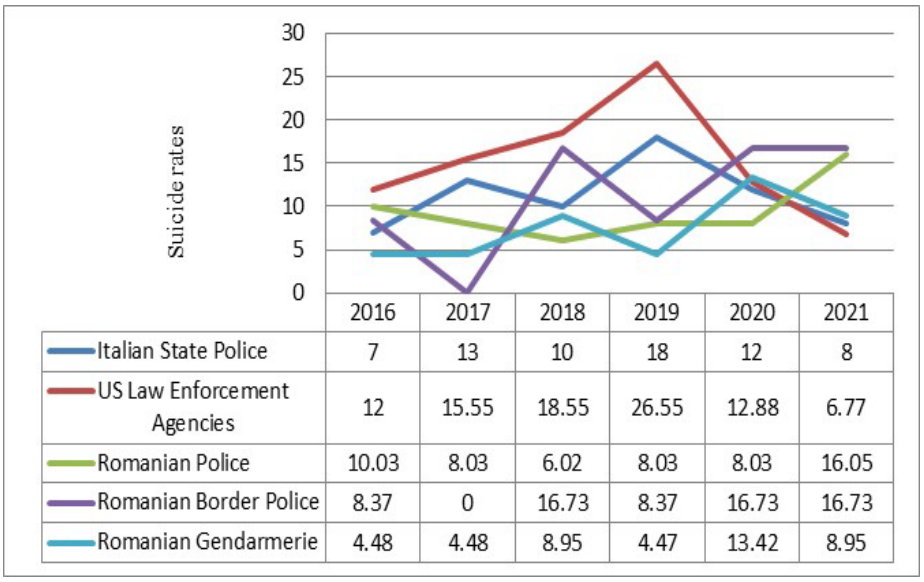
had the highest suicide rates in 2016 and 2017, and a high rate in 2021, the highest annual suicide rate among its personnel in the analyzed period, and the Romanian Gendarmerie has a higher suicide rate in 2020.

Compared to the annual suicide rates from Romania, those at the MIA level were in most years of the analyzed period lower, more precisely in the period 2016-2019, and in the period 2020-2021, in which the Covid-19 pandemic was declared by the World Health Organization, they show higher values. A more important increase in the suicide rate at the level of the MIA occurs in 2020 due to the strong increase in the suicide rates compared to the previous year at the level of the Romanian Gendarmerie and the Romanian Border Police, as well as in 2021 due to the doubling of the suicide rate compared to the previous year at the level of the Romanian Police and due to the maintaining a high suicide rate at the level of the Romanian Border Police.

The comparison of annual suicide rates from the pre-pandemic period of Covid-19, 2016-2019, and from the pandemic period, 2020-2021, reveals that:

- at the MIA level, suicide rates increased during the pandemic compared to those in the pre-pandemic period;
- at the Romania's level, in general, suicide rates increased during the pandemic period compared to those in the pre-pandemic period, except the 2018 year, when the suicide rate had the highest value from the analyzed period;
- at the level of the Romanian Police, the suicide rate from 2020 was similar to that of the previous year, and in 2021 the suicide rate increased significantly, having the highest value at the level of the respective structure during the analyzed period;
- at the level of the Romanian Border Police, suicide rates increased during the pandemic period compared to those in the pre-pandemic period, except the rate from 2018 that was equal to the suicide rates during the pandemic period;
- at the level of the Romanian Gendarmerie, suicide rates increased during the pandemic compared to those in the pre-pandemic period, except in 2021 when the suicide rate was equal to that of 2018, with 2020 being the highest suicide rate during the analyzed period at the level of the respective structure;
- at the level of the Inspectorates for Emergency Situations, suicide rates had the same value in the period 2018-2021.

To better understand the significance of the annual suicide rates at the level of Romanian law enforcement institutions during the analyzed period, these are presented in Figure 3 alongside the annual suicide rates at the level of some similar institutions from abroad.




| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|
| Italian State Police | 7 | 13 | 10 | 18 | 12 | 8 |
| US Law Enforcement Agencies | 12 | 15.55 | 18.55 | 26.55 | 12.88 | 6.77 |
| Romanian Police | 10.03 | 8.03 | 6.02 | 8.03 | 8.03 | 16.05 |
| Romanian Border Police | 8.37 | 0 | 16.73 | 8.37 | 16.73 | 16.73 |
| Romanian Gendarmerie | 4.48 | 4.48 | 8.95 | 4.47 | 13.42 | 8.95 |

**Figure 3.** The evolution of suicide rates in the period 2016-2021 at the level of law enforcement institutions from Romania and of similar institutions from USA and Italy

The annual suicide rates from US law enforcement agencies, police and prisons institutions, were higher than those from the Romanian law enforcement agencies up to 2019, inclusive. In the period 2020-2021, the annual suicide rates from US law enforcement agencies were:

- compared to that of the Romanian Police, higher in 2020 and lower in 2021;
- compared to that of the Romanian Border Police, lower in both years;
- compared to that of the Romanian Gendarmerie, lower in both years.

The suicide rates from the Italian State Police were higher than those of the Romanian Police between 2017 and 2020, while in 2016 and 2021 the respective rates were lower.

In 2021, compared to 2020, at the level of Romanian Police personnel, the suicide rate increased sharply, although all the suicide rates at the level of the other institutions presented in the previous figure decreased or remained constant.

At the level of the Romanian Border Police, the sharp increase in suicide rates occurred in 2018, later it decreased, and in 2020 there was a sharp increase again, which remained at the same level in 2021. In the last two aforementioned years, the annual suicide rates from the level of the Romanian Border Police were higher than similar rates from the Italian State Police and US law enforcement

agencies. In 2018, the suicide rate at the level of the Romanian Border Police was higher than the similar rate at the level of the Italian State Police, but lower than the suicide rate at the level of US law enforcement institutions. At the level of the Romanian Gendarmerie, there was a sharp increase of the suicide rate in 2020, which decreased in 2021, in both mentioned years, the suicide rates being higher than those in the mentioned international law enforcement institutions.

The vast majority of MIA personnel who committed suicide were:

- male, 94.55% throughout the entire analyzed period, in 4 years, 2016, 2017, 2019, and 2020, self-murderers being only male.

- from the body of police agents/non-commissioned officers/military foremen, 85.45% in the entire analyzed period, in 3 years, 2017, 2019, and 2020, self-murderers being exclusively included in this professional body.

- among those who carried out a field activity, 83.64% in the entire analyzed period, in 3 years, 2016, 2019, and 2020, the self-murderers carrying out only this type of activity.

- from the category of those aged between 31 and 40, 32.73%, and aged between 41 and 50, 36.36%. There were no suicides among those under the 20 years, between the 21 and 30 years in 2016 and 2018, and over 50 years in 2017, 2019, and 2020.

To commit suicide, the vast majority of self-murderers among MIA personnel used hanging (50.9%) or shooting (38.2%).

Based on the number of suicide cases among the MIA personnel from 2016 to 2021, the prediction of the annual number of suicide cases in the years 2022 to 2025 was made, and the results are presented in Table 1.

**Table 1.** The results of the prediction of the number of suicide cases from the MIA level in the period 2022-2025

| Year | Value | Predicted value | Lower bound of the 95% confidence interval | Upper bound of the 95% confidence interval |
|---|---|---|---|---|
| 2021 | 14 | 14 | 14.00 | 14.00 |
| 2022 | | 14.81 | 10.46 | 19.17 |
| 2023 | | 16.39 | 11.52 | 21.25 |
| 2024 | | 17.96 | 12.62 | 23.29 |
| 2025 | | 19.53 | 13.76 | 25.30 |

A continuous upward evolution of the predicted number of suicide cases at the MIA level is observed between 2022 and 2025. In the optimistic version, indicated by the values of the lower bound of the 95% confidence interval, after a clear decrease in 2022, a slightly upward evolution is possible of the annual number of suicides, but with values lower than the number of suicides from 2021.

The results of the prediction of the annual numbers of suicide cases in the years 2022-2025 at the level of Romanian Police personnel are presented in Table 2.

**Table 2.** The results of the prediction of the number of suicide cases at the level of the Romanian Police in the period 2022-2025

| Year | Value | Predicted value | Lower bound of the 95% confidence interval | Upper bound of the 95% confidence interval |
|---|---|---|---|---|
| 2021 | 8 | 8 | 8.00 | 8.00 |
| 2022 | | 8.28 | 4.96 | 11.60 |
| 2023 | | 8.90 | 4.42 | 13.37 |
| 2024 | | 9.51 | 4.13 | 14.89 |
| 2025 | | 10.13 | 3.96 | 16.29 |

The predicted evolution of the number of suicide cases between 2022 and 2025 at the level of the Romanian Police has a slightly continuous upward trend. In the optimistic version, the evolution of the number of suicides will be strongly downward in 2022 and then relatively stagnant.

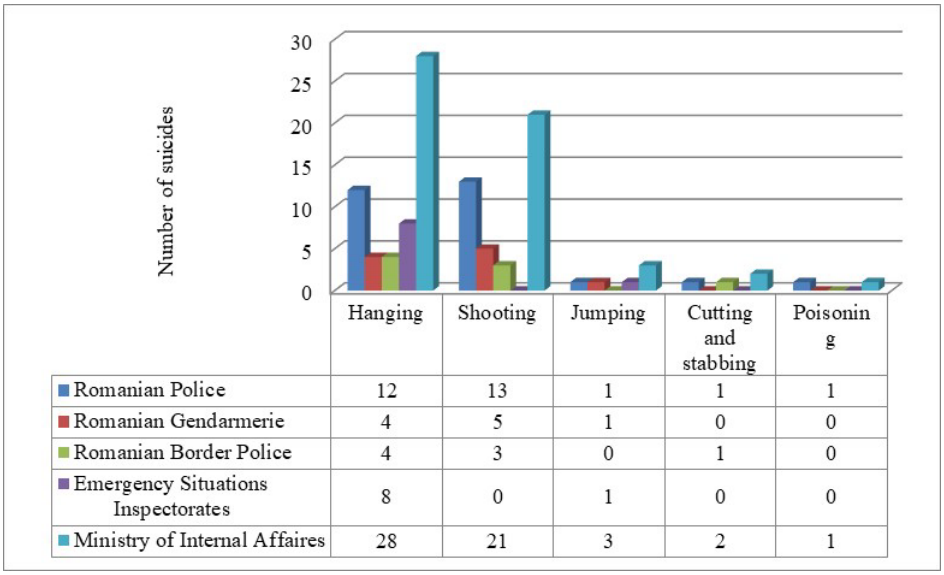
The situation of deaths among MIA personnel during the period 2016-2021 following suicide, work-related accidents and assaults is presented in Table 3.

**Table 3.** The situation of deaths among MIA personnel in the period 2016-2021 as a result of suicide, work-related accidents and assaults

| Year | Number of suicide cases | Total number of persons deceased in occupational accidents and assaults |
|---|---|---|
| 2016 | 8 | 4 |
| 2017 | 5 | 4 |
| 2018 | 9 | 1 |
| 2019 | 8 | 2 |
| 2020 | 11 | 1 |
| 2021 | 14 | 2 |

In every year of the analyzed period, at the level of the MIA personnel, there was a higher number of deaths by suicide than as a result of accidents during the execution of the service and of assaults.

The methods of suicide used by the MIA personnel during the period 2016-2021 are presented in Figure 4.




| | Hanging | Shooting | Jumping | Cutting and stabbing | Poisoning |
|---|---|---|---|---|---|
| Romanian Police | 12 | 13 | 1 | 1 | 1 |
| Romanian Gendarmerie | 4 | 5 | 1 | 0 | 0 |
| Romanian Border Police | 4 | 3 | 0 | 1 | 0 |
| Emergency Situations Inspectorates | 8 | 0 | 1 | 0 | 0 |
| Ministry of Internal Affaires | 28 | 21 | 3 | 2 | 1 |

**Figure 4.** Methods of suicide used by the MIA personnel and component structures personnel during the period 2016-2021

At the MIA level, the most used method of suicide was hanging, in 50.9% of cases, and the second most frequent, in descending order, was shooting, in 38.2% of cases.

The shooting was the most used method of suicide at the level of the Romanian Police, in 46.4% of the cases, and at the level of the Romanian Gendarmerie, in 50% of the cases, and was in second place in terms of frequency of use in the case of the Romanian Border Police, in 37.5% of cases. At the level of the Inspectorates for Emergency Situations, no person committed suicide by shooting.

The hanging was the most frequently used method at the level of the Inspectorates for Emergency Situations, in 88.9% of the cases, and at the level of the Romanian Border Police, in 50% of the cases.

## DISCUSSION

In most of the years of the analyzed period, the suicide rates among MIA personnel were lower than those from Romania, more precisely in the period 2016-2019, and in the period 2020-2021, when the Covid-19 pandemic was declared by the World Health Organization, they had higher values. The increase of the annual suicides rate among MIA personnel in the pandemic period compared with the pre-pandemic period was consonant with the same evolution in the annual suicide rates from Romania, although the annual suicide rates presented of the international law enforcement institutions personnel had continuously decreased during the Covid-19 pandemic compared to the pre-pandemic period. Compared to the year 2020, in the year 2021, at the level of Romanian Police personnel, the suicide rate increased sharply, although all the suicide rates presented from the level of the other law enforcement institutions, at the Romania and international level, decreased or remained at the same level.

The evolution of annual suicide rates is relatively unpredictable, from year to year might appear both more or less accentuated decreases, which are welcomed, as well as accelerated increases, such as a 100% increase in the annual number of suicide cases among Romanian Police personnel in 2021 or the increase of the US law enforcement suicide rate from 18.55 in 2018 to a rate of 26.55 in 2019.

The algorithm used to predict the annual suicide rates in the period 2022-2025 revealed that the annual number of suicide cases will follow an increasing trend at the level of the MIA and a slightly increasing trend at the level of the Romanian Police.

The suiciders from the MIA law enforcement institutions used the firearm, a method with high lethality, in 45.7% of the cases during the analyzed period while the data available reveal that at the level of the international law enforcement institutions, from USA, Italy, and France, the personnel who used this method for suicide was between about 65% - 90% of the total number of suiciders.

In the period 2016-2021, the annual number of suicides among MIA personnel was higher than the number of deaths caused by accidents during service and assaults, a situation similar to that reported in the USA by the Police Research Forum (2019), which indicates that suicide is a real occupational risk.

## CONCLUSIONS

The analysis of the annual suicide rates among MIA personnel in the period 2016-2021 revealed the fact that, compared to the annual suicide rates in the same period from Romania and from the level of some international law enforcement institutions, they had oscillating values, lower or higher. This situation is valid both at the level of the MIA and of the large structures within, except the annual suicide rates at the level of the Inspectorates for Emergency Situations, which are lower compared to the vast majority of suicide rates available.

The algorithm used to predict the annual suicide rates in the period 2022-2025 revealed that the number of suicide cases will follow a general trend of growth among MIA personnel.

In the period 2016-2021, the annual number of suicides among the MIA personnel was higher than the annual number of deaths caused by accidents during the service and assaults.

Taking into account issues such as those previously mentioned, as well as the effects of suicide that manifest at the level of the suicide's family, colleagues, and organization, it is necessary to manage carefully the suicide risk among MIA personnel, which must be based on detailed and updated data about suicide cases and attempts, as well as about the risk and protective factors for suicide among personnel, ideally obtained through psychological autopsies.

### *Limitations*

One of the limitations of this study is that the data and information on suicides at the MIA level during the analyzed period were not collected based on a specially developed methodology, which would involve both standard rules and the mandatory reporting of all events that fall within a definition of suicide.

Another limitation of the study is that it cannot present an in-depth picture of the suicidal phenomenon in MIA containing possible explanations for it because there were no detailed data on the suicide cases committed during the analyzed period, regarding both the suicide itself and the particular risk and protection factors at the person level, workplace, and social environment.

### *Practical Implications*

Following a careful opportunity and cost-benefit analysis, the actions like following can be implemented to manage suicidal risk at the level of MIA:

- Training of psychologists from the MIA level to prevent, intervene and post-vent in the issue of suicide;

- The training of psychologists from the MIA level as trainers to prevent and post-vent in the issue of suicide for the staff who provide peer support and for those with management positions;

- Development of a database related to suicides/suicide attempts from the level of MIA staff and its permanent updating;

- Development of a methodology for performing psychological autopsies in case of suicide/suicide attempt;

- Carrying out psychological autopsies in case of suicide/suicide attempt;

- Periodic analysis of data related to the suicidal phenomenon from the level of MIA staff/MIA structures;

- Elaboration and implementation of universal suicide prevention programs at the level of the entire staff;

- Elaboration and implementation of selective prevention programs at the level of groups exposed to the risk of suicide;

- Development and implementation of prevention programs indicated for people exposed to a high risk of suicide;

- Training non-specialist personnel in the field of psychology/mental health to recognize the warning signs of the immediate risk of suicide in a person and regarding the way of action in such situations;

- Elaboration of a guide on postvention activities following suicide among MIA staff;

- Conception and implementation of a peer support system;

- Designing and implementing a system of recuperative psychological intervention, including remotely, for staff with mental health problems;

- Reorganization of the psychology structure from the MIA level to avoid multiple professional relationships, more precisely to ensure that psychologists do not carry out psychological assessments completed with psychological results such as fit or unfit/psychological reports and psychological interventions at the level of the same person beneficiaries.

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# Sex (Is Not) On Fire: The Mediating Role of Cognitive Schemas Between Symptoms of Endometriosis and Sexual Distress

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**ABSTRACT**. The purpose of this research is to examine the cognitive schemas activated in sexual situations as mediating factors in the relationship between endometriosis symptoms and sexual distress. N=173 women diagnosed with endometriosis, who had a sexually active status during data collection, took part in the research. The survey consisted of a demographic data sheet, the ENDOPAIN-4D, the Questionnaire of Cognitive Schema Activation in Sexual Context and the Female Sexual Distress Scale - Desire/Arousal/Orgasm questionnaires. The results of the Structural Equation Modeling technique indicate that the mediation model does not show a good model fit with our data. We do not see this explanatory power regarding the relationship between pelvic pain and sexual distress sexual, or between bowel pain and sexual distress. Based on the complex indirect effect, maladaptive cognitive schemas mediate the relationship between pain during sexual intercourse and sexual distress, as well as the relationship between other symptoms of endometriosis and sexual distress.

**Keywords:** endometriosis symptoms, maladaptive cognitive schemas, sexual distress, structural equation modeling

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## INTRODUCTION

Endometriosis can be classified as a chronic illness, mostly affecting women of reproductive age (American Society for Reproductive Medicine, 2016). Based on the systematic review of literature by Smolarz et al. (2021), endometriosis affects 10-15% of women of reproductive age, as well as 35-50% of women experiencing pelvic pain and/or infertility. Based on summaries of literature on the topic, the leading symptoms of endometriosis are extremely strong menstrual pain (dysmenorrhea), painful sexual intercourse (dyspareunia), painful and difficult bowel movements (dyschezia), as well as cyclic painful urination (dysuria). Another leading symptom, irregular vaginal bleeding, is related to the disturbances of the menstrual cycle. Other, organ-specific symptoms may also affect women suffering from endometriosis: lower back pain, chronic fatigue, bloating, diarrhea (Van den Broeck et al., 2013).

World Health Organization (1986) extended the definition of health, which now describes as a state of complete physical, emotional and social wellbeing. The correlation between the different dimensions of health are proven, therefore it can be said that endometriosis, and chronic illnesses in general, do not only harm a person's physical health indicators, but also show correlations with negative changes in mental and social wellbeing.

### *The relationship between endometriosis symptoms, cognitive schemas and sexual distress*

Schemas are people's deep, recurring, script-like beliefs about themselves and their relationships with others, which they evaluate and experience as unquestionably true (Steavens & Roediger, 2017; Young et al., 2003). The activation of the schema modes determines the general attitude of the individual towards their environment. The maladaptive schemas activation shows a correlation with different physical health indicators. Several studies (Saariaho et al., 2010; Salari et al., 2022) also addressed the relationship systems related to chronic pain as follows: in the group of individuals who reported experiencing chronic pain, the activation of maladaptive schema domains (disconnection/rejection, impaired autonomy/performance, over-vigilance/inhibition, impaired limits, other-directedness) is more significant than in people who do not struggle with chronic pain. The inverse of this relationship pattern was also supported, and according to the research results, patients experiencing pain who also had different maladaptive schemas showed higher pain intensity, duration, and more significant degrees of functional impairment caused by pain. Saariaho et al. (2012) pointed out in their study that the most common maladaptive schemas observed in these patients

were self-sacrifice and unrelenting standards/hypercriticalness. The interaction of the two constructs is explained from several perspectives. Vakili et al. (2020) reflected on the aspect that in individuals suffering from chronic pain, maladaptive schemas are related to the pain experience through the mediating effect of depression. From this perspective, the correlation of all five dimensions of early maladaptive schemas with depression was demonstrated, and the moderating effect of mood disorder in connection with the development and severity of chronic pain was highlighted (Davoodi et al., 2018). Moreover, the approach according to which cognitive schemas can influence the individual's attention and perceptual functions, which can lead to the misinterpretation of bodily sensations and signals, is also relevant (Brown, 2004).

Furthermore, these belief systems can fundamentally influence a person's general attitude and experiences regarding sexuality. Regarding the intensity of experienced sexual distress, Rossi et al (2022) point out that women diagnosed with endometriosis report more significant distress than their peers without the syndrome. The results also reflect that women diagnosed with endometriosis show a greater activation of maladaptive schemas (e.g. helplessness schema) than women not affected by endometriosis, which can play a role as a potential predictor factor regarding the degree of experienced sexual distress. The significant positive correlation between the increased presence of maladaptive schemas and sexual problems is also covered by further research, according to which the following relationships can be assumed: in addition to the more frequent, intense and extensive occurrence of dysfunctional beliefs, problems associated with sexual behavior can be identified to a greater extent as well (Evli et al., 2021; Peixoto & Nobre, 2015).

Mechanical stimulation of tissue adhesions and scarring in the vagina or uterus can result in severe pain experience, and possibly bleeding during and after sexual intercourse. Women affected by endometriosis are significantly more likely to experience persistent and recurrent genital and pelvic pain, bowel problems and infertility issues, compared to members of the healthy female population (Fritzer et al., 2013; Rossi et al., 2022). Several studies have linked the presence of chronic pelvic pain and dyspareunia to different forms of sexual dysfunctions (e.g. decreased sexual desire, orgasm disorders, etc.) (Privitera et al., 2023; Shum et al., 2018).

Based on the pathophysiological model of dyspareunia, physical pain changes the attitude towards sexuality of the women involved, which in turn can further increase the subjective experience of pain or the manifestation of negative attitudes towards sexuality (Nimbi et al., 2019; Vannuccini et al., 2023).

It can therefore be seen that not only biological, but also cognitive and emotional components of pain experience can be identified. In recent years, we have seen a growing tendency of research themes targeting the role of cognitive and emotional factors in explaining the development of sexual distress. Preliminary results show that negative belief systems and maladaptive schemas can be identified as predictor factors regarding sexual distress in populations of women who report experiencing endometriosis symptoms (Rossi et al, 2022). Furthermore, the results show that maladaptive cognitive schemas have a more significant predictive power regarding the degree of sexual distress than endometriosis symptomatology (Zarbo et al., 2019).

Overall, it can be said that cognitive schemas play a prominent role in the development and maintenance of the pain experience through the misinterpretation or catastrophizing of bodily sensations and symptoms, which can be identified as predisposing factors in the manifestation of sexual distress.

## OBJECTIVES

Our goal is to examine what potential relationship patterns can be observed between the five main dimensions of the cognitive schemas that appear in connection with sexuality (undesirability/rejection, incompetence, self-deprecation, difference/loneliness, helplessness), endometriosis symptoms (pelvic pain, bowel pain, pain during sexual intercourse, other gynecological symptoms) and sexual distress. Furthermore, we aimed to use methodological procedures through which we can examine not only linear relationships, but also point out factors that appear as having explanatory roles in the relationship between two variables. In order to do this, we performed a mediation analysis.

## MATERIALS AND METHODS

### *Participants*

To join the research, the participants had to fulfill three conditions: a) only the data of people over 18 could be processed, b) women in question had undergone surgery and had an endometriosis diagnosis made by a specialist, c) only people who had a sexually active status at the time of data collection could be included.

Based on Kline's (2015) recommendations, the minimum sample size required to implement the Structural Equation Modeling technique is between 100 and 200 people. Based on this, it can be said that the number of participants included in our study proves to be adequate. During the process, we managed

to collect data from a total of 179 people, from which we excluded the data of 6 women due to those conflicting with one of the inclusion criteria presented above. Four people declared that they were not sexually active, and another two did not have an official diagnosis established by a specialist.

Based on the previous inclusion criteria, we worked with a total of N=173 female participants' data.

### *Ethics Statement*

It was used a questionnaire-based procedure to assess participants' demographic information, as well as to measure the symptoms of endometriosis, maladaptive cognitive schemas, and levels of sexual distress. The method and procedure were conducted in accordance with the professional requirements of the Romanian College of Psychologists (COPSI). The questionnaire package included written information of the study and a consent statement for the participants.

### *Instruments*

*Demographic Questionnaire*

In this questionnaire, the questions target the following dimensions: age, marital status, highest education, age at diagnosis (years), type of the treatment, sexual activity status.

*Questionnaire about gynecological and pelvic pain symptoms (ENDOPAIN-4D)*

The 21-item questionnaire developed by Puchar et al. (2021) is aimed at assessing the severity of endometriosis symptoms along 4 subscales, which are the following: spontaneous pelvic pain and dysmenorrhea, pain during the sexual intercourse/dyspareunia, intestinal pain symptoms, and other gynecological symptoms. For each group of questions, the first questions must be evaluated dichotomously, with yes/no answers. In the case of a "No" answer, the respondent automatically receives 0 points, with a "Yes" response however, the person then must record the degree of pain/discomfort on one or more additional Likert scales ranging from 0 (No pain/discomfort) to 10 (The worst pain/discomfort imaginable). From higher obtained scores, a more severe manifestation of endometriosis symptoms can be concluded.

*Questionnaire of Cognitive Schema Activation in Sexual Context - Female Version*

The 28-item questionnaire was developed by Nobre & Pinto-Gouveia (2009) with the aim of assessing the cognitive schemas that appear when encountering sexual situations. In the first section of the questionnaire, there

are four short stories that refer to situations related to different sexual dysfunctions. In the second part, the respondents have to evaluate different statements depending on the extent to which these statements describe their feelings and thoughts towards themselves, if they imagine themselves in a situation similar to the one presented at the beginning. The evaluation is done using a Likert scale ranging from 1 (Completely false) to 5 (Completely true). The scale examines the activation of five schema types, which are: undesirability/ rejection, incompetence, self-deprecation, difference/loneliness, helplessness. The evaluation is done by summing the scores from each subscale, where higher scores indicate increased activation of the respective schema domain.

*Female Sexual Distress Scale - Desire/Arousal/Orgasm*

The 15-item scale was created by Derogatis et al. (2021) to assess the sexuality-related distress levels in the female population. The evaluations must be made based on the person's experiences in the last 4 weeks, along a Likert scale ranging from 0 (Never) to 4 (Always). The questionnaire does not contain subscales, it only allows the calculation of a total score by summing up the point values of each answer. The obtained result can take a value between 0 and 60, where higher total scores indicate a greater level of sexual distress.

### *Data Processing and Statistical Analysis*

The process is carried out with a one-time data collection, so our study is based on a cross-sectional, correlational arrangement.

As an initial step, we examine some preliminary analysis with the help of the IBM SPSS 20 statistical program package. Firstly, the data processing began with the analysis of descriptive statistical data, the normality test, and the reliability test. For each continuous variable, we described the mean (M) and standard deviation (SD) values, while for categorical variables, we presented the percentage distribution.

Then, the direction and strength of the associations was examined between the constructs (cognitive schemas, endometriosis symptoms, sexual distress) by means of a correlation calculation. During the data processing, a p-value less than .05 is considers statistically significant. Based on the standards developed by Bryne (2010) and Hair et al. (2010), it can be said that since the Skewness and Kurtosis indicator results of our scales and subscales are within the -2 and +2 interval, the conditions of normal distribution are not violated. In our data the values fall between -0.91 and 0.27. In accordance with this, the use of parametric tests becomes necessary during statistical processing. Next, the reliability indicators of the scales were verified. Cronbach α values for the three scales and their different dimensions vary between .73 and .94.

According to the standards defined by Pallant (2011), an instrument and its subscales can be considered reliable if the Cronbach's α value is always higher than the threshold value of .70, hence the instruments used in the study can be considered reliable.

Then in order to check the suitability of our hypothetical model the Structural Equation Modeling technique was used with the additional SPSS AMOS software. In the first step, a path diagram-construction was carried out based on the previously synthesized, preliminary research results, which depict the hypothetical relationship between the variables. This is followed by a model specification process, during which the number and nature of the parameters are estimated, and then model identification takes place. In the parameter estimation phase, the actual and the derived covariance matrices are compared. During data processing, in the case of all exogenous variables (pelvic pain, bowel pain, pain during sexual intercourse, other symptoms), it was necessary to examine the complex, indirect effect with regard to the output variable, through the interweaving of the five schema types. This was carried out using the user-defined estimands procedure, which summarizes the indirect effect of each individual mediator variable on the relationship between the two variables (Kline, 2015). The bootstrapping method (10.000 resamples, 95% confidence interval (CI)) was used to assess the significance of the complex indirect effect (Hair et al., 2010). A p-value less than .05 is considers statistically significant. Next, we want to examine the level of compatibility between our data and the hypothetical model we created, determining the extent to which the model can represent our data. This is called the assessment of model fit (Kline, 2015).

## RESULTS

### *Preliminary analysis*

We worked with the data of 173 sexually active women diagnosed with endometriosis. All respondents are from Hungary. Youngest person who took part in the survey was 18 years old, while the oldest was 48, the average age of the population being 32.55 years (SD = 5.84). The earliest diagnosis comes from the age of 15, the latest from the age of 46, and on average it was around the age of 28.28 years (SD = 5.62). The summary of demographic data is presented in Table 1.

**Table 1.** *Demographic data of participants (N = 173)*

| | |
|---|---|
| Participants (N = 173) | |
| Gender_female (n, %) | 173 (100%) |
| Age, years | 32.55 (5.84) |
| Marital status (n,%) | |
| Single | 14 (8.1%) |
| In relationship | 82 (47.4%) |
| Married | 77 (44.5%) |
| Highest education level (n, %) | |
| Baccalaureate | 27 (15.6%) |
| Vocational training | 32 (18.5%) |
| College | 32 (18.5%) |
| Bachelor's degree (BA) | 44 (25.4%) |
| Master's degree (MA) | 36 (20.8%) |
| Doctorate (PhD) | 2 (1.2%) |
| Endometriosis severity stage (n, %) | |
| I | 25 (14.5%) |
| II | 58 (33.5%) |
| III | 49 (28.3%) |
| IV | 41 (23.7%) |
| Type of treatment received (n, %) | |
| Surgery | 69 (39.9%) |
| Surgical procedure and medication | 104 (60.1%) |
| Ongoing hormone treatment (n, %) | |
| Yes | 96 (55.6%) |
| No | 77 (44.4%) |
| Fertility problems (n, %) | |
| Yes | 70 (40.5%) |
| No | 45 (26%) |
| Not applicable | 58 (33.5%) |
| Children (n, %) | |
| Yes | 58 (33.5%) |
| No | 115 (66.6%) |
| Pelvic Pain | 63.34 (26.22) |
| Pain During Sexual Intercourse | 22.84 (11.53) |
| Bowel Pain | 30.85 (15.56) |
| Other Symptoms of Endometriosis | 39.91 (20.07) |
| Undesirability/Rejection | 26.16 (7.63) |
| Incompetence | 27.71 (7.15) |
| Self-Deprecation | 9.16 (3.09) |
| Difference/Loneliness | 10.17 (3.04) |
| Helplessness | 11.97 (3.55) |
| Sexual Distress | 47.06 (11.90) |

*Note. The indicated values represent the mean (M) and the standard deviation (SD) values unless otherwise specified.*

In order to examine the relationship system, the parametric Pearson's correlation test was used, during which we performed a correlation analysis between the different symptom groups of endometriosis, the maladaptive schema activation and its dimensions, and the sexual distress variables. The results of this are presented in Table 2.

**Table 2.** *Correlation coefficients between endometriosis symptoms, cognitive schemas and sexual distress*

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Pelvic Pain | - | | | | | | | | | |
| 2. Pain During Sexual Intercourse | .70** | - | | | | | | | | |
| 3. Bowel Pain | .47** | .37** | - | | | | | | | |
| 4. Other Symptoms | .67** | .54** | .48** | - | | | | | | |
| 5. Undesirability/ Rejection | .60** | .66** | .44** | .57** | - | | | | | |
| 6. Incompetence | .59** | .68** | .38** | .53** | .80** | - | | | | |
| 7. Self-Deprecation | .54** | .57** | .35** | .56** | .88** | .71** | - | | | |
| 8. Difference/ Loneliness | .65** | .63** | .45** | .53** | .81** | .77** | .75** | - | | |
| 9. Helplessness | .61** | .58** | .31** | .45** | .66** | .67** | .58** | .62** | - | |
| 10. Sexual Distress | .57** | .68** | .31** | .48** | .76** | .79** | .71** | .75** | .69** | - |

*Note. **p < 0.01*

The presented results show that there is a positive, significant correlation between our variables. This means that in addition to more severe endometriosis symptoms (e.g. intense lower abdominal pain, pain during sexual intercourse, abdominal bloating, diarrhea, constipation, bladder pain, infertility, etc.), the manifestations of dysfunctional beliefs can be identified in a high proportion. Participants report feelings of helplessness, inferiority, feelings of incompetence, insecurity, or related beliefs and fears of being left by their partners more often. In addition, more negative attitudes and opinions about sexuality are also more significant in these cases. Frustration, worry, feelings of inadequacy or negative emotions such as anger appear with greater intensity.

***The mediating role of cognitive schemas between symptoms of endometriosis and sexual distress***

In this phase of the data processing we want to examine the explanatory role of maladaptive cognitive schemas in the relationship between symptoms of endometriosis and sexual distress. In order to do this, we performed a mediation analysis. The mentioned model is illustrated in Figure 1.

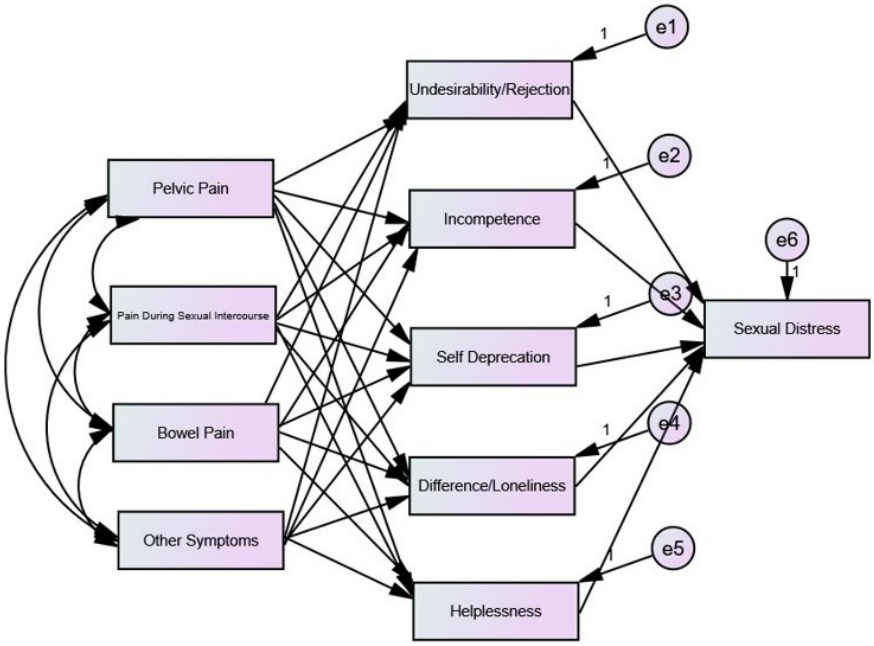


**Figure 1.** *Maladaptive cognitive schemas as mediator variables in the relationship between endometriosis symptoms and sexual distress*

The direct path does not show a significant prediction between *pelvic pain* and undesirability/rejection schema type (β=-.021, p=.421). The pattern is similar in the schema domains of incompetence (β=.002, p=.939), self-deprecation (β=-.001, p=.915), and difference/loneliness (β=.016, p=.137) as well. The result of the direct path analysis between pelvic pain and the helplessness schema indicates a significant, positive prediction (β=.032, p=.014). The direct prediction between the undesirability/rejection schema and sexual distress was not statistically significant (β=.076, p=.330). In addition, incompetence (β=.607,

p<.001), self-deprecation (β=.476, p=.007), difference/loneliness (β=.801, p <.001), and helplessness (β=.724, p<.001) schema domains can be identified as significant, positive predictors of sexual distress. In the case of the complex indirect effect (Effect = .031, 95% CI = -.051, +.117, p=.395), the confidence interval includes the value 0, which means that the cognitive schemas cannot be interpreted as mediator variables in the relationship between pelvic pain and sexual distress.

*Pain during sexual intercourse* can be identified as a significant, positive predictor variable in the case of undesirability/rejection (β=.281, p<.001), incompetence (β=.286, p<.001), self-deprecation (β=.081, p=.004), difference/ loneliness (β=.082, p<.001) and helplessness (β=.087, p=.001) schemas. In this system of relationships, we can see helplessness (β=.724, p<.001), difference/ loneliness (β=.801, p=.008), and incompetence (β=.607, p<.001) schemas as having a significant, positive predictive effect on sexual distress. In the case of undesirability/rejection (β=.076, p=.711) and self-deprecation (β=.476, p=.203), the direct path analysis did not give a significant value. In the case of the complex indirect effect (Effect = .361, 95% CI = .221, .491, p=.001), the confidence interval does not include the value 0, which means that the cognitive schemas mediate the relationship between pain during sexual intercourse and sexual distress together.

During the direct path analysis, *bowel pain* did not have a significant predictive effect on any of the following schemas: undesirability/rejection (β=.047, p=.151), incompetence (β=.013, p=.668), self-deprecation (β=.004, p=.798), difference/loneliness (β=.024, p=.070), helplessness (β=.001, p=.957). In this relationship system, the positive, statistically significant predictors of sexual distress are the incompetence (β=.607, p<.001), self-deprecation (β=.476, p=.007), difference/loneliness (β=.801, p<.001) and helplessness (β=.724, p<.001) schemas, but this is not true for the undesirability/rejection (β=.076, p=.303) schema type. The complex indirect effect (Effect = .033, 95% CI = -.049, +.119, p=.514) is not statistically significant. The confidence interval contains the value 0, from which we can conclude that the cognitive schemas have no explanatory power in the relationship between the bowel pain symptom and sexual distress.

In the case of *other symptoms of endometriosis* (e.g. infertility), the direct path analysis gives the following results: the symptoms are significant, positive predictors of the undesirability/rejection (β=.103, p<.001), incompetence (β=.068, p=. 020), and self-deprecation (β=.052, p<.001) schemas, but this is not true for the difference/loneliness (β=.020, p=.105) and helplessness (β=.015, p= .332) schemas. Apart from the undesirability/rejection schema domain (β=.076, p=.303), all of the others: incompetence (β=.607, p<.001), self-deprecation (β=.476, p=.007), difference/loneliness (β=.801, p<.001) and helplessness (β=.724, p<.001) are significant predictors. In the case of the complex indirect

effect (Effect = .101, 95% CI = .029, .161, p=.020), the confidence interval does not include the value 0, which means that the relationship between sexual distress and other symptoms of endometriosis (e.g. fertility problems) are jointly mediated by the cognitive schemas.

Looking at the results, the model gave a significant solution (CMIN=513.997, p=.000, CMIN/df=36.714). Afterwards, the comparative fit index (CFI) was checked. Based on the standards defined by Byrne (2010), it can be said that results above 0.90 indicate adequate model fit. In our case, CFI=.648, which shows that the model does not adequately represent our data. In the case of the Root Mean Square Error of Approximation (RMSEA) indicator literature standards (Byrne, 2010) indicate that values smaller than 0.08 are considered acceptable. In our case, RMSEA=.456, which is not part of the designated, ideal interval, and for this reason it identifies a significant discrepancy between the model we created and the data. According to the results, the fit indices cannot be considered acceptable, because none of the obtained results meet the threshold values established by Kline (2005) and Bryne (2010). Our model, which identifies cognitive schemas appearing in sexual situations as mediating factors in the relationship between endometriosis symptoms and sexual distress, does not represent our data well.

## DISCUSSION AND CONCLUSION

The analysis points out that in cases where the symptoms of endometriosis are increased, a higher degree of maladaptive schema activation may be characteristic. This means that in addition to symptoms of endometriosis such as severe pelvic pain, limb pain, diarrhea, constipation, painful sexual intercourse, or infertility, those affected may have more significant dysfunctional beliefs about themselves. Thought contents and beliefs that refer to their own inferiority, feelings of being different or unlovable in sexual situations are more common and more solidified. These results are consistent with those formulated by Saariho et al. (2010) and Salari et al. (2022). Based on the nature of the relationship system, the reverse of the pattern can also be described in the same way, meaning that with a higher degree of maladaptive schema activation, the perceived pain symptoms prove to be more significant. Brown (2004) has already made findings in this regard, so it can be said that his approach, according to which maladaptive cognitive schemas can correlate with the attention and perceptual functions of an individual, in addition to the increased nature of body sensations and pain perception is also supported by our results. The earlier results of Rossi et al. (2022) indicate that, in addition to endometriosis symptoms, the experience of sexual

distress is more significant. In line with this, our analysis also shows that, in addition to the presence of a more intense pain experience in several areas and possible infertility problems, negative emotions arising due to sexuality-related concerns, fears, frustration, shame, readiness and desire problems are dominant. Previous research results of Evil et al. (2021) and Peixto & Nobre (2015) formed the basis of our theoretical framework, which pointed to a positive correlation between maladaptive schema activation and the different problem types related to sexuality. Our results, which show that apart from a more frequent, intense and extensive occurrence of dysfunctional convictions and beliefs, sexual distress can also be identified to a greater extent, support this proposition.

We based our assumption on the results of Zarbo et al. (2019), which pointed to the significant role of cognitive factors in this issue. According to our results, we failed to prove the full adequacy of our mediation model. Certain parts of the proposition have been confirmed, as it can be seen that together, maladaptive cognitive schemas mediate the relationship between pain during sexual intercourse and sexual distress, as well as the relationship between sexual distress and certain symptoms of endometriosis, such as infertility. This result can justify the importance of cognitive modification of the dysfunctional beliefs to support sexual health in the population of women with endometriosis symptoms. However, we do not see this explanatory power regarding the relationship between pelvic pain and sexual distress, or between bowel pain and sexual distress. Thereby, we can conclude that in the case of endometriosis symptoms which are not related to sexuality or conception difficulties, the correlation with sexual distress is not explained by the maladaptive schema activation that appears, and presumably these can be explained through other background mechanisms. Which can be explain by the following: bowel pain and pelvic pain are less related to sexuality or conception difficulties. They do not necessarily affect the quality of sex life or the family planning. So likely, they cause more significant functional impairment in other areas of life. Regarding pain during sexual intercourse and fertility problems however, women's thoughts about inferiority, rejection and otherness explain the connections with sexual distress.

### *Limitations*

First of all, it can be said that participants included in the study were women who had already undergone endometriosis surgery. Since the main goal of the surgery is to reduce symptoms, it is likely that the pain symptoms are already present at a more moderate level in the members of our population, compared to those who also show symptoms, but have not yet undergone surgical intervention. In several cases, the preliminary studies worked only

with symptomatic groups without surgical intervention, so it is possible that those results, which were the starting point of our proposals, were related to a more severe symptom manifestation. More moderate symptoms have a less intense impact on everyday activities, the quality of sexual intercourse, and relationships, so this can be considered a potential explanatory factor in terms of our results.

In previous research, in addition to the explanatory nature of cognitive schemas, the results also showed the prominent influence of emotional disorders, especially depression, regarding the relationship between endometriosis symptoms and sexual distress (Davoli et al., 2018; Vakili et al., 2020). We worked without including these constructs in our research, therefore, it may be worthwhile to include the measurement of symptoms of emotional disorders in further studies. Finally, since the sample size shown in the research only works with the minimum number of cases, it is recommended to think about a more extended data collection, involving more participants, in order for our results to show a more accurate picture.

During the study, a correlational design was used. Consequently, the results do not reveal causal relationships. In the following, it is suggested to examine the relational system of constructs alongside an experimental arrangement.

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# The Highs and Lows of Pornography Use: Does Motivation Affect Users' Life Satisfaction?

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**ABSTRACT.** The negative outcomes of problematic pornography use (PPU) have been well documented, but there is a gap in the literature on the underlying mechanisms that influence the life satisfaction and mental health of pornography users. In the current study we have used a cross-sectional, person-centered approach in order to reveal the motivational and life satisfaction profile of problematic and non-problematic pornography users based on the theoretical framework of Self-determination Theory (SDT). We also wished to determine the role of self-determination in the life satisfaction of pornography users, as this variable is considered to be relevant for the life satisfaction and mental health of online pornography consumers. Our participants (N = 4302) were Hungarian speaking adults from Romania and Hungary (age M=27,91; SD=9,50), selected through sampling on social networking sites related to pornography, sexual dysfunction and addiction. Individuals were assigned to one of 3 groups (i.e., no symptoms, few symptoms, problematic use), based on the presence of symptoms related to pornography use. Demographic data was gathered, self-determination, life satisfaction and pornography use were assessed using the online version of validated instruments. Results indicated that SDT-based motivation and life satisfaction have a significant role in shaping the profile of pornography users. Participants with PPU felt less satisfied with their life, were less self-aware and experienced lower levels of perceived choice than both no symptom and few symptom groups. Although self-determination significantly predicted life satisfaction, this effect was not influenced by the problematic character of pornography use.

**Keywords:** self-determined motives; life satisfaction; online sexual activities; problematic pornography use.

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## INTRODUCTION

The negative outcomes of problematic pornography use have been well documented (Willoughby et al., 2021; Tóth-Király et. al., 2019; Vaillancourt-Morel et al., 2017; Wéry & Billieux, 2017), but there is a gap in the literature on the underlying mechanisms and characteristics (Binnie & Reavey, 2020) that influence these outcomes and might have a determining role in the life satisfaction and mental health of pornography users (Young, 2017). Some current results evinced that pornography use (PU) motivations may differentiate between the adaptive and maladaptive outcomes of pornography use (Bőthe et al., 2022) and might be important correlates of users' life satisfaction.

*Life satisfaction* was conceptualized as a cognitive evaluation process of a person's life, based on certain personal criteria (Shin & Johnson, 1978; Diener et al., 1985). Diener et al. (2002) emphasized that it is an important motivational component of daily living activities and can be considered as one of the most common indicators of one's general well-being. Recent studies concluded that basic psychological needs, motivation aspects (Tang et al., 2020), well-being (Huang, 2022; Ruggeri et al., 2020) and self-esteem (Huang, 2022) are some of the main correlates of life satisfaction. Research oriented on the main influencing factors of life satisfaction revealed that the variable is consistently influenced by sexual satisfaction (Schmiedeberg et al., 2017). In recent years, the literature of the field suggested that some aspects of pornography use also have a significant impact on sexual satisfaction (Wright et al., 2019) and consequently, problematic aspects of pornography use might affect the level of one's life satisfaction (Kraus et al., 2018; Harper & Hodgins, 2016; Willoughby et al., 2018).

*Pornography use* is a common recreational activity and due to the availability of internet access, it has become one of the most frequent online sexual activities (OSA). Online sexual activities encompass behaviors that appear in a digital environment and involve sexual content, sexual topics and sexual stimuli (Shaughnessy et al., 2017). According to Cooper et al.'s (2000) classification, we can differentiate between non-compulsive and compulsive online activities. Compulsive activities have been characterized by lack of control, they are less prevalent, but they tend to present a higher risk for addictive behavior (Wéry & Billieux, 2017). Based on the OSA forms determined by Shaughnessy et al. (2017), pornography use (PU) was considered a solitary arousal activity, which can have different positive or negative effects on a person's life and can also escalate to problematic use. While some studies suggested that only a small percent (4% of male and 1% of female users) may be at risk for problematic pornography use (PPU) (Rissel et al., 2017), other results indicated that these levels are higher

and reach almost 13% (Grubbs et al., 2019; Wéry & Billieux, 2017). Interestingly, only about half of self-labeled problematic users acknowledged that pornography use has a negative effect on their life.

Previous research revealed some positive aspects of pornography use, such as sexual knowledge, sexual consciousness or improving sexual life (e.g., Koletic et al., 2021; Bőthe et al., 2020; Barrada et al., 2019; Vaillancourt-Morel et al., 2017). Recent data indicated that PU in general is more related to positive aspects of life satisfaction, as the level of positive emotional associations related to pornography use has a small, but stabile effect on a person's life satisfaction (Olmstead et al., 2023).

Studies focused on the effect of PU on sexual well-being and satisfaction suggested that although it can have positive effects on one's attitude, sexual well-being and sexual satisfaction, when it becomes problematic, it is often associated with negative outcomes on the aforementioned variables (Hoagland & Grubbs, 2021; Binnie & Reavey, 2020). Participants high on PPU reported low levels of social well-being (Maitland & Neilson, 2023), and, regardless of consumption frequency, poorer sexual satisfaction (Goh et al, 2023). There was also evidence that PPU is negatively related to sexual and life satisfaction (Kraus et al., 2018; Harper & Hodgins, 2016). Regular users of porn sites presented lower life satisfaction and high rates of dysfunctional online sexual activity (OSA) as compared to abstainers with low engagement in pornography (Willoughby et al., 2018). Recent study results in a male adolescent sample also indicated a stabile negative correlation between the level of PPU and life satisfaction (Štulhofer et al., 2020). However, these results were obtained with only a small percentage of participants presenting high levels of problematic use. The current state of the literature led us to the conclusion that the effect of pornography use in general is limited regarding life satisfaction. However, there seem to be significant differences in life satisfaction and correlated variables, based on the level of PU of individuals (i.e., non-users, pornography users, self-reported problematic pornography users) (Czajeczny et al., 2023; Maitland & Neilson, 2023; Willoughby et al., 2018; Kraus et al., 2018).

In their *Self-determination theory (SDT)* Deci and Ryan (2000) stated that people have an inherent growth tendency, and they engage in behaviors conducive to physical and mental well-being when their basic psychological needs are socially accepted (Deci & Ryan, 2002). If their needs for *autonomy, competence and relatedness* are supported, people experience *better quality motivation, and are more likely to maintain desirable behaviors*.

In the framework of SDT, sexual behavior was considered to be guided by different forms of motivation (Tóth-Király et al., 2019). Based on their perceived level of self-determination and autonomy, individuals might experience different

degrees of intrinsic (i.e., autonomous, one engages in sex for its own sake) or extrinsic (i.e., sex is performed for instrumental reasons) (Deci & Ryan, 2000) sexual motivations. Differences in the process of internalization during sex-related activities were found to shape specific profiles with characteristic behavioral and psychological outcomes (Tóth-Király et. al., 2019). Individuals who considered that sex was a part of their identity engaged in a free and *autonomous* way in sexual activities and presented a higher potential for adaptive outcomes. When sex-related values, norms and behaviors were not completely self-endorsed and were experienced as the result of inter- or intrapersonal contingencies, a more *controlled* profile emerged which might result in maladaptive outcomes (Tóth-Király et. al., 2019). Although there is a lack of studies examining the relationship between PU and SDT-based sexual motivations, self-determination has been previously linked to problematic or risky behaviors in different domains: risky sexual behaviors, e.g. number of casual sex partners, unprotected sexual intercourse (Ingledew & Ferguson, 2007); online gaming (Király, Tóth, Urbán, Demetrovics & Maraz, 2017); drinking behavior (Richards, Pearson & Field, 2020).

Literature oriented at SDT and specific forms of sexual behavior posited that people with more autonomous and positive sexual motives tended to be more satisfied with their sexual functioning (Gravel et al., 2016), relationship (Wood et al., 2018; Brunell & Webster, 2013), well-being and life in general (Brunell & Webster, 2013; Tóth-Király et al., 2019). Overall, *autonomous motivation* was considered to have a protective role in problematic and risky sexual behavior (Ingledew & Ferguson, 2007). Regarding the correlates of negative motivations, less autonomous and more extrinsic motivations (i.e., emotional avoidance, stress reduction) were associated with higher levels of PPU (Bőthe, Tóth-Király, Bella et al., 2021).

Previous studies have emphasized that more autonomous or self-determined motivations were connected to specific aspects of general psychological well-being, suggesting that performing sex for autonomous reasons also relates to higher life satisfaction (Brunell & Webster, 2013; Gravel et al., 2019). The presence of multiple self-determined motivations was found to induce high levels in positive sex-related correlates (e.g. life satisfaction, sexual satisfaction and positive emotions during sex) and low levels of PPU. Non-self-determined motivations were in turn associated with non-desirable correlations (e.g. low life satisfaction, low sexual satisfaction and negative emotions during sex) (Tóth-Király et. al., 2019) and higher incidence of PPU (Bőthe, Tóth-Király, Bella et al., 2021). However, the authors found that individuals with moderately self-determined profiles presented the lowest level of PPU (Tóth-Király et. al., 2019).

These results suggest that PU motivations may differentiate between the adaptive and maladaptive outcomes of pornography use (Bőthe et al., 2022) and are important correlates of users' life satisfaction.

## OBJECTIVES

In this study we wished to explore in a person-centered cross-sectional study the motivational characteristics of pornography users based on the theoretical framework of SDT. Contrary to previous variable-centered approaches we wished to apply a person-centered methodology in order to assess the multidimensional influence of motivation and life satisfaction on pornography use.

As a specific goal, we aimed to identify the main SDT-based motivational and life satisfaction profiles of problematic and non-problematic pornography users. Second, we wanted to determine the role of different dimensions of motivation in the overall life satisfaction of pornography users, as this variable was considered to have a relevant role in the life satisfaction and mental health of online pornography consumers.

## MATERIALS AND METHODS

### *Participants*

Volunteers (N = 4302) were recruited through sampling on social platforms on social networking sites related to pornography, sexual dysfunction and addiction. Using the OSAS ordinal scores the sample was divided into three groups based on the presence of symptoms associated with pornography use: no symptoms (N=3373); few symptoms group (N=730); problematic pornography use (N=199). The sample consisted of Hungarian participants and Hungarians from Romania, Transylvania (age M=27,91; SD=9,50). All participants' mother tongue was Hungarian, and they were adults aged 18 and over. The sample was heterogeneous in terms of age, marital status and educational level. Descriptive statistics are shown in Table 1.

**Table 1.** *Baseline characteristics of the participants (N = 4302)*

| | **Pornography_use_groups** | | |
|---|---|---|---|
| | no symptoms n=3373 | few symptoms n=730 | problematic pornography use n=199 |
| **Age** | 28.70*±9.64* | 24.78±7.88 | 25.95±9.96 |
| **Biological sex** (n, %) | | | |
| male | 435(12.9%) | 208(28.5%) | 101(50.8%) |
| female | 2938(87.1%) | 522(71.5%) | 98(49.2%) |
| **Education** (*n, %*) | | | |
| primary school | 73(2.2%) | 33(4.5%) | 13(6.5%) |
| vocational secondary | 170(5.0%) | 27(3.7%) | 8(4.0%) |
| vocational high school | 719(21.3%) | 152(20.8%) | 35(17.6%) |
| high school | 901(26.7%) | 256(35.1%) | 67(33.7%) |
| college, university, master | 1476(43.8%) | 260(35.6%) | 73(36.7%) |
| doctoral degree | 34(1.0%) | 2(.3%) | 3(1.5%) |
| **Country** (*n, %*) | | | |
| Hu | 3160(93.7%) | 680(93.2%) | 176(88.4%) |
| Ro | 213(6.3%) | 50(6.8%) | 23(11.6%) |
| **Marital status** (*n, %*) | | | |
| single | 675(20.0%) | 192(26.3%) | 81(40.7%) |
| married | 598(17.7%) | 8011.0%) | 24(12.1%) |
| separated, divorced | 1637(48.5%) | 382(52.3%) | 86(43.2%) |
| relationship, life partner | 443(13.1%) | 75(10.3%) | 7(3.5%) |
| widowed | 20(.6%) | 1(.1%) | 1(.5%) |
| **Sexual orientation (n, %)** | | | |
| heterosexual | 3250(96.4%) | 673(92.2%) | 179(89.9%) |
| other | 123(3.6%) | 57(7.8%) | 20(10.1%) |

*Note. Values are mean and standard deviation (M± SD) for continuous variables and frequencies, percentages for categorical variables.*

### *Power and sample size*

Using G*Power we conducted an a priori power analysis in order to determine the minimum sample sizes required to reach our objectives. Results for the ANOVA analysis indicated that in order to achieve 95% power at a significance criterion of $\alpha = .05$ for detecting a medium effect ($f^2 = 0.25$), a sample of N = 252 was required. In order to reach a small effect size ($f^2 = 0.1$) the required sample size was N = 1548. Thus, the obtained sample size of N = 4302 was found to be adequate to test the hypothesis with medium effect size.

Results for linear regression with one predictor indicated the required sample size necessary to achieve 95% power for a medium effect size ($f^2 = 0.15$) was N = 89, while for a small effect size ($f^2 = 0.02$) the required sample size was N = 652. Thus, the sample sizes of no symptoms group (N=3373) and few symptoms group (N=730) were considered suitable for detecting small effect sizes, while for the PPU group (N=199) the sample was found to be optimal for detecting medium effect.

### *Ethics Statement*

Throughout our research, methods and procedures were implemented as requested by the Guideline of the Code of Deontology for the Profession of Psychologist, elaborated by the Romanian College of Psychologists (COPSI). The study is in line with research ethical standards, ethical approval was obtained from Babes-Bolyai University (reference number 11.804 / 26.08.2020).

### *Measurements*

#### *Demographics*

Participants included in the study provided data regarding their sex, age, education and marital status.

### *Instruments*

The following instruments were used to explore our research variables, respectively self-determined motives, satisfaction with life and the presence of symptoms associated with online pornography use:

*The Self-Determination Scale (SDS)* is an instrument developed by Sheldon and Deci (1996) which measures the degree to which people tend to behave and function in a self-determined way (Sheldon, Ryan & Rice, 1996). The tool is a 10-item scale measuring two variables, self-awareness and self-perceived choice, with two subscales. Self-Awareness subscale (items 2, 4, 6, 8,

10) reflects the extent to which individuals are aware of their feelings and their sense of self. Self-Perceived Choice subscale (items 1, 3, 5, 7, 9) evaluates the degree to which one perceives having choice in one's actions. Participants were asked to evaluate on a 5-point Likert scale the degree to which they agree with the presented statements. Each subscale is assessed by 5 items. The scores for each subscale are determined by calculating the mean value of scores obtained on the 5 items. Items of the SPC subscale are reversed. Subscales can be used independently, as well as combined by calculating an *overall self-determination index* (Sheldon & Deci, 1996). The scale in the current study shows good reliability (Cronbach's a = 0.74).

*Satisfaction with Life Scale (SWLS)* (Diener et al., 1985) is a short 5-item instrument designed to measure global cognitive judgments of satisfaction with one's life. The SWLS is a 7-point Likert style response scale. The possible range of scores is 5-35, with a score of 20 representing a neutral point on the scale. Scores between 5-9 indicate the respondent is extremely dissatisfied with life, whereas scores between 31-35 indicate the respondent is extremely satisfied.

The scale in the current study has a good reliability level (Cronbach's a = 0.86).

*The Online Sexual Activity Scale (OSAS*) (Kotta et al., 2022) is a 12-item true/false scale designed to measure problematic cybersex activity in the general population. In line with the network approach of problematic online sexual activity, the scale contains criteria for addiction and compulsivity, as well.

In the current study the one-factor OSAS showed adequate internal consistency (α = .73).

### *Data Processing and Statistical Analysis*

A list-wise deletion approach was used as the method for handling missing values: all cases with missing values for any variable were excluded from the analysis. The data distribution was checked according to the suggestions of George and Mallery (2011), and values between -2 and +2 for skewness and kurtosis were considered acceptable for a normal univariate distribution.

Descriptive statistics, namely percentages for categorical variables and means and standard deviations (M ± SD) for continuous variables, were reported. Cronbach's alpha values were calculated to check the internal consistency of the scales. One-way analysis of variance (ANOVA) (and the more robust Welch statistic for unequal distributions), Tukey's HSD and Games-Howell post hoc analyses were used. The alpha level was set at $p \leq 0.05$. The

effect sizes were assessed using eta-squared coefficients (0.01 small, 0.06 medium, and 0.14 large (Richardson, 2011).

In order to be able to examine different profiles of pornography use, 3 groups were stratified based on their results on OSAS. Pornography users who reported no symptoms were assigned to the 'no symptom' group. Participants with OSAS scores ranging from 1 to 2 were assigned to the 'few symptoms' group. Finally, pornography users who reported 3 or more symptoms were included in the 'problematic pornography use' group.

In the second part of our statistical analysis, simple linear regression was used to examine the predictive role of the autonomy index (self-determined motives) on life satisfaction. The predictive role was tested separately for each of the groups stratified along pornography use.

Calculations were performed with SPSS (statistical package for the social sciences) version 23.0.

## RESULTS

Results of the statistical analysis endorsed our two specific objectives, namely, that SDT-based motivation and life satisfaction have a significant role in shaping the profile of pornography users. Self-determination was also found to predict the level of life satisfaction in all three subgroups of pornography users. Results of the one-way ANOVA between the 3 subgroups are presented in Table 2.

When analyzing the life satisfaction variable, Tukey's HSD post hoc test was performed in order to identify significant differences between specific pairs. Tukey's HSD post hoc test showed that the no symptoms group had significantly higher levels of life satisfaction than both few symptoms ($p < 0.01$) and problematic pornography use ($p < 0.001$) groups. The few symptoms group presented significantly higher life satisfaction than our problematic pornography users group ($p < 0.05$).

In order to establish whether the pairwise comparisons are statistically significant for self-awareness, we used the Games-Howell post hoc test. The test revealed that participants with *no symptoms* presented significantly higher self-awareness compared to both *few symptoms* ($p < 0.001$) and *problematic pornography use* ($p < 0.001$) groups. The *few symptoms* group had also significantly higher levels of self-awareness than the *problematic pornography uses* group ($p < 0.05$).

**Table 2.** *Means, Standard Deviations, and One-Way Analyses of Variance between groups stratified by pornography use status*

| | *no symptoms* | | *few symptoms* | | *problematic pornography use* | | | |
|---|---|---|---|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* | *M* | *SD* | F/(df) | η2 |
| Satisfaction_ with_life | 22.11 | 6.58 | 21.27 | 6.53 | 19.85 | 6.93 | 14.640 (2,4299) *** | .007 |
| Awareness_of_ Self | 19.85 | 3.97 | 18.56 | 4.32 | 17.66 | 4.29 | 48.052Welch (2,471.82) *** | .024 |
| Perceived_Choice | 17.25 | 3.39 | 16.68 | 3.39 | 16.41 | 3.36 | 13.130 (2,4299) *** | .006 |
| Self_Determination (autonomy) index | 37.11 | 6.20 | 35.24 | 6.38 | 34.08 | 6.41 | 44.605 (2,4299) *** | .020 |

*Note. ***p ≤ .001*

To test our last two motivation-related variables, perceived choice and self-determination, we have performed Tukey's HSD post hoc test. Results for perceived choice presented significant differences between the group without no symptoms and the other two groups, as participants with *no symptoms* experienced an elevated level of perceived choice compared to *few symptoms* ($p < 0.001$) and *problematic pornography use* ($p < 0.01$) groups. This difference in perceived choice was, however, not tangible between individuals with *few symptoms* and *problematic pornography uses* ($p = 0.583$).

In the case of self-determination (autonomy) index, results showed that *no symptoms* group had significantly higher perceived autonomy than both *few symptoms* ($p < 0.001$) and *problematic pornography use* ($p < 0.001$) groups. Again, no significant contrast was detected between *users with few symptoms* and *problematic users* ($p = 0.052$).

To address our second specific objective, we have tested the predictive role of self-determined motives on the life satisfaction of pornography users. This link was examined in each of the three groups determined based on the degree of self-reported problematic symptoms.

In the group of individuals who reported *no symptoms*, the adjusted R2 showed that 23% ($\Delta$ R2 = 0.230, F (1,3371) = 1005.03, $p < 0.001$; $\beta = 0.479$, $p < 0.001$) of the variance in their life satisfaction could be explained by the self-determination index. Results obtained in the *few symptoms* group revealed an adjusted R2 that explained 22% of the variance ($\Delta$ R2 = 0.220, F (1,728) = 207.002, $p < 0.001$; $\beta = 0.471$, $p < 0.001$). In the case of *problematic pornography users*, the adjusted R2 was 24 % ($\Delta$ R2 = 0.239, F (1,197) = 63.264, $p < 0.001$; $\beta = 0.493$, $p < 0.001$). These outcomes reflect that the linear regression model testing the predictive role of self-determination on life satisfaction is significant for all three groups, showing the proportion of variation to be largely the same, whatever the amount of symptoms experienced.

## DISCUSSION AND CONCLUSION

Our research proposed a person-centered cross-sectional design to explore the motivational characteristics of pornography users based on the theoretical framework of SDT. We considered the person-centered methodology to be an optimal approach in order to assess the multidimensional role of self-determination in problematic and non-problematic pornography use.

Therefore, our first goal was to identify the *SDT-based motivational and life satisfaction profile of pornography users*. In order to achieve this, we created 3 profile groups based on the presence of problematic symptoms: problematic pornography users, users with few symptoms and non-problematic users (users with no symptoms). Our results suggest that compared to non-problematic pornography users, individuals with PPU experience *less self-awareness* and have a *lesser sense of choice.* These profile characteristics partially integrate in the pattern suggested by previous findings on SDT and PPU, specifically that less autonomous and more extrinsic motivations are associated with higher levels of PPU (Tóth-Király et al., 2019; Bőthe, Tóth-Király, Bella et al., 2021). However, the mechanisms of SDT in PPU are not fully clear, as problematic use was previously found to have the lowest rate in the group of moderately self-determined users. The profiles described by Tóth-Király et al. (2019) might suggest that there is an optimum level of self-determination and autonomous motives which functions as a protective component in PPU.

The profiles reveal a similar tendency in respect to *life satisfaction*: problematic pornography users were the least satisfied with their lives, followed by users with few symptoms and finally users with no symptoms. These outcomes are endorsed by the literature, aspects of problematic pornography use were found to show a negative correlation with life satisfaction (Kraus et al., 2018;

Harper & Hodgins, 2016; Štulhofer et al., 2020). Negative associations with life satisfaction were found to be more elevated in regular porn site users, when compared to abstainers with low engagement in pornography (Willoughby et al., 2018). Although a large amount of the studies focus on the negative aspects of PU and OSA (Štulhofer et al., 2020; Willoughby et al., 2018; Harper & Hodgins, 2016; Czajeczny et al., 2023; Maitland & Neilson, 2023), pornography use can also have positive effects on life satisfaction. Recently, PU in general was associated with positive aspects of life satisfaction, specifically positive emotions related to PU were found to have a small, but stabile positive effect on a person's life satisfaction (Olmstead et al., 2023). This recent research supports our findings, which confirmed that pornography users with few or no symptoms present a better satisfaction with life, compared to PPU.

Based on the current outcomes, we can posit that individuals who experience negative symptoms associated with pornography use are less self-determined and autonomous in their motivation and are less satisfied with their life. The motivational and life satisfaction aspects seem to be negatively affected by the amount of self-perceived symptoms, self-determined motivation and satisfaction with life decrease when the level of symptoms is higher.

Second, we analyzed the role of different dimensions of motivation in the overall life satisfaction of pornography users, as this variable is considered to have a relevant role in the well-being and mental health of online pornography consumers (Czajeczny et al., 2023; Maitland & Neilson, 2023). In order to achieve this, a linear regression analysis was conducted. The models testing the predictive role of self-determination on life satisfaction are significant for all 3 profile groups. However, being a PPU does not influence this effect, as autonomous and self-determined motives predict life satisfaction to a similar degree regardless of the frequency or quantity of symptoms. Previous research results suggest that the presence of multiple self-determined motivations induces high levels in positive sex related correlates, e.g., life satisfaction. Non-self-determined motivations are in turn associated with non-desirable correlations, e.g., low life satisfaction (Tóth-Király et. al., 2019). Specific autonomous sexual motives (Brunell & Webster, 2013; Gravel et al., 2019) are also associated with higher life satisfaction. The scientific literature examining the link between motivation and life satisfaction in addictive behavior (i.e., social network overuse), might also help explain the underlying mechanisms of the predictive effect identified in our research. Findings of Masur et al. (2014) on social network overuse evince that if the needs for competence, autonomy and relationship are unsatisfied, there is a tendency for online overuse in order to gratify corresponding needs. If usage is able to compensate the 3 needs, the level of life satisfaction might increase, but with a risk of developing addictive behavior.

These results emphasize the role of self-determined motivations in differentiating between adaptive and maladaptive outcomes of pornography use (Bőthe et al., 2022).

### *Limitations*

Because participants were sampled on a voluntary basis, there is a possibility for selection bias, which might have influenced individuals' responses.

One of the main shortfalls in our study is that we have limited the spectrum of variables when addressing the motivation and life satisfaction profile of problematic and non-problematic pornography users.

Future research should explore the role of specific demographic and psychological variables (e.g., age, education, marital/relationship status, difficulties in emotion regulation, loneliness, etc.) related to different PU motivation profiles. Some of them were previously associated with pornography consumption (i.e., age, emotion regulation, loneliness, Cardoso et al., 2022), and were able to differentiate between PPU and non-users. Examining the relationship between these variables using a multi-level analysis combined with person-centered methodology would allow us to create a more nuanced profile of PPU.

### *Conflict of interests*

The authors declare that the research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

Authors contributed equally to this work.

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# Teacher's Intention to Report Child Abuse and Neglect in Romania: A Mixed-method Study

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**ABSTRACT.** Child abuse and neglect (CAN) have long-lasting effects on a child's physical, social, and psychological development. Teachers have a unique position to identify, protect, and intervene in these cases, but they often fail to help children in need. This study aims to describe and investigate the factors associated with CAN reporting behavior of school teachers and counselors from Romania using the Theory of Planned Behavior (TPB) as a framework. *Methods.* We conducted a mixed-method study using a modified version of the Child Abuse Intention to Report Scale (CARIS-R). 1025 teachers (91,7% female) participated in the survey. Quantitative and qualitative data analyses were performed to explore the predictors of intention to report CAN and the reasons to report CAN. *Results.* More than half of the teachers (51.9%) suspected at least one CAN case, but only 28.1% reported their concerns. Attitudes towards child discipline and professional responsibility, direct subjective norms, and perceived behavioral control were significant predictors of intention to report CAN. Eight categories of reasons might influence a teacher's decision to report CAN, including the type of abuse, the teacher's characteristics, or the perceived social support. *Conclusions.* This study's findings contribute to our understanding of the individual factors that can influence teachers' intention to report CAN in Romania. Teachers from Romania should have the opportunity to participate in evidence-based training, which fosters their confidence in making CAN reports.

**Keywords:** child abuse and neglect; intention to report CAN; teachers; theory of planned behavior; knowledge.

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## INTRODUCTION

Every child has the right to be happy, healthy, and live a life free of violence. Unfortunately, each year, millions of children worldwide are victims of child abuse and neglect (Lampe, 2002; Moody, Cannings-John, Hood, Kemp, & Robling, 2018; Stoltenborgh Bakermans-Kranenburg, Alink, & van IJzendoorn, 2015). Child abuse has been defined as: "all forms of physical and/or emotional ill-treatment, sexual abuse, neglect, or negligent treatment, or commercial or other exploitation, resulting in actual or potential harm to the child's health, survival, development, or dignity in the context of a relationship of responsibility, trust or power" (World Health Organization [WHO], 1999, p. 15). Four types of child maltreatment are generally recognized: physical abuse, sexual abuse, psychological (or emotional or mental) abuse, and neglect.

CAN is an intergenerationally transmitted epidemic (Anderson, Edwards, Silver, & Johnson, 2018) with a severe impact on childs' cognitive abilities, language skills, and academic performance (Child Welfare Information Gateway, 2013; Irigaray et al., 2013). The majority of abuses occur in the family, and almost half of them occur over long periods of a child's life (Meadow, 2007). In Europe, it is estimated that only 10-20% of the abuse cases come to light and the rest of them go undisclosed (WHO, 2013). In the last few years, many efforts have been made to prevent CAN (Brassard & Fiorvanti, 2014; Czerwinski, Finne, Alfes, & Kolip, 2018), but the problem is far from being resolved and needs to be addressed by evidence-based prevention programs (Jones Harden, Simons, Johnson-Motoyama, & Barth, 2020).

While growing up, victims of CAN spend most of their time in educational settings, and many fail to be recognized by the school system (Admon Livny & Kantz, 2016). Teachers have an essential role in promoting the well-being of children, identifying and supporting those in distress, and referring them to help providers such as school counselors or other types of professionals. Moreover, teachers and children usually have trust-based relationships, making children more willing to disclose the occurrence of CAN to them (Osofsky & Lieberman, 2011). Also, school counselors are bound by legal and ethical mandates for reporting CAN (White & Flynt, 2000). They also provide counseling services, coordinate intervention and prevention programs, and help teachers support children in need. Thus, teachers and school counselors are expected to work together to identify CAN victims, guide them with appropriate educational intervention, or report them to local authorities. Studies have shown that school personnel does report cases of CAN (Krase, 2015; Vanderfaeillie, De Ruyck, Galle, Van Dooren, & Schotte, 2018), but they also fail to report some of them (Feng, Chen, Fetzer, Feng, & Lin, 2012; Feng, Huang, & Wang, 2010).

The reporting of CAN is a complex behavior and has no specific definition in the literature, making it difficult to draw clear conclusions (Alazri & Hanna, 2020). However, we can conceptualize reporting of CAN as a two-step decision-making process: in the first step, the teacher must detect and recognize CAN, and in the second step, he must take action such as referring the child to professional help or child protection agencies (Walsh, Bidgstock, Farrell, Rassafiani, & Schweitzer, 2008). Thus, a teacher has to recognize a CAN case and know how to report it al the school level or community level. Unfortunately, the available international research revealed that teacher's lack evidence-based training in child abuse, are unaware of the legal requirements of mandate reporting (Karadag, Sönmez, & Dereobali, 2015; Gilbert et al., 2009), or have erroneous beliefs regarding reporting procedure (Kenny, 2001). In order to explore in more depth the behavior of reporting a case of CAN, we included in the survey an open-ended question regarding reasons for reporting.

In their systematic review, Alazri and Hanna (2020) revealed three categories of factors associated with school personnel CAN reporting behavior: system characteristics, victim characteristics, and reporter characteristics. Teachers were more likely to report CAN if they were elementary school teachers, lived in countries that have mandatory reporting law, had sufficient knowledge about CAN, were self-confident in their ability to identify and report, had social support from those important to them, were sure about the occurrence of abuse, believed that it is their professional responsibility to report, and disapproved child physical punishment (Alazri & Hanna, 2020). Feng et al. (2012) wrote that 18-21% of the variance in the intention to report CAN by school personnel in Taiwan was explained by school geographical area. Still, this difference was not confirmed in other studies (Sikes, Remley, & Hays, 2010). Bryant and Baldwin (2010) revealed that positive experience with reporting CAN increases the school personnel's likelihood to make further reports, but this hypothesis was not confirmed in the study conducted by Bibou-Nakou and Markos (2017). Consequently, this study aims to extend the knowledge regarding CAN reporting behavior of teachers by further investigating the role of the school setting and previous reporting experience in the intention to report CAN.

The majority of studies conducted so far used different instruments to measure reporting behavior, and only three studies had a theoretical background (Feng et al., 2005; Schols, de Ruiter, & Öry, 2013; Goebbels et al., 2008; Toros & Tiirik, 2016). Accordingly, to support a systematic examination of the factors that influence the intention to report CAN, the Theory of Planned Behavior (TPB) was used as a theoretical background. Not all school teachers encounter CAN cases; therefore, the TPB model is appropriate for investigating the factors associated with the intention to report CAN. According to the TPB model, an individual's

behavior is influenced by the intention to perform that behavior, which in turn is influenced by three factors: attitudes towards the behavior, subjective norms, and perceived behavioral control (Ajzen, 2006; Feng, Huang, & Wang, 2010 ). In previous studies, knowledge and experience in working with CAN cases were correlated with nurses' intention to report (Fraser, Mathews, Walsh, Chen, & Dunneet, 2010; Kraft & Eriksson, 2015); thus, both knowledge and work experience were included in the theoretical framework of our study.

Children can be CAN victims at any age (Akmatov, 2011). Studies conducted so far focused on the experience of teachers who work at one grade level, except for a few ones that investigated the experience and knowledge of all school staff members (Kenny, 2004; Choo, Walsh, Marret, Chinna, & Tey, 2013; Bibou-Nakou & Markos, 2017; Greco, Guilera, & Pereda, 2017;), or school counselors (Bryant & Baldwin, 2010; Sivis-Cetinkaya, 2015). As previously mentioned, teachers and school counselors have essential roles in helping out the victims of CAN in the educational settings; thus, we included both categories in our study. Moreover, teachers from all school levels were included to explore whether the level of the school has an influence on reporting behavior and draw a complete picture about the factors associated with reporting behavior.

### *The Romanian context*

In Romania, data on violence against children are provided by: the National Statistics Institute of Romania; sectorial statistics from Child Protection Agencies; research studies like Adverse childhood experiences (Băban et al., 2013) and Health Behaviour in School-Aged Children (starting from 2013, researchers have included a subscale on child abuse; Meinch, Cosma, Mikton, & Băban, 2017); and several organizations which develop and implement prevention and intervention programs for CAN (United Nations Children's Fund; World Vision Romania; Salvați Copiii Romania).

In 2018, 15 000 children were victims of CAN [National Authority for the Protection of the child's rights and Adoption (ANPDCA)], but the prevalence is likely to be much higher because most of the cases are not identified/reported. World Vision Romania (2015) emphasized in a report that "violence is a part of the vicious circle of poverty (...). At least 1.5 million Romanian children are directly exposed to a degrading and violent environment" (p. 12). Even if Law no. 272/2004 establishes that violence against children is forbidden, only 1 in 10 parents say they would never hit their child (World Vision Romania, 2015).

Article no. 89 from the Law no. 272/2004 specifies that employees of public or private institutions who have a suspicion that a child is a victim of CAN should immediately notify Child Protection Services (CPS). Otherwise, they will

be sanctioned according to the law" (Law no. 272/2004), but no sanctions are mentioned. Anonymous or not, the notification of a CAN suspicion can be given directly, by phone, or by email to DGASPC (The General Direction of Assistance and Protection of the Child). Following the notification, the social workers will investigate the child's home and will decide whether the suspicion of CAN is sustained. The child will be left in the family or relocated in a shelter, depending on the decision.

In a qualitative study conducted by Salvați Copiii Romania (2018), most teachers were unaware of the legal requirements to report CAN. They emphasized that they do not have the instruments and professional preparation to deal with these cases. Moreover, Romania lacks a systematic collection of data regarding the detection and reporting of CAN cases; thus, we don't know how many reports to CPS are made by teachers.

### *Current study*

Teachers are in the unique position to identify, intervene, prevent, and report CAN cases. Previous research has investigated factors that influence teachers' decisions to report CAN. Still, each country's cultural factors may influence teachers' personal motivation to get involved in these cases (Schols, Ruiter, & Öry, 2013). Moreover, children can be victims of abuse at any age; thus, teachers and school counselors should know how to deal with these cases and report them to the school principal or local authorities. Therefore, teachers from four educational levels and school counselors were required to participate in this study. The four educational levels were: preschool education (kindergarten; children aged 3-6 years), primary school (children aged 7-11 years), secondary education (gymnasium; children aged 11-15 years), and high school (covers grade 9 through 12 or 13). The specific objectives of this study were to:

1. Identify teachers' reporting behavior of CAN in the Romanian context.
2. Identify the main reasons of Romanian' teachers for reporting and not reporting CAN.
3. Explore differences in knowledge, attitudes, subjective norms, perceived behavioral control, and intention to report between primary, secondary, high school teachers and school counselor.
4. Assess which factors from the TPB model significantly predict teachers' intention to report severe and less severe CAN cases.

This study is the first one conducted in Romania that investigates teachers' reporting behavior and factors associated with the intention to report CAN.

## METHODS

This cross-sectional study was conducted in two phases. Phase one was the translation, adaptation, and validation of the Child Abuse Report Intention Scale - *Kindergarten Teacher's Version* (CARIS; Feng et al., 2010) on Romanian teachers. Permission to adapt the CARIS was obtained from the authors, and care was taken to contextualize the questionnaire for Romania-specific legislation. In phase two, the CARIS-R was used to conduct a national survey, of which results are reported in this study.

### *Participants*

The study sample included 1025 teachers (91.7% female and 8.3% males, $M_{age}$ = 42.56, SD = 9.62) who voluntarily completed the online questionnaire. The majority of the participants were married (72.5%) and had at least one child (75.9%). Regarding their last form of graduated education, 2.8 % had a high-school diploma, 43.9 had Bachelor's degree, 49.2 % had a Master's degree (49.2%), and 4.1 % had a doctoral degree. Most of the schools were located in the North-East and North-West of Romania, with 72.1% in urban areas. The years of work experience as a teacher varied between 3 months and above 25 years: 15.5% were early career teachers (1-5 years experience), 23.6 % were mid-career teachers (6 -15 years experience), and 60.9 were late-career teachers (with 16 or more years experience).

### *Sampling procedure*

In order to reach the participants, schools databases and social media accounts (Facebook) were used. In the first step, 1753 public schools were selected from an official database (Ministry of Education and Research, 2020) using a proportionate stratified random sampling technique in which strata were: school residence (urban and rural), school level (preschool, primary, secondary or high school) and administrative district. Specifically, from each administrative district, we randomly selected 5% of the schools from each of the four school levels included in each setting (urban and rural). Regarding social media accounts, a systematic search was performed to identify teachers' Facebook groups across Romania. The groups were selected if the members were only teachers, had above 500 members, were national groups, and the group moderator agreed to post the information about the study. A total sample of 12 Facebook groups met the selection criteria. The initial sample of participants who completed the questionnaire was 1073; 48 were not included

in the data analysis because they were working in special education or were not teachers (e.g., secretary, librarian, social worker, kinetotherapist). All participants had to read an information letter about the study protocol, the rewards for participation, and sign the informed consent before completing the questionnaire.

### *Measurement*

CARIS-R (*Child Abuse Report Intention Scale – Romanian version)* is a revised scale from the CARIS - *Kindergarten Teacher's Version* (Feng et al., 2010). The scale was developed according to the TPB model and consisted of 6 sections. The first section included demographic data, experience of encountering and reporting CAN, the professional training of teachers regarding CAN, and an open-ended question: "What reasons would make you report a case of CAN?". The following sections included five individual scales measuring the major study variables: 1) attitudes; 2) subjective norms; 3) perceived behavioral control; 4) knowledge; and 5) intention to report CAN (eight vignettes). (See Table 2 for scale characteristics).

*The attitudes scale* consisted of three subscales that measured the attitudes toward child discipline, the punishment of perpetrators, and professional responsibility to report CAN. Participants rated their responses on a 6-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree). Items that were negatively worded were reverse-coded. Items were added up separately on each subscale, in which low scores represented that teachers strongly disagree with harsh discipline, firmly believe that perpetrators should not be punished for their acts, and that it is not their responsibility to report CAN. *The direct and indirect subjective norms* were each measured with one question, with response options ranging from 1 (definitely no) to 5 (definitely yes); low score represented: 1) direct subjective norms - teacher believes that most of the people from the general population believe that teachers should not report CAN; 2) indirect subjective norms - teacher believes that most of the people of whose opinion he/she respects believe that they should not report. *The perceived behavioral control* over reporting was measured with 8 items and response options were 1(definitely no) to 5 (definitely yes), a low score was equivalent to low perceived behavioral control. *The knowledge subscale* included questions about signs and symptoms of abuse and CAN legislation and the teacher had to answer with 1 (yes), 2 (no), or 3 (I don't know); a low score indicated poor knowledge. The last section included eight vignettes, four with severe cases of abuse and four with less severe cases of abuse, and measured *the intention to report CAN* based on a 10-point continuum (1 = almost certainly would not report; 10 = almost certainly would report).

Previous studies have reported good construct and content validity of the CARIS questionnaire (Feng & Levine, 2005; Feng et al., 2010). In this study, the internal consistency of the subscales was increased by deleting all items that did not have at least one correlation above 0.3 (two items from the attitude towards child discipline subscale and two from the attitudes towards professional responsibility subscale). The deleted items were excluded from the inferential analysis but maintained for the descriptive statistics.

## PROCEDURE AND STUDY DESIGN

### *Data collection methods and study design*

A mixed-method study was performed combining the following: 1) a cross-sectional study in which the focus was on investigating the knowledge, attitudes, subjective norms, perceived behavioral control, and intention to report CAN of preschool, primary, secondary, high school teachers, and school counselors; 2) a qualitative approach in which we analyzed teachers' answers to one open-ended question regarding reasons for reporting CAN.

The responses to the survey were collected in two phases. First, a link to the questionnaire and a study poster was distributed on 12 Facebook groups created for teachers. Second, an email was sent to 1753 school secretaries requesting to forward its content to all teachers. The email contained information about the study (objective, rewards, the people involved and their email addresses) and a link to the questionnaire in Google forms. Fifty-seven email addresses were not valid, resulting in only 1696 emails reaching their destination. To increase the number of participant, we offered three incentives: the chance to win a package of books on Self Development, a brief report of the study results, and free participation in an online course *"Methods of identification and intervention in child abuse cases in schools*". The questionnaire was available online for two months, and the responses were saved confidentially to a password-protected computer. Teachers interested in receiving one of the incentives provided an email address saved in a separate excel document.

Given that CAN is a sensitive matter, teachers received the email address of the principal investigator if they felt the need to talk about the questionnaire or other issues regarding the research subject. The principal investigator received 43 emails from teachers across Romania who wanted to talk about their experience with CAN in school, the training needs of the teachers, or to collaborate further in the research project.

### *Data analysis strategy*

The data were analyzed quantitatively in SPSS-20 software and qualitatively with content analysis (Elo & Kyngäs, 2008; Padgette, 2008) in MAXQDATA-10 software. All questions were mandatory in the Google forms questionnaires except those with open-ended answers, which led to no missing data. Descriptive analysis was performed using Means, Standard Deviation, and percentages to describe teachers' answers to the survey. Pearson's chi-square tests were performed to test the association between demographic characteristics of the teachers (school level, teaching experience, participation in evidence-based training, previous reporting experience), setting of the school, and intention to report CAN. Further, parametric and non-parametric statistical analyses were conducted to compare differences in the main variables among preschool, primary, secondary, high school teachers, and school counselors. The distribution was normal, skewness and kurtosis did not exceed the value of ±2 (Gravetter & Wallnau, 2014). Consequently, one-way analysis of variance ANOVA followed by the Scheffe tests were used to compare the perceived behavioral control and attitudes toward the punishment of the abusers, and the Kruskal-Wallis test was used to compare the rest of the variables. Pearson and Point-biserial correlation coefficients were calculated to investigate the correlates of intention to report CAN. Predictors of intention to report CAN were investigated with hierarchical multiple regression. Each variable was added to the model according to the TPB theory to investigate the amount of variance each dimension explains.

The content analysis was performed by the main investigator and one school counselor to enhance the reliability of the data analysis, Cohen's kappa coefficient was also computed. The following steps were used in content analysis: 1) reading all the answers to gain an understanding of their nature; 2) coding the answers through repeated reading; 3) the author and the school counselor discussed the findings and permanently compared and refined the codes; 4) similar codes were grouped in themes; 5) all the answers were reread to extract quotes that represented the themes. In the text, the quotes are presented with R (from the response) and the participant's number (e.g., R29).

## RESULTS

### *Descriptive statistics*

The descriptive statistics for each subscale are presented in Table 1. Regarding the items that were only maintained for the descriptive analysis, 81.3% of the teachers agreed that physical punishment is child abuse, 30%

reported that parents have the right to decide how they discipline their children, 33.6% agreed that reporting a case is troublesome for them, and 82.1% said that is time-consuming to deal with these cases.

Regarding the knowledge subscale, 45.6% of the school teachers indicated that they *do not know* if they have to report a CAN case, and 47.9% stated that *they must have concrete evidence before reporting CAN*. Between 23.1% and 65.5% of teachers revealed that *they do not know* the correct answer to the law-related questions. The school counselors had more correct answers at the knowledge subscale than all other teachers $F(5, 1019) = 14.86$, $p < .001$; all posthoc comparisons performed with Scheffe test between the school counselors and the teachers from different levels were statistically significant at the level of $p < .001$.

**Table 1.** Descriptive statistics and internal consistency of CARIS subscales

| Subscale | Item | Mean | *SD* | Actual range | Potential range | Cronbach's α |
|---|---|---|---|---|---|---|
| Intention report | 8 | 61.52 | 14.69 | 8-80 | 8-80 | .87 |
| Attitudes toward: | | | | | | |
| Child discipline | 4 | 5.13 | 2.16 | 4-24 | 4-24 | .72 |
| Perpetrators | 5 | 24.60 | 5.01 | 9-30 | 5-30 | .67 |
| Professional responsibility | 5 | 26.60 | 3.76 | 6-30 | 5-30 | .65 |
| Subjective norm | | | | | | |
| Norm-direct | 1 | 4.23 | .95 | 1-5 | 1-5 | - |
| Norm-indirect | 1 | 4.29 | .90 | 1-5 | 1-5 | - |
| Perceived behavioral control | 8 | 31.06 | 5.64 | 13-44 | 8-48 | .75 |
| Knowledge | 13 | 4.66 | 2.68 | 0-12 | 0-12 | .76 |

Note. $N = 1025$, *SD* = standard deviation;

Descriptive statistics for intention to report severe and less severe cases of CAN are presented in Table 2. The mean for intention to report *severe vignettes* was 31.61 ($SD = 6.94$) and for *less severe* vignettes was 29.91 ($SD = 8.45$). Teachers did not significantly differ in their intention to report severe and less severe cases, regardless of the school level to which they teach and the gravity of the case. Teachers were more likely to say that they will report physical and sexual abuse than psychological abuse and neglect, in the case of both severe and less severe vignettes. Regarding work experience, early career teachers had a slightly stronger intention to report (M = 64.46) than mid-career teachers (M = 59.85) and late-career teachers (M = 61.42), but the differences did not reach statistical significance.

**Table 2.** Descriptive statistics of intended reporting behavior

| Intended reporting behavior | Mean | *SD* |
|---|---|---|
| *Severe cases of abuse:* | | |
| Psychological abuse: dress a girl like a boy and tell her they wished for a boy | 6.24 | 3.04 |
| Physical abuse: beat a child resulting in facial bruising and fractures | 9.36 | 1.60 |
| Sexual abuse: engage in sexual intercourse with their child | 9.35 | 1.61 |
| Neglect: left a child home alone until midnight and child started a fire | 6.68 | 2.78 |
| Total mean/standard deviation | 31.61 | 6.94 |
| *Less severe cases of abuse:* | | |
| Psychological abuse: ridicule and criticize the child | 6.01 | 3.02 |
| Physical abuse: hit a child's palms and legs with a cane | 8.27 | 2.30 |
| Sexual abuse: show pornographic pictures to the child | 8.21 | 2.50 |
| Neglect: delay medical treatment for their child | 7.42 | 2.72 |
| Total mean/standard deviation | 29.91 | 8.45 |

*Note. N* = 1025, *SD* = standard deviation

### *Reporting history and educational preparation for dealing with CAN*

A third of the teachers (28.1%) indicated that they had reported at least one CAN case. The majority of them were females (90.6%), had at least one child (81.5%), worked in urban areas (71.2%), were 40 to 50 years old (45.1%), and had no personal experience of victimization in their childhood (52.9%). There was a statistically significant association between the school educational level of the teacher and previous experience in CAN reporting ($\chi 2$ (5) = 96.49, $p <$ .001). The association was moderately strong (Cohen, 1988), Cramer's V = .307. Specifically, school counselors (57.7%), secondary (31.1%), and primary school teachers (30.3%) had the highest rate of reporting CAN, while preschool teachers had the lowest (8.4%). Similar percentages of teachers from rural and urban areas reported at least one case of CAN, $\chi 2$ (2) = .716, p = .699.

More than half of teachers (51.9%) failed to report at least one case of CAN identified in the school. The majority of them were preschool teachers (67.3%), followed by high school teachers (55.7%) and primary school teachers (54.2%). The most prevalent reason for not reporting was lack of evidence (39.1%), followed by lack of trust in local authorities (20.4%), and fear of repercussion (6.6%). It is worth mentioning that a third of the teachers (32.3%) who said that they did not encounter cases of CAN were late-career teachers (above 16 years of work experience).

Regarding school teachers' preparation in dealing with CAN, only 18.4% participated in child maltreatment courses. The majority of them were school counselors (37.4%), followed by secondary and high school teachers (19.2%) and primary school teachers (17.4%). More than half of the teachers (57%) considered that the courses meet their expectations, 85% of the teachers continued to read about CAN after the course ended, and 94.2% applied the acquired knowledge in the school. Although they did not participate in formal training, 7.5% of the teachers learned about CAN through reading studies or reports provided by organizations involved in child protection.

### *Comparisons of major variables by teachers' position*

The ANOVA results indicated a group effect on both perceived behavioral control, $F$ (5, 1019) = 4.62; $p < .001$, and attitudes towards the punishment of the abusers $F$ (5, 1019) = 3.92, $p < .01$. Post-hoc analyses using the Scheffé test indicated that teachers from secondary school ($M$ = 30.32, $SD$ = 5.36) and high school ($M$ = 30.25, $SD$ = 5.67) perceived significantly lower levels of control over reporting CAN than school counselors ($M$ = 33.43, $SD$ = 5.42). In addition, school counselors ($M$ = 23.32, $SD$ = 5.17) were more lenient in their attitudes regarding punishing the abuse perpetrators than kindergarten teachers ($M$ = 25.38, $SD$ = 4.82). No other significant differences emerged from the data.

Kruskal-Wallis H tests were run to determine if there were significant differences in attitudes towards child discipline, professional responsibility, and direct and indirect subjective norms. The distribution of scores was similar for all groups and variables, as assessed by visual inspection of the boxplot. The results showed that teachers had different attitudes regarding child discipline $H(5) = 14.99$, $p < .05$, professional responsibility $H(5) = 21.21$, $p < .001$, direct subjective norms $H(5) = 23.33$, $p < .001$, and indirect subjective norms $H(5) = 15.59$, $p < .01$). Pairwise comparisons revealed that high school teachers (mean rank = 547.79) were more likely to say that physical discipline is a good method to discipline children than primary school teachers $H(5) = 471.93$ and school counselors $H(5) = 457.98$. Moreover, high school teachers perceived less responsibility to report CAN (mean rank = 451.97) than preschool teachers (mean rank = 563.25) and primary school teachers (mean rank = 551.60). Regarding direct subjective norms, preschool teachers (mean rank = 575.82) perceived that people important for them felt that they should report CAN cases, while the high school teachers (mean rank = 463.80) perceived the opposite. Finally, preschool teachers (mean rank = 569.63) also perceived that friends, family, colleagues, or school principals expect them to report CAN, while school counselor (mean rank = 466.38) and high school teacher (mean rank = 493.65) perceived that others do not expect them always to report.

### *Correlates of intention to report CAN*

The correlations between main variables and intention to report severe plus less severe CAN cases were examined with Pearson and Point-biserial correlation coefficients (Table 3). Teachers who had a solid intention to report CAN ($r$ > .30) were more likely to believe that it is their professional responsibility to report, perceive that family and other people felt that they should report, and perceived more behavioral control in reporting.

**Table 3.** Person's correlation coefficient between main variables and intention to report CAN

| Variables | Intention to report CAN |
|---|---|
| Work experience | -.037 |
| Having children | -.023 |
| Previous experience of victimization | .012 |
| Participation in courses about CAN | .142** |
| Previous reporting of CAN | .090* |
| Reasons for not reporting CAN | -.159** |
| Attitudes toward: | |
| Child discipline | -.180** |
| Perpetrators | .230** |
| Professional responsibility | .432** |
| Subjective norms: | |
| Norm-direct | .443** |
| Norm-indirect | .411** |
| Perceived behavioral control | .484** |
| Knowledge | .144** |

*Note*. $N$ = 1025, * $p$ < .05, **$p$ < .001.

### *Predictors of intention to report CAN*

Hierarchical multiple regression was run to determine if the attitudes, perceived behavioral control, and subjective norms (independent variables) contributed to teachers' intention to report (dependent variable) severe and less severe CAN cases while controlling for reasons for not reporting CAN, the previous reporting of CAN, participation in courses about CAN, and knowledge. All assumptions for conducting hierarchical regression were met (Field, 2013, p. 132-154). In Table 4**,** full details on each regression model are presented. The full model was statistically significant, $R^2$ = .346, $F(10, 1014)$ = 53.699, $p$ < .001,

adjusted $R^2$ = .340. The addition of attitudes to the prediction of intention to report CAN (Model 2) led to a statistically significant increase in $R^2$ of .161, $F(3, 1017)$ = 70.976, p < .001. The addition of subjective norms (Model 3) also led to statistically significant increase in $R^2$ of .064, $F(2, 1015)$ = 46.075, p < .001. The addition of perceived behavioral control (Model 4) also led to statistically significant increase in $R^2$ of .0.50, $F(1, 1014)$ = 76.830, $p$ < .001.

**Tabel 4.** Hierarchical Multiple Regression Predicting Intention to report CAN

| | **Intention to report Severe and less Severe cases of CAN** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Model 1** | | **Model 2** | | **Model 3** | | **Model 4** | |
| **Variable** | **B** | **β** | **B** | **β** | **B** | **β** | **B** | **β** |
| Constant | 59.06** | - | 21.96** | - | 12.53** | - | 2.47 | - |
| Reasons for not reporting | -3.15** | -0.19 | -2.16** | -0.13 | -1.20* | 0.07 | -0.36 | -0.02 |
| Previous reporting of CAN | 2.34* | 0.07 | 1.45 | 0.04 | 1.04 | 0.03 | 0.16 | 0.01 |
| Participation in courses | 4.27** | 0.11 | 3.14* | 0.09 | 2.69* | 0.07 | 0.71 | 0.02 |
| Knowledge | 0.73** | 0.13 | 0.40* | 0.07 | 0.33* | 0.06 | 0.11 | 0.02 |
| Attitude - child discipline | | | -0.62** | -0.09 | -0.45* | -0.07 | -0.39* | -0.06 |
| Attitude-perpetrators | | | 0.19* | 0.06 | 0.09 | 0.03 | 0.11 | 0.03 |
| Attitude-Professional responsibility | | | 1.38** | 0.36 | 1.03** | 0.26 | 0.76** | 0.19 |
| Norm-direct | | | | | 2.77** | 0.18 | 2.37** | 0.16 |
| Norm-indirect | | | | | 1.99* | 0.75 | 1.23 | 0.08 |
| Perceived behavioral control | | | | | | | 0.72** | 0.28 |

*Note*. $N$ = 1025; * $p$ < .05, **$p$ < .001.

### *Teacher's reasons for reporting CAN*

The qualitative content analysis revealed eight themes presented in Figure 1**,** along with their sub-themes and absolute frequencies. The themes are: 1) abuse characteristics (teachers talked about the gravity, frequency and types of child abuse that they would report more frequently); 2) signs, symptoms, and consequences of abuse (specific and general indicators of abuse and long term consequences); 3) the teacher (teachers' characteristics that would increase their probability in making a report); 4) the child (teacher's concerns about the children's safety and their future); 5) family characteristics (attributes of the family that would influence teacher's decision to report); 6) respecting the law (teacher's thoughts about the child rights, punishment of the abuser, and what should be done to improve the legislation regarding CAN); 7) receiving social support (the need of teachers to work in a team in CAN cases); 8) concrete evidence (teachers talked about the importance of having concreate evidence before making a CAN report). In the following, some of the themes and sub-themes are briefly presented.

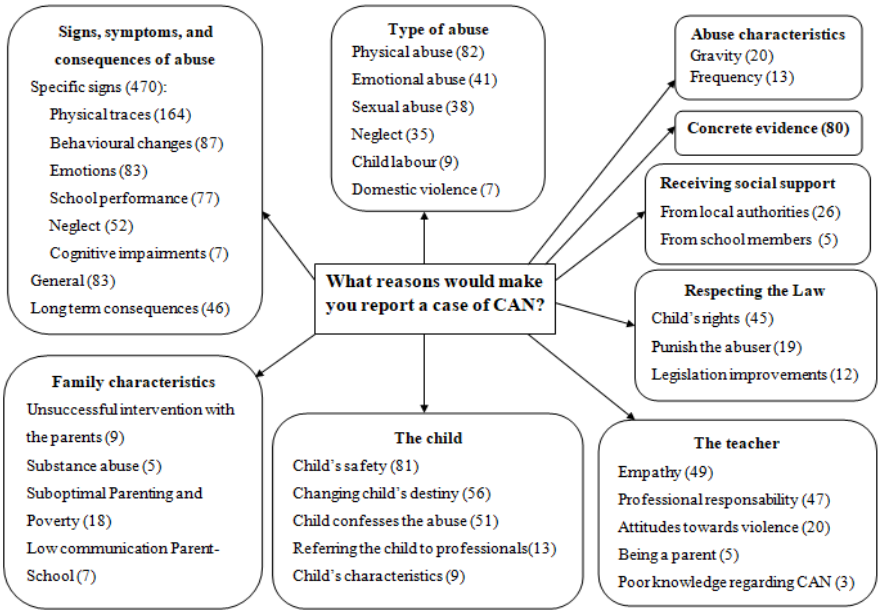


**Figure 1.** Themes and sub-themes (absolute frequencies in parentheses) revealed by qualitative content analysis

Three of the themes that emerged from the data are around the phenomenon of abuse. Physical abuse was the most frequent type of abuse mentioned by teachers, followed by emotional abuse and neglect. When it comes to signs, symptoms, and consequences of abuse, teachers described them in general terms (*"child suffering*", *"changed behavior*", *"emotional state*", *"physical health*", *"emotional consequences*") and specific ones (*"bruises*", *"cuts", "injuries*", *"sadness*", *"aggressive behavior*", *"low concentration*", *"dirty clothes*", *"no food package*", *"low grades*", *"absenteeism*"). Some teachers included among their statements the gravity of the abuse (*"I have to suspect that it is a serious case of abuse*" R8) and its frequency (*"the student is repeatedly abused and his behavior changes*" R470).

Some of the reasons are reflecting teachers' traits like empathy (*"I was abused in childhood. I cannot be indifferent to the child suffering. I care about the children from my class. I need to help them*" R846), strong professional responsibility (*"from the perspective of a teacher, I believe that we have to teach children about their rights, to notify the authorities and get involved in solving cases of abuse of which we are aware*" R1069), and negative attitudes towards violence (*violence in my view is intolerable, destructive, with negative consequences for the future adult*" R98).

All references regarding the child and its well-being are gathered in one theme. Teachers are more inclined to report CAN when the child's life is in danger (*"for the child safety*", *"child would die*", *"child is in danger*"), if they strongly believe that the child's destiny would change (*"saving the child*", *"better future for the child*", *"give him a chance*"), and if the child confesses the abuse and asks for help (*"the preschooler's confession about their home environment and abuse; when he asks for help!*" R516).

A few teachers mentioned parents and their influence in the process of identifying and intervening in CAN cases. Teachers would report the case if the intervention in the family has no results (*"if I reported my complaints to the parents and they would do nothing to change their behavior towards the child*" R478), parents have risk behaviors (*"children from families in which one of the parents is an alcoholic*" R1012) and lack parental skills (*"some parents are not intellectually and emotionally prepared to raise a child. The child is a simple biological accident"* R545).

Receiving social support, respecting the law, and concrete evidence were other three themes that emerged. Some teachers need concrete evidence before reporting a case of CAN (*"clearest evidence of abuse – the ability to trust what the victim is reporting. Another teacher that confirms that the child story is real*" R197). Sources of social support mentioned by the teacher were colleagues (*"if I knew for sure that other colleagues would be involved in the case*"

R27), and local authorities (*"to have the help and involvement of local authorities, to find various solutions and sources of support for the whole family*" R521). Regarding the sub-theme clear legislation, teachers emphasized the issues of the current legislation which would make them think twice before reporting (*"too much paperwork*" R15, *"no real solutions for the child*" R46, *"I would report cases of child abuse, but I do not trust the Child's protection system*" R154).

## DISCUSSION

Millions of children are referred annually to Child Protection Services. Still, the true extent of child maltreatment is underestimated, mainly because those required by the law to report CAN cases often fail to do so. In Romania, the law states that all school teachers should report suspected cases of CAN. However, data on how many reports are made by teachers, the extent to which they are knowledgeable about legal regulations regarding CAN reporting, and how well-prepared they are in dealing with these cases is missing. Therefore, this study aimed to identify the teacher's reporting behavior of CAN in the Romanian context and explore which factors from the TPB model best predict the intention to report CAN.

In the current study, 1025 teachers participated from all regions of Romania. The majority of teachers were female and lived in urban areas; over a quarter of teachers reported at least one CAN case. Primary and secondary school teachers reported more cases than high school teachers. The same result was obtained in the study conducted by Webster et al. (2005), in which the number of reports of child maltreatment decreased as the victim's age increased. Although preschool teachers should be the ones that protect defenseless young children, similar to previous findings (Feng et al., 2010), the rates of reporting were low. An explanation for this could be that apart from physical traces, other pieces of evidence of abuse are difficult to obtain from young children. As Feng et al. (2009) stated, preschool teachers might feel that they are "dancing on the edge" and maintaining the relationship with the family and overlooking the signs of CAN might seem a better option in some cases. The school counselor reported more cases than other teachers. Possible explanations might be that other teachers ask for their help when they suspect that a child is a victim, children have more confidence in school counselors and confess the abuse, and school counselors are more knowledgeable and prepared to help them (Bryant, 2009).

Almost half of the teachers suspected that a child was victimized but failed to report their suspicions. Other studies also revealed that school teachers do not report a significant proportion of CAN cases (Kenny, 2001; Schols et al., 2013; Webster et al., 2005). Unfortunately, more than half of the kindergarten

teachers did not make a report despite their suspicions. Preserving a relationship with the parents, avoiding further harm for the child, maintaining the balance between reporting a case and risk to face negative consequences, and maintaining trust-based relationships with the child might explain underreporting (Feng et al., 2009). However, the difference between reported and suspected cases is overwhelming; further studies should investigate whether teachers used other means to help the children despite their failure to report.

An interesting finding is that a third from the late-career teachers said that they never encountered a case of CAN. Other studies revealed that one in five children in every class is a victim of abuse (Daignault & Hebert, 2009, as cited in Dănilă, Tăut & Băban, 2019). Accordingly, we can only suppose that teachers did not encounter these cases, failed to identify child victims due to their insufficient knowledge, or maybe they have chosen to ignore the case and focus on teaching their lessons.

Similar to other studies (Briggs & Potter, 2004; Dinehart & Kenny, 2015; Feng et al., 2010; Kenny, 2004; Schols et al., 2013; Toros & Tiirik, 2016; Walsh, Farrell, Bridgstock, & Schweitzer, 2006; Walsh et al., 2008), the teachers had insufficient knowledge regarding signs and symptoms of CAN and mandatory reporting law, except for school counselors (Bryant & Milsom, 2005). Poor knowledge could be a barrier in intervening in CAN cases (Dienhart & Kenny, 2015; Gilbert et al., 2009; Greco et al., 2017; Kenny, 2001). These findings might also be explained by the fact that only a quarter of teachers from this study participated in CAN courses. Although teachers did not participate in CAN training, a small proportion of them improved their knowledge through reading about child maltreatment.

Along with a solid knowledge base, personal motivation also has an essential role in helping victimized children (Alvarez, Kenny, Donohue, & Carpin, 2004; Delaronde, King, Bendel, & Reece, 2000). Perceived barriers identified by teachers were the fact that they feel uncomfortable when reporting and that it is time-consuming to deal with these cases. In other studies (Alvarez et al., 2004; Schols et al., 2013), teachers revealed that lack of trust in authorities, fear of repercussions, and lack of evidence prevented them from reporting.

In addition to other studies conducted with school staff members (Choo et al., 2013; Greco et al., 2017; Kenny, 2004), we investigated the differences in attitudes, subjective norms, perceived behavioral control, and knowledge between kindergarten, primary, secondary, high school teacher and school counselors. The majority of teachers, except for high school teachers, reported that they disagree with harsh discipline, in opposition to other studies (Briggs & Potter, 2004; Feng et al., 2010; Ibanez, Borrego, Pemberton, & Terao, 2006; Kenny, 2004). In Romania, 1 in 10 parents reported that they would never hit their child, while 1 in 2 said they hit the child for his good (World Vision România, 2015). Therefore, this

study findings gives us hope that, at least in the school environment, children will not have to face physical discipline, and teachers might be an essential agent of change who can advise parents to use positive disciplinary practices.

School counselors reported more positive attitudes towards the punishment of the abusers. Simultaneously, kindergarten teachers were more likely to say that severe penalties are the best way to stop the abuse. The professional background might explain this difference in opinions. School counselors might be more inclined to support the rehabilitation of the abuser and end the circle of violence. At the same time, kindergarten teachers agreed to severe punishments because they work with younger children who, in comparison with older children, are more vulnerable and can be severely affected by the experience of CAN. School counselors had the highest scores in terms of perceived behavioral control, while secondary and high school teachers had the lowest. Therefore, we can argue that the school counselor is an essential pillar of support in reporting abuse in the school environment.

There was no significant difference among teachers regarding the intention to report severe and less severe abuse cases. We found significant, but low correlation coefficients between intention to report CAN and participation in courses about CAN, previous experience in reporting, knowledge, the belief that perpetrators should be punished for their acts, and that others important expect them to intervene, and perceived behavioral control. These results are supported partially by other studies (Feng et al., 2010; Schols et al., 2013; Toros & Tiirik, 2016). Furthermore, work experience did not significantly correlate with the intention to report, as previous studies stated (Greco et al., 2017; Toros & Tiirik, 2016), but the quality of previous reporting experiences. We could only observe a slight tendency of early career teachers to report higher scores at the intention to report.

Except for indirect subjective norms and attitudes towards perpetrators, this study's findings support the TPB model. Similar to other studies (Feng & Wu, 2005; Feng et al., 2010; Goebbels et al., 2008), attitudes towards child discipline, professional responsibility, and perceived behavioral control were significant predictors of the intention. An interesting result is that the most important predictor of intention was direct subjective norms, which means that for teachers from Romania, societal expectations to report child abuse significantly influence their decision. In the study conducted by Feng et al. (2010), subjective norms did not predict teacher's intention to report CAN. Taken together, the results of hierarchical regression emphasized the importance of attitudes, perceived behavioral control, and subjective norms in the intention to report CAN among teachers from Romania.

In order to explore in more depth, the personal motivation of teachers for helping a child in need, answers to an open-ended question were analyzed.

The content analysis revealed a broad spectrum of motives. A close examination of sub-themes frequencies shows that, first of all, teachers pay attention to physical traces of abuse, followed by changes in behavior and emotional consequences. Teachers are more inclined to report physical and sexual abuse and minimize the effect of emotional abuse and neglect. The reasons for these discrepancies might be that physical traces are indisputable evidence of physical abuse and sexual abuse it is socially unacceptable. Emotional abuse is more difficult to detect, and teachers might not have the instruments to investigate. At the same time, neglect is common in low-income families or those in which parents have gone abroad, and teachers might feel powerless in helping the child in need. Other reasons for reporting are related to the intervention's benefits, like the child will be safe and will have access to professional help, which will ensure a better future for him. Some teachers emphasized that a child's confession is a crucial factor for a teacher's intervention. Moreover, empathetic teachers who believe that it is their professional responsibility to intervene and have negative attitudes towards violence will not let a child down when victimized. Finally, like other studies showed (Kenny, 2001; Greco et al., 2017), teachers might be more inclined to report if other colleagues or local authorities are involved in the case and find plausible solutions for child' safety.

### *Practical implications*

This study's results emphasize the importance of attitudes, perceived behavioral control, and subjective norms in designing training programs for all school teachers to help them detect, recognize, and take action in CAN cases. Although previous studies revealed mixed results about the impact of training in identifying and reporting CAN (Kenny, 2004; Walsh et al., 2008), there were also a few studies that indicated that participation in training increases teacher's confidence over the recognition of CAN (Baginsky, 2003; Baginsky & Macpherson, 2005). Training programs should focus specifically on the legal aspects regarding child maltreatment, signs, and symptoms of CAN in the school environment, and the most common barriers in reporting.

Moreover, training should emphasize the importance of professional responsibility towards reporting, address the attitudes regarding child discipline, and enhance teachers' perceived behavioral control. All schools should have written policies about CAN reporting, accessible and known by the school personnel. The school principal and teachers should work as a team and collaborate with Police and Child Protection Agencies.

The school counselors also have an essential role. The results revealed that they have more knowledge and confidence in reporting CAN than other teachers. School principals and teachers should be more supportive of the school

counselors and assist them in reporting procedures. Moreover, school counselors should promote their school activity and educate the children, teachers, and parents regarding their role in promoting children's well-being. Also, the school counselor could offer additional training to the school teachers regarding CAN signs, symptoms, and consequences.

Finally, this study revealed that kindergarten school teachers have the lowest reporting rate and the highest rate of suspecting abuse without reporting. Therefore, they should participate in mandatory educational programs about recognizing and reporting CAN.

### *Limitations*

There are several limitations of the present study which must be taken into account when interpreting the results. First of all, this study used vignettes presenting hypothetical situations about CAN cases. Therefore, the results are limited only to the cases presented. Second, although the participants' sample was diverse in socio-demographic variables and a stratified random sampling technique was used, the findings' generalizability is limited. Only those teachers who were interested in the subject have likely chosen to complete the questionnaire. Third, we cannot confirm the validity of teachers' answers regarding participation in training about CAN and the number of cases reported. The reporting system data are kept confidential; thus, the actual reports of teachers remain unknown. Forth, we used a self-report questionnaire, which can conduct to response bias, given that CAN is a sensitive subject and teachers might be more tempted to respond in a socially desirable manner. Finally, the knowledge of teachers was only partially covered by the subscale questions. Other studies should test in more depth the actual knowledge of the teachers.

## CONCLUSIONS

This study explored the reporting behavior of school teachers from Romania and demonstrated how the TPB model could help us understand the factors associated with the teacher's intention to report CAN. In addition to other studies, school teachers from different educational levels participated, which enabled us to describe more broadly what factors might influence their intention to report. The majority of teachers disapproved of the child's physical punishment, and except for school counselors, they had insufficient knowledge about signs and symptoms of CAN and mandatory reporting law. Also, school counselors, followed by primary and secondary school teachers, make most CAN reports. In contrast, preschool teachers reported the fewest cases of CAN.

Almost half of the teachers said that they did not make a report even if they suspected that the child was a victim. Teachers are more inclined to report physical and sexual abuse than emotional abuse and neglect. Teachers who had a solid intention to report CAN were more likely to disapprove child's harsh discipline, believed that it is their professional responsibility to report, felt that others important for them expect them to report, and perceived more behavioral control in reporting.

In conclusion, this study's findings contribute to our understanding of the individual factors that can influence teachers' intention to report CAN in Romania and add up to understanding the reporting behavior cross-culturally. In the school environment, teachers are the key to early detection and intervention, and they must be aware of their responsibility to intervene and report these cases to social services. Training programs designed for teachers should address all factors related to the intention to report to enable teachers' recognition and reporting of CAN and foster their confidence over intervening in these sensitive cases.

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# Health Behaviour of Police Officers in Relation to Hypertension. Observations from a Hungarian County

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**ABSTRACT. *Purpose*:** The aim of this study is to assess the health behavior of those who are treated for high blood pressure among law enforcement officers, compared to those who are not under treatment for high blood pressure. ***Methodology:*** In Hungary, a cross-sectional survey was carried out among those serving in the County of Szabolcs-Szatmár-Bereg. This is the publication of partial results of a study carried out in the framework of a comprehensive health behavior survey. ***Findings:*** The number of items in the sample is 1,719. 11.40% were treated for hypertension. There is a significant difference in gender ($\chi2$= 3.979; p=0.047). The highest proportion of people with hypertension is among those with a secondary school leaving certificate (18.8%). The lowest prevalence is among university graduates (9.1%). Education level is significantly associated with hypertension ($\chi2$=17.013; p=0.004). There is a very strong significant association between length of time in service and hypertension ($\chi2$=83.204; p= 0.000). The proportion of people with hypertension increases steadily with the length of service. No significant differences were found for work schedule, smoking, alcohol consumption or physical activity. When examining the relationship between social support and hypertension, there is a significant difference between grandparent support and parent support (p=0.002; p=0.012). Those treated for hypertension can count on less parental or grandparental support. Non-hypertensives have higher personal health awareness (p=0001), as well as higher self-assessment of health (p=0.000). They are more motivated to avoid unhealthiness (p=0.002) and to maintain

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their health (p=0.009). They feel in better health (p=0.000) and are confident that this will be maintained in the future (p=0.000). Health concern is higher among hypertension patients (p=0.045). Both internal and external health control scores are higher (p=0.000; P=0.001) as is health anxiety (p=0.000). ***Value:*** The prevalence of hypertension increases with age, so it is of paramount importance that appropriate health promotion programmes help law-enforcement workers to maintain their health.

**Keyword:** high blood pressure, law enforcement, health behavior, health promotion

## INTRODUCTION

The present study was designed to explore the prevalence of hypertension among law enforcement workers. We compare the health behaviours of untreated and treated hypertensives, highlighting the health behaviours of police officers treated for hypertension. In our study, we do not discuss the different forms of medical treatment, we only examine the lifestyle-related factors.

In Europe, cardiovascular disease accounts for 48% of all deaths (Allender S, 2008). Hypertensive heart disease is responsible for about a quarter of the causes of heart failure. Appropriate management of hypertension reduces the risk of cardiovascular disease outcomes, including stroke, heart attack, and heart failure (SPRINT, 2017, Towsend, 2016)

## IN THE FIELD OF LAW ENFORCEMENT

Hypertension among police officers is high according to a review of various studies. Different countries have studied the prevalence of hypertension and the health factors that prevent it in different ways.

In a study in India, 67.90% of police officers working in a district were found to have hypertension, of whom 75.8% were diagnosed. Length of service, higher position, and inadequate diet show a higher association with hypertension. It was found that an increase in BMI and waist circumference also increases the prevalence of high blood pressure. (Chauhan, 2022) Results from the West Bengal region also show that police officers have more cardiovascular risk factors than the general population in that region. BMI index, hypertension, cholesterol, triglyceride, and lipoprotein levels were also higher among police officers (Saha, 2010)

Zimmerman (2012) examined cardiovascular diseases and the prevalence of their risk factors in his meta-analysis of law enforcement studies. Although there are conflicting studies, the majority of research suggests that the risk of cardiovascular disease and mortality among police officers is high among active (15.3-38.5%) and retired police officers. High blood pressure, dyslipidemia, obesity, diabetes, smoking, and a sedentary lifestyle are all factors that contribute to the development of these diseases. Zimmerman highlights profession-specific risk factors, such as sudden physical stress (a mostly sedentary activity is suddenly interrupted by extreme physical exertion), events experienced in connection with the performance of work tasks, and stress from the organizational system. Shift work also affects health by changing sleep and eating habits.

In a meta-analysis, Magnavita (2018) investigated the association between police stress and cardiovascular disease. Most of the studies concluded that high levels of stress increase cardiovascular morbidity and its risk factors. The risk factors include weight gain, hypertension, dyslipidemia, and diabetes. These associations have better been supported by longitudinal studies.

## HEALTH BEHAVIOR OF HYPERTENSIVE PATIENTS

Several studies have been conducted to investigate the main health behaviors of people with hypertension. There were studies where it was found that those treated for hypertension improved their lifestyle to maintain their health, but there are also several studies where this lifestyle change was not observed. Most countries monitor the health behavior of their population to help improve a better quality of life by making changes.

A Dutch sample found that subjects who are generally aware of their high blood pressure lead a healthier lifestyle than those who are unaware of it. They are characterized by dietary changes, lower BMI, and lower alcohol consumption. (Scheltens, 2010)

A Canadian survey published in 2008 found that the main lifestyle modification for newly diagnosed hypertensive patients was smoking cessation. Almost one in five smokers quit after being informed that they had high blood pressure. A smaller change was observed in the reduction of physical inactivity. People who did not take antihypertensive medication were not more likely to make lifestyle changes. People who took antihypertensive medication were more likely to quit smoking and more likely to increase their physical activity. The proportion of obese people (BMI higher than 30 $^{kg}/_{m2}$) increased rather than decreased after the diagnosis of hypertension. Weight gain was particularly significant among those using antihypertensive medication and was greatest among women using beta-blockers, raising the possibility of a drug effect. (Neutel, 2008)

However, according to data published in 2012, most Canadians changed their lifestyle after a blood pressure diagnosis. Those who reported less physical activity mostly indicated a chronic illness as the cause. Lack of motivation was found to be behind the change in eating habits. Low desire, interest, or awareness is often a barrier to limiting salt intake, changing diet, losing weight, stopping smoking, and reducing alcohol consumption. (Gee, 2012)

According to the results of a study conducted among people over 50 years of age in England, the prevalence of smoking is lower in the case of hypertensives, which is due to the increased frequency of quitting. They are characterized by a sedentary, inactive lifestyle, but this is more due to associated diseases and movement problems rather than the belief that taking medication can compensate for the health condition, and thus lifestyle changes are not necessary. High alcohol consumption and a sedentary lifestyle probably contributed to the development of high blood pressure in the first place. (Steptoe, 2009)

In a Korean longitudinal study, it was found that among hypertensive subjects compared to healthy subjects, the group diagnosed with hypertension was more obese than those without hypertension. However, smoking and alcohol consumption decreased over time with all participants, and physical activity increased. A group-by-group interaction was observed for smoking: smoking decreased to a greater extent in the group diagnosed with high blood pressure. No significant interactions were found for other behaviors. (Ahn, 2023)

In a survey conducted among hypertensives in Indonesia, a positive correlation was found between the responsibility of those with high blood pressure and nutrition as a health-protective behavior. However, due to the lack of motivation and planning, exercise was not typical. (Wicaksana, 2022)

During a Brazilian survey, the reports showed that dietary recommendations were followed, but this was not reflected in the anthropometric indicators. The importance of family support was significant, for example, in changing meals, but rather as a hindering factor. Regular exercise was not typical. (Barros, 2014) Another study in Brazil found that 63.8% of hypertensives did not exhibit appropriate health behaviors. The tendency was that they did not give up health-damaging behaviors (smoking, alcohol consumption). The least reported was the consumption of fruit and vegetables. The most important factors influencing inappropriate behavior change are the short time since diagnosis, not taking medication, not visiting a doctor, and subjectively perceived good health (V.Dionato, 2021)

According to a Greek study, a change in the diet of hypertensive patients was detectable, which meant healthier diets. (Pitsavos, 2006)

Research on a sample from Iran showed that knowledge of the disease did not significantly change behavior. Two groups were compared. One group knew about their hypertension, the other group did not know about it, but the tests showed hypertension. There were differences in salt and alcohol consumption and smoking between those who knew about their disease and those who did not. Those who were aware of their disease and did not take medication led a better lifestyle than those who had hypertension and took antihypertensive medication. Those who were unaware of their condition had higher levels of physical activity than those who were aware of their condition. The reason for this may be related to age. Those who were unaware of their disease were younger and more likely to be more physically active than older people with hypertension (Akbarpour, 2018).

In their meta-analysis, Elnaem (2022) found that factors such as sociodemographic factors and comorbidity were the most common obstacles to controlling high blood pressure. This was followed by barriers to medication adherence, followed by lifestyle barriers (dietary habits, physical inactivity), and barriers related to affordability and accessibility. Obstacles related to care and awareness (knowledge, health literacy) were among the last of the aggravating factors, together with obstacles related to prescribed antihipertension medication.

## FACTORS UNDERLYING HEALTH BEHAVIOR IN HYPERTENSIVE PATIENTS

Factors underlying health behavior of hypertensive patients have been found in several studies. Health behavior was significantly associated with income, social support, knowledge about hypertension, and perceived barriers. These findings suggest that health behavior of people with hypertension can be improved by increasing knowledge about hypertension, increasing social support, and decreasing perceived barriers. (Oo, 2018)

A cross-country study on medication adherence found that low age, low self-efficacy, and perceived barriers (costs) were factors behind not taking medication. In Hungary, social support is also found to be an influencing factor: those with lower levels of social support comprise a higher proportion of those who do not take medication. (Morrison, 2015) Building a relationship with patients and providing personalized counseling improves self-efficacy and social support, thereby promoting appropriate medication taking. (Criswell, 2010)

Eshah (2021) found that behavior change was not influenced by sociodemographic factors or clinical history. Concerning smoking, there was an inverse proportionality - if physical activity and weight control were higher, there was less tendency to reduce smoking, which may be due to the higher proportion of non-smokers (Eshah, 2021).

Adults with high self-efficacy are more likely to adhere to self-care in the management of hypertension, so it is advisable to design interventions that improve self-care through self-efficacy (Tan, 2021).

According to Wiener's research (2017), people with hypertension report significantly higher vulnerability and lower self-efficacy than those without hypertension), which may promote the pursuit of an active lifestyle. Those who (no longer) have high blood pressure as a result of medical treatment and lifestyle changes (regular physical activity) do not have increased vulnerability. Those with current high blood pressure had lower action planning and self-efficacy level, which makes it difficult to develop appropriate health behaviors (Wienert, 2017).

## HEALTH PROMOTION PROGRAMS

According to the main recommendations, lifestyle changes for the treatment of high blood pressure are mainly the cessation of harmful addictions (smoking, alcohol consumption), developing an appropriate diet, and reducing sodium, increasing physical activity, and reducing obesity (Guy De Backer, 2003; Maraj, 2013).

Given the tendency for cardiovascular disease risk factors to accumulate, BMI assessment and blood pressure measurement are excellent non-invasive screening tools for core wellness programs. Second, individuals at higher risk of cardiovascular disease (those in the prehypertension and hypertension categories) should receive individualized counseling for non-pharmacological management of blood pressure, including diet, sodium restriction, physical activity, moderate alcohol consumption, and maintaining a healthy weight, weight loss for those with BMI in the overweight/obese category (Kales, 2009).

Motivational interviewing can effectively improve blood pressure control in patients with hypertension (Huang, 2023). Physical activity support programs and wellness programs contribute to reducing work-related stress and increasing individual well-being, reducing the development of chronic diseases (Acquadro Maran, 2018).

Health behaviors are also supported by complementary interventions with a positive psychology approach, targeting the emotional correlates of behavior that facilitate successful behavior change. However, research is still needed to uncover the exact mechanisms. (Feig, 2022) In law enforcement, intervention approaches based on positive psychology are effective in reducing depression, anxiety, and negative effects in particular. However, the effect was limited in terms of other health behaviors. (Kukucska D, 2023).

## METHOD

### *Sample*

The research was conducted in 2020, 2021 and 2022. The target population of the research was the professional staff of the Szabolcs-Szatmár-Bereg County Police Headquarters. The questions on hypertension were also part of a complex survey package on health awareness and health behaviour. The research was approved by the United Psychological Research Ethics Committee (EPKEB) (2021-70 (amendment 2020-24).

The questionnaire was filled in as part of the compulsory periodic psychological aptitude test for police officers. Before starting to fill out, those intending to participate in the research received written and verbal information about the questionnaire and its voluntariness. The participants could start participating after giving their written consent. The number of professional police officers in Szabolcs-Szatmár-Bereg County is approximately 2,200. The approximate percentage of respondents was 78%. The number of responses providing data relevant to hypertension was 1,719. 87.9% (n= 1467) of the respondents were male, 13.8% were female (n=235). The mean age of the sample is 39.19 years (SD=8.13), the youngest respondent was 21 years old and the oldest was 62 years old.

### *Measuring tools*

In addition to the traditional socioeconomic characteristics (gender, age group, educational level), the questionnaire also includes the length of time spent in the workforce.

The work schedule is among the factors we examined. In law enforcement, police officers have a variety of working hours, so the questionnaire includes the following most common work schedule:

- Office: from Monday to Friday between 8 a.m. and 4 p.m
- Commanding: in practice, it usually corresponds to the office work schedule but the schedule can be changed at any time, depending on the given command
- Shift 1.: 12/24-hour service
- Shift 2.: 24/48-hour service

The 19-item disease list used in the Hungarostudy 2013 survey was also included in the questionnaire. Respondents were asked to indicate whether they had been treated as an outpatient or had received inpatient care for diseases such as diabetes, gastric ulcer, hypertension, cancer in the past year or during their lifetime (Susánszky É., 2013). Among those who gave responses, we singled out those suffering from high blood pressure.

The frequency of alcohol consumption was measured with the following question:

How often do you drink alcoholic beverages:

1. never
2. monthly or less often
3. twice or four times per month
4. two to three times per week
5. at least four times per week

The following questions were asked in relation to smoking:

- Which statement is true for you? 1. have never smoked, 2. have quit, 3. still smoke.
- How long have you been smoking?.....years
- If you smoke, usually how many cigarettes do you smoke per day? .....db

How often do you do sports such as swimming, running, cycling, football, aerobics or other physical activity? 1. never; 2. less than once per week; 3. once per week; 4. several times per week

Apart from playing sports, how often do you do physical activity, such as gardening or construction, where your heart beats faster for at least 10 minutes, you get overheated, or you sweat: 1. never; 2. once a week; 3. several times per week

Do you pay attention to what and how much you eat? 1.always; 2. most of the time; 3. sometimes; 4. never

Are you on a special diet? 1. yes; 2. no

Do you take nutritional supplements? 1. yes; 2. no

To assess social support, we used the Caldwell Social Support Questionnaire, which is used to assess the various sources and extent/measures of social support. It was translated into Hungarian by Kopp (1992). The following are possible sources of social support: parent, spouse, partner, grandparent, schoolmate, neighbor, colleague, friend, child, relative, helper, church group, association-civic group. The strength of the support was described on a four-point scale: 0 = never; 3 = often or always.

The questionnaire developed by Snell (1991) focuses on the measurement of personality variables related to physical health. The Health Orientation Scale consists of 50 items related to health status.

Respondents were asked to indicate the extent to which they identify with each statement on a 5-point likert scale (1 = not at all characteristic of me, 2 = slightly characteristic of me, 3 = somewhat characteristic of me, 4 = moderately characteristic of me, and 5 = very characteristic of me). The 50 items are divided into 10 subscales, each containing 5 items. Total scoring for each subscale was 0–20. The subscales measure the following personality variables:

1. Personal Health Consiousness, PHC
2. Health Image Concern, HIC
3. Healt Anxiety, HA
4. Health-esteem and Confidence, HEC
5. Motivation to Avoid Unhealthiness, MAU
6. Motivation for Healthiness, MFH
7. Internal Health Controll, IHC
8. Externall health Control, EHC
9. Health Expectations, HE
10. Health Status, HS

### *Statistical analysis*

The data were analyzed using the IBM SPSS Statistics for Windows v26.0 program package. After calculating the basic statistics, we checked the normality of the data using the Shapiro-Wilk test, and further analyses were designed accordingly. Since the data typically showed a non-normal distribution, we chose non-parametric tests in the analyses: we performed a Chi-square test for gender differences, educational attainment, work schedule, length of service and some health behavior indicators. Mann-Whitney U test was used for possible sources of social support regarding and the scales of the HOS questionnaire. The reliability indicators of the HOS questionnaire, the Cronbach-α values were between 0.582 and 0.818 so the questionnaire is considered reliable.

## RESULTS

Of the 1719 respondents, 87.9% were male and 13.8% were female (Figure 1).

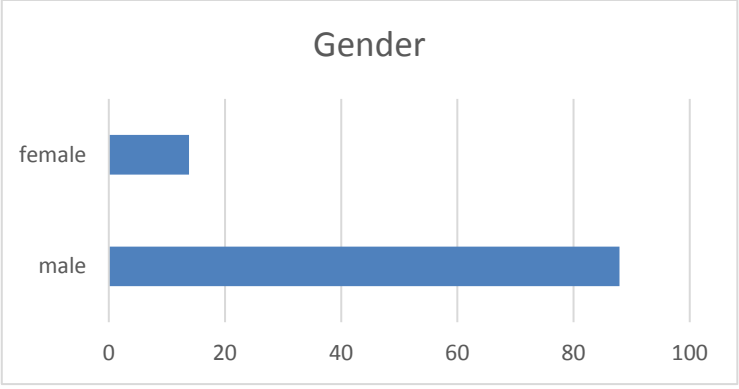


**Figure 1.** Gender frequency (edited by the authors)

The minimum educational requirement for police officers is a secondary school leaving certificate. The most common is specialized post-secondary education for law enforcement personnel (45.08%) (Figure 2). This training provides a professional police qualification to graduates. So the majority of the sample have done secondary school level education (secondary school certificate or police professional qualification) (59.62%). One-third of the respondents have done higher education (34.09%).

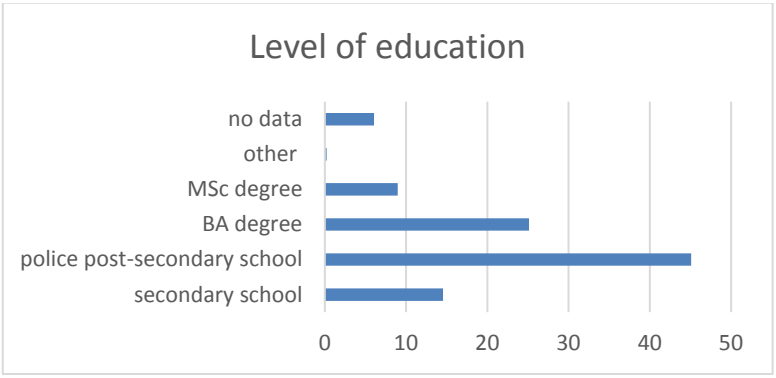


**Figure 2.** Level of education (edited by the authors)

In terms of length of service, those who have served for 15 to 20 and 20 to 25 years accounted for more than 40% of the sample (41.88%), they are the most prominent group in the sample. Those with more than 30 years of service are the least frequent (4.07%) (Figure 3). Basically, due to the previous retirement legislation and the then existing career model, there are currently few members with more than 31 years of service.

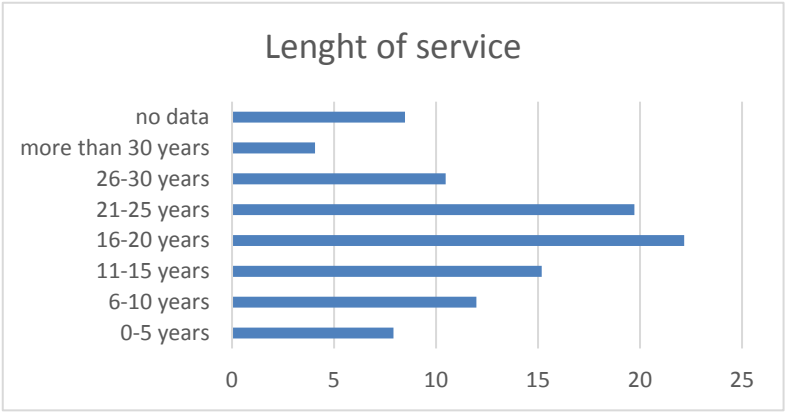


**Figure 3.** Lenghth of service (edited by the authors)

Law enforcement personnel can work in various work schedules (Figure 4). The official working schedule includes the period between 8 am and 4 pm, with 10.4% of the staff work in such schedule. The command work schedule can vary depending on service needs, usually the aim is to work according to the office schedule. More than half of the staff, 53.0%, work under command schedule. Shift 1, which means the work schedule in the 12/24 cycle working pattern, affects 19.9% of the staff. The lowest proportion, with 1.2%, in the sample, is Shift 2 which is a 24/48 hour working pattern.

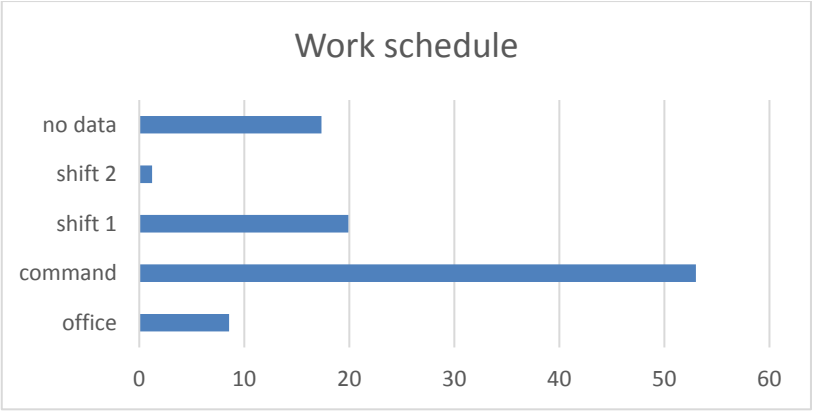


**Figure 4.** Work schedules (edited by the authors)

32.3% of respondents smoke (Figure 5) and 67.7% no longer smoke. 43.3% of respondents have never smoked or have already quit smoking (24.4%).

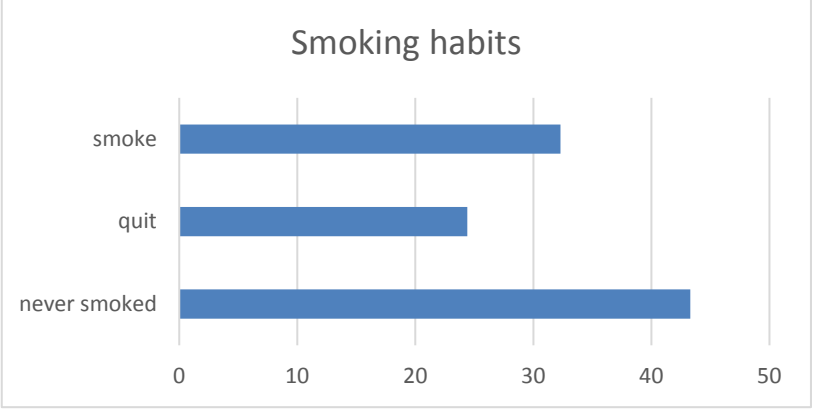


**Figure 5.** Smoking habits Dohányzási szokások (edited by the authors)

Regarding alcohol consumption habits (Figure 6), almost 70% of respondents (69.8%) drink alcohol a few of times a month. Almost one-fifth (19.4%) of respondents never drink alcohol, while 1.2% drink alcohol four times a week.

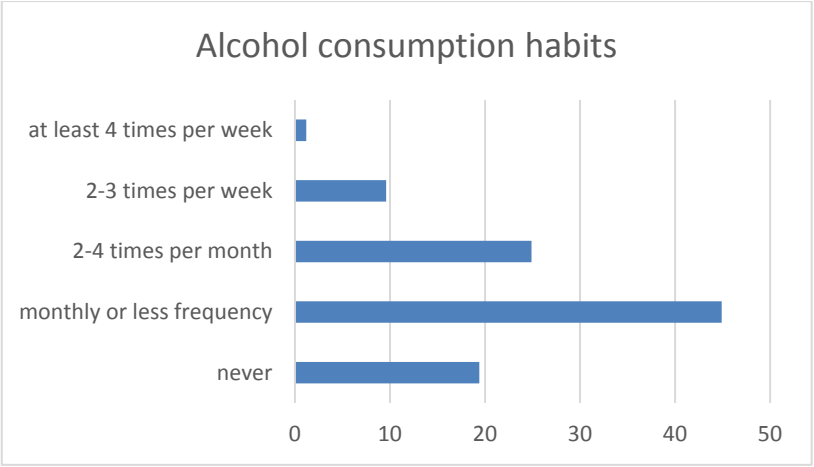


**Figure 6.** Alcohol consumption habits (edited by the authors)

In terms of sports and physical activity (Figure 7, Figure 8), a third of the respondents do sports several times a week, so more than half of the respondents do sports on a weekly basis. Slightly more than half of respondents (54.6%) do physical activity several times a week, while more than a third do it at least once a week (36.5%).

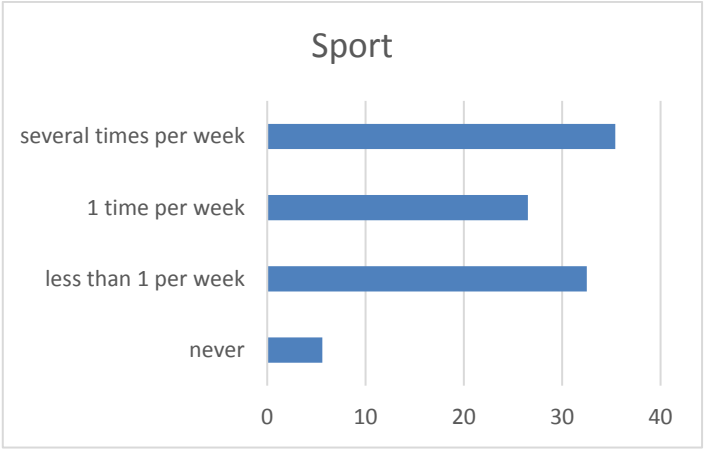


**Figure 7.** Sport activity (edited by the authors)

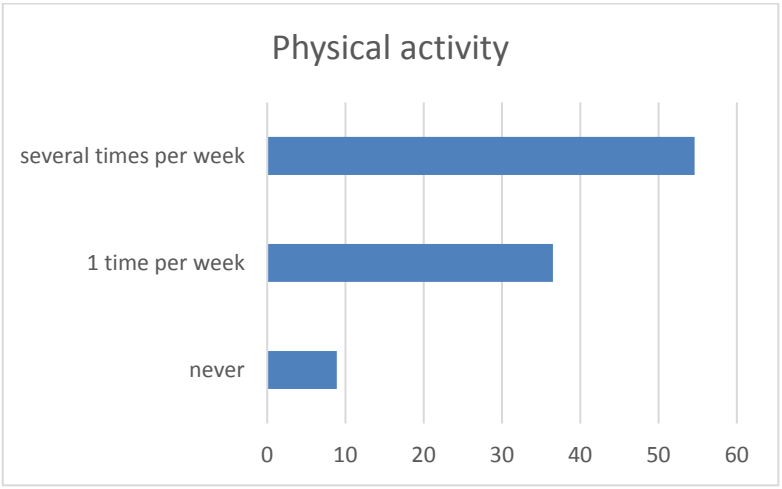


**Figure 8.** Physical activity (edited by the authors)

The results show that 63.4% of respondents try to pay attention to their diet (Figure 9). 29.2% and 6.7% sometimes or never pay attention to it.

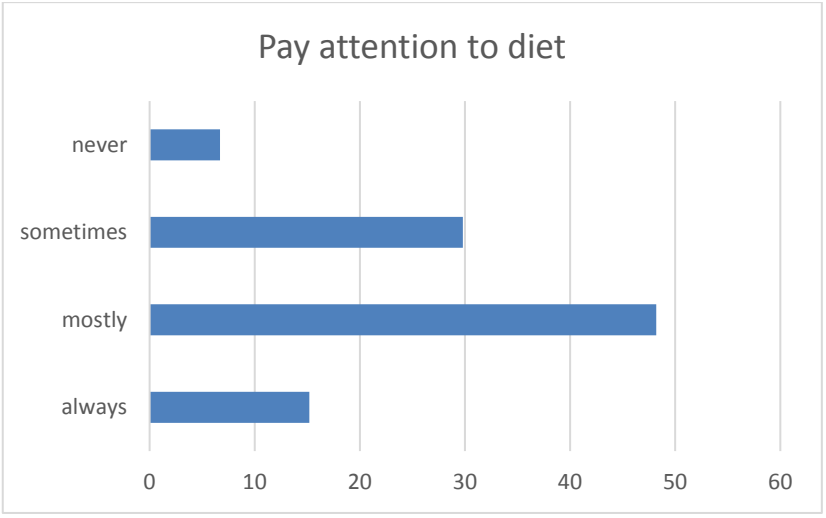


**Figure 9.** Pay attention to diet (edited by the authors)

The majority of respondents do not follow a special diet (95.1%) and more than half of them do not take any nutritional supplements (62.1%) (Figure 10, 11)/

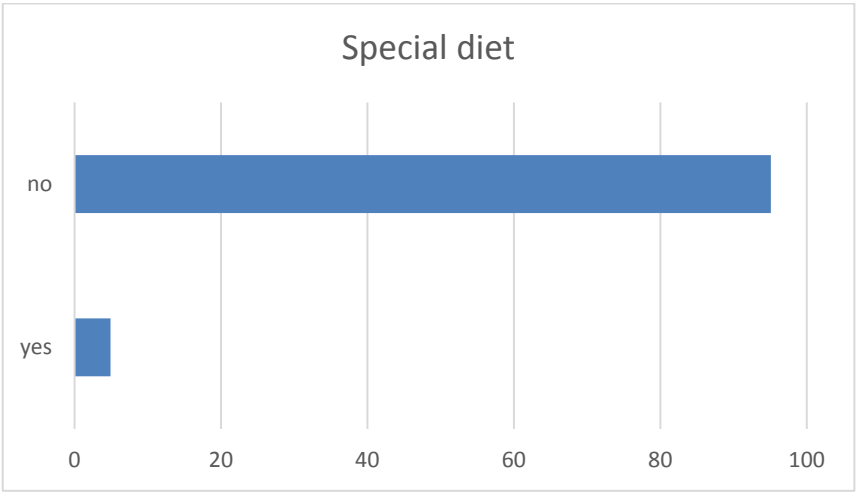


**Figure 10.** Special diet (edited by the authors)

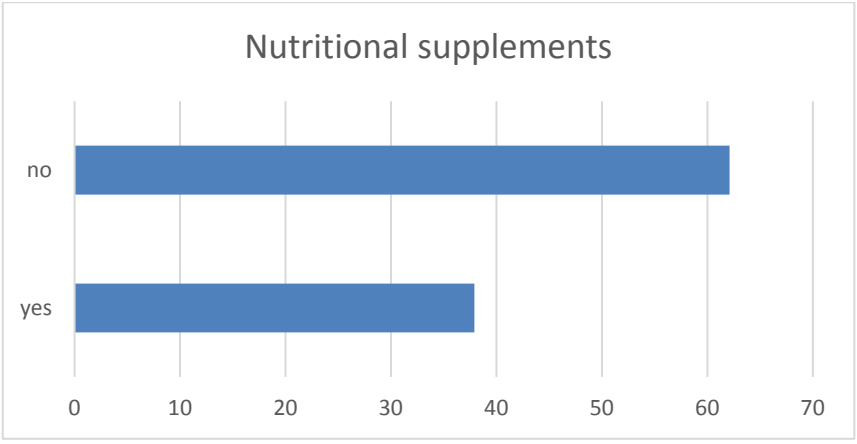


**Figure 11.** Nutritional supplements (edited by the authors)

In the social support questionnaire, based on the frequency of mention (Table 1) parents, co-workers, friends as possible support were mentioned most often in the questionnaire (1582 – 1549 – 1535), while the co-habiting partner was mentioned the least often (562). The spouse represented the highest average value ( M=2.81; SD=±0.66), then the child (M=2.65; SD=±0.79) and the friend (M=2.59; SD=±0.62). The lowest was represented by the church group (M=0.81; SD=±0.94). Comparing the frequency of mention and the average of the strength of support, it can be seen that both values are high for

parents and friends, meaning they are available and respondents can count on their support. In the case of the spouse and the child, the mention frequency is lower compared to the previous ones, but the support is stronger, while in the case of the co-worker and relative, social support is weaker. The frequency of mentioning the co-worker is in third place (89.30%), but the strength of the support is lower (M=2.14; SD=±0.66).

**Table 1.** Social support (edited by the authors)

| Social support | mention frequency | | M | SD |
|---|---|---|---|---|
| | n | % | | |
| 1. parents | 1582 | 92,03 | 2,57 | 0,83 |
| 2. spouse | 1253 | 72,89 | 2,81 | 0,66 |
| 3. partner | 562 | 32,69 | 2,24 | 1,25 |
| 4. grandparents | 747 | 43,46 | 1,60 | 1,31 |
| 5. schoolmate | 658 | 38,28 | 0,96 | 1,02 |
| 6. neighbour | 1284 | 74,69 | 1,54 | 0,94 |
| 7. co-workers | 1535 | 89,30 | 2,14 | 0,66 |
| 8. friends | 1549 | 90,11 | 2,59 | 0,62 |
| 9. child | 1206 | 70,16 | 2,64 | 0,79 |
| 10. relatives | 1445 | 84,06 | 2,05 | 0,84 |
| 11. helper | 807 | 46,95 | 0,98 | 0,94 |
| 12. church group | 814 | 47,35 | 0,81 | 0,94 |
| 13. civilian group | 842 | 48,98 | 0,86 | 0,96 |

Based on the HOS questionnaire results (Table 2), respondents gave the highest scores on the Health-esteem and Confidence scale (M=19.83; SD=3.58), indicating that they care about and trust their physical fitness and its durability. The Internal Health Controll scale is the second highest (M=19.06; SD=3.72), according to which individuals rate highly their personal control over influencing their own health. Closely related to this is the third highest mean score item, the Health Expectations scale (M=18.79; SD=3.70), that is, the belief that one's health will remain excellent and stable in the future. The scales with the lowest mean scores are Health Anxiety scale(M=8.84; SD=3.23) and Health Image Concern scale (M=9.73; SD=3.99), that is, anxiety about their health is low and they feel little concern about what others think about their health.

**Table 2.** HOS (edited by the authors)

| | n | M | SD |
|---|---|---|---|
| 1. Personal Health Consiousness (PHC) | 1668 | 17,81 | 3,54 |
| 2. Health Image Concern (HIC) | 1669 | 9,73 | 3,99 |
| 3. Healt Anxiety (HA) | 1668 | 8,84 | 3,23 |
| 4. Health-esteem and Confidence (HEC) | 1670 | 19,83 | 3,58 |
| 5. Motivation to Avoid Unhealthiness, (MAU) | 1666 | 17,22 | 4,07 |
| 6. Motivation for Healthiness (MFH) | 1667 | 16,77 | 3,65 |
| 7. Internal Health Controll (IHC) | 1668 | 19,06 | 3,72 |
| 8. Externall health Control (EHC) | 1671 | 10,39 | 3,19 |
| 9. Health Expectations (HE) | 1665 | 18,79 | 3,70 |
| 10. Health Status (HS) | 1668 | 18,27 | 3,40 |

### *Comparison of those treated and not treated for hypertension*

1,501 people were not treated for hypertension, and 196 people were treated for hypertension. The prevalence of hypertension increases significantly with age (U=80774.5; Z=-10.199; p=0.000) 87.9% of the respondents (n=1467) were men, 13.8% were women (n=235) (Table 3). 87.9% of men are not treated with hypertension, 12.1% have high blood pressure. In the case of women, 92.3% are not treated for hypertension, and 7.7% of female respondents have hypertension. 90.8% of those treated for hypertension are male and 9.2% are female, so 1.1% (n=18) of all respondents treated for hypertension are female, while 10.5% (n=178) treated for hypertension are male. The results show that the difference between genders is significant ($\chi 2$= 3.979; p=0.047). Men are more likely to be treated for hypertension.

**Table 3.** Gender distribution and hypertension (edited by authors)

| Gender | Prevalence in the total sample n (%) | Not treated with hypertension n (%) | Treated with hypertension n (%) |
|---|---|---|---|
| male | 1467 (87,9) | 1289 (87,9) | 178 (12,1) |
| female | 235 (13,8) | 217 (92,3) | 18 (7,7) |

In terms of educational attainment (Table 4), the highest prevalence of hypertension was among those with a secondary school certificate (18.8%). The lowest prevalence was among Msc education (9.1%). Educational attainment was significantly associated with hypertension ($\chi 2$=17.013; p=0.004).

**Table 4.** Hypertension and educational attainment (edited by authors)

| Level of education | Prevalence in the total sample n (%) | Not treated with hypertension n (%) | Treated with hypertension n (%) |
|---|---|---|---|
| secondary school | 250 (14,54 | 203 (81,2) | 47 (18,8) |
| police post-secondary school | 775 (45,08) | 693 (90,2) | 75 (9,8) |
| BA degree | 432 (25,13) | 383 (89,1) | 47 (10,9) |
| MSc degree | 154 (8,96) | 90,9% (n=140) | 14 (9,1) |

According to the length of time in service (Table 5), there are no people with hypertension among those with less than 6 years of service. The proportion of people with hypertension increases continously with length of service, with the highest proportion (21.4%) among those with more than 30 years of service. The level of significance between length of time in service and hypertension is very strong ($\chi 2=83.204$; $p=0.000$).

**Table 5.** Correlation of length of time in service and hypertension (edited by authors)

| Length of time in service | Prevalence in the total sample n (%) | Not treated with hypertension n (%) | Treated with hypertension n (%) |
|---|---|---|---|
| 0-5 years | 136 (7,91) | 1,6 (100) | 0 (0,0) |
| 6-10 years | 206 (11,98) | 194 (94,6) | 11 (5,4) |
| 11-15 years | 261 (15,18) | 248 (96,9) | 8 (3,1) |
| 16-20 years | 381 (22,16) | 332 (87,7) | 48 (12,6) |
| 21-25 years | 339 (19,72) | 272 (80,7) | 65 (19,3) |
| 26-30 years | 180 (10,47) | 142 (79,3) | 37 (20,7) |
| 31+ | 70 (4,07) | 55 (78,6) | 15 (21,4) |

Regarding work schedule, around 11% of those working in command and shift work have high blood pressure (Table 6), which makes the proportion slightly lower among those working in the office work schedule. The probability of high blood pressure is the highest among those working in the Shift 2 work schedule (23.8%). According to statistical indicators ($\chi 2=3.692$; $p= 0.299$) there is no correlation between hypertension and work schedule.

**Table 6.** Correlation of work schedule and hypertension (edited by authors)

| Work schedule | Prevalence in the total sample n (%) | Not treated with hypertension n (%) | Treated with hypertension n (%) |
|---|---|---|---|
| official | 147 (8,55) | 133 (90,5) | 14 (9,5) |
| command | 911 (53,00) | 804 (88,4) | 105 (11,6) |
| shift 1. 1 (12/24) | 342 (19,90) | 301 (88,5) | 39 (11,5) |
| shift 2. 2 (24/48) | 21 (1,22) | 16 (76,2) | 5 (23,8) |

Regarding smoking habits (Table 7), the distribution of smoking habits between hypertensives and those not treated for hypertension is similar, around 10%. According to the measured indicators, smoking habits are not related to the frequency of hypertension ($\chi 2=1.442$; $p= 0.486$).

**Table 7.** Smoking habits and hypertension

| Smoking habits | Prevalence in the total sample n (%) | Not treated with hypertension n (%) | Treated with hypertension n (%) |
|---|---|---|---|
| never | 733 (43,3) | 87,7% (n=643) | 12,3% (n=90) |
| quit | 413 (24,4) | 90,1% (n=372) | 9,9% (n=41) |
| smoke | 546 (32,3) | 88,5% (n=483) | 11,5% (n=63) |

We found the highest number of respondents treated for hypertension (17.2%) among those who drink alcohol 2 or 3 times a week. (Table 8). It is definitely remarkable that there are people treated for hypertension who consume alcohol at least four times a week. Regarding alcohol, the correlation between hypertension and alcohol consumption frequency is not significant, either ($\chi 2=6.198$; $p=0.174$).

**Table 8.** Correlation of alcohol consumption and hypertension (edited by authors)

| Alcohol consumption habits | Prevalence in the total sample n (%) | Not treated with hypertension n (%) | Treated with hypertension n (%) |
|---|---|---|---|
| never | 329 (19,4) | 293 (89,1) | 36 (10,9) |
| monthly or less frequemtly | 763 (44,9) | 683 (89,5) | 80 (10,5) |
| 2-4 times per month | 24,9 (423) | 375 (88,7) | 48 (11,3) |
| 2-3 times per week | 163 (9,6) | 135 (82,8) | 28 (17,2) |
| at least 4 times per week | 20 (1,2) | 17 (85,0) | 3 (15,0) |

In terms of doing sport and physical activity (Tables 9 and 10), the smallest number of people treated for hypertension comes from those who exercise several times a week (8.8%). The biggest number of people treated for hypertension (15.0%) is from among those who exercise less often than once a week. The results indicate a significant relationship ($\chi 2=11.129$; $p= 0.011$).

The physical activity of those treated and not treated with hypertension is similar, but the responses are not significantly related to hypertension ($\chi 2=2.956$; $p= 0.229$).

**Table 9.** Doing sport

| Sports | Prevalence in the total sample n (%) | Not treated with hypertension n (%) | Treated with hypertension n (%) |
|---|---|---|---|
| never | 95 (5,6) | 84 (88,4) | 11 (11,6) |
| less than 1 per a week | 553 (32,5) | 470 (85,0) | 83 (15,0) |
| 1 times per a week | 450 (26,5) | 401 (89,1) | 49 (10,9) |
| several times per a week | 602 (35,4) | 549 (91,2) | 53 (8,8) |

**Table 10.** Correlation of physical activity and hypertension (edited by authors)

| Physical activity | Prevalence in the total sample n (%) | Not treated with hypertension n (%) | Treated with hypertension n (%) |
|---|---|---|---|
| never | 151 (8,9) | 140 (92,7) | 11 (7,3) |
| 1 times per a week | 620 (36,5) | 547 (88,2) | 73 (11,8) |
| several times per a week | 929 (54,6) | 817 (87,9) | 112 (12,1) |

Among those who do not pay attention to their diet, the lowest rate is from those treated for hypertension (7.9%). (Table 11) Among those who always and most often pay attention to diet, the proportion with hypertension is 10.8% and 11.6%, respectively. The highest is among those who sometimes pay attention to their diet (12.6%). The statistical values show no significant correlation ($\chi 2=2.205$; $p= 0.532$).

**Table 11.** Attention to diet and hypertension (edited by authors)

| Attention to diet | Prevalence in the total sample n (%) | Not treated with hypertension n (%) | Treated with hypertension n (%) |
|---|---|---|---|
| always | 259 (15,2) | 231 (89,2) | 28 (10,8) |
| mostly | 819 (48,2) | 724 (88,4) | 95 (11,6) |
| somtimes | 507 (29,8) | 443 (87,4) | 64 (12,6) |
| never | 114 (6,7) | 105 (92,1) | 9 (7,9) |

For special diets and nutritional supplements (Tables 12 and 13), no significant value was found ($\chi2=1.003$; $p=0.343$; $\chi2=0.014$; $p=0.936$). There are similar proportions of hypertensives between those who did or did not follow special diets and between those who did or did not take supplements.

**Table 12.** Special diet and hypertension (edited by authors)

| Special diet | Prevalence in the total sample n (%) | Not treated with hypertension n (%) | Treated with hypertension n (%) |
|---|---|---|---|
| yes | 74 (4,9) | 63 (85,1) | 11 (14,9) |
| no | 1425 (95,1) | 1267 (88,9) | 158 (11,1) |

**Table 13.** Special diet and hypertension (edited by authors)

| Nutritional supplements | Prevalence in the total sample n (%) | Not treated with hypertension n (%) | Treated with hypertension n (%) |
|---|---|---|---|
| yes | 625 (37,9) | 553 (88,5) | 72 (11,5) |
| no | 1024 (62,1) | 908 (88,7) | 116 (11,3) |

In relation to social support (Table 14), there is a significant difference in support from grandparents ($p=0.002$) and parents ($p=0.012$) between hypertensives and non-hypertensives. Those with hypertension perceive less support from these two groups.

**Table 14.** Correlation of social support and hypertension (edited by authors)

| | n | M | SD | U | Z | p |
|---|---|---|---|---|---|---|
| 1 parents | 1570 | 2,57 | 0,83 | 125864,50 | -2,500 | 0,012 |
| Not treated with hypertension | 1396 | 2,60 | 0,80 | | | |
| Treated with hypertension | 174 | 2,40 | 0,99 | | | |
| 2 spouse | 1242 | 2,81 | 0,66 | 97290,50 | -0,135 | 0,911 |
| Not treated with hypertension | 1085 | 2,80 | 0,66 | | | |
| Treated with hypertension | 157 | 2,80 | 0,67 | | | |
| 3 partner | 556 | 2,24 | 1,25 | 12790,50 | -1,570 | 0,121 |
| Not treated with hypertension | 499 | 2,27 | 1,2 | | | |
| Treated with hypertension | 57 | 1,96 | 1,41 | | | |
| 4 grandparents | 737 | 1,60 | 1,31 | 17852,50 | -3,101 | 0,002 |
| Not treated with hypertension | 669 | 1,65 | 1,30 | | | |
| Treated with hypertension | 68 | 1,13 | 1,31 | | | |
| 5 schoolmate | 651 | 0,96 | 1,02 | 19825,50 | -1,008 | 0,315 |
| Not treated with hypertension | 586 | 0,98 | 1,03 | | | |
| Treated with hypertension | 65 | 0,81 | 0,88 | | | |

| | n | M | SD | U | Z | p |
|---|---|---|---|---|---|---|
| 6 neigbour | 1274 | 1,54 | 0,94 | 84444,00 | -0,086 | 0,933 |
| Not treated with hypertension | 1123 | 1,54 | 0,95 | | | |
| Treated with hypertension | 151 | 1,54 | 0,84 | | | |
| 7 co-workers | 1522 | 2,14 | 0,66 | 11484,50 | -0,744 | 0,456 |
| Not treated with hypertension | 1346 | 2,15 | 0,66 | | | |
| Treated with hypertension | 176 | 2,10 | 0,70 | | | |
| 8 friends | 1537 | 2,59 | 0,62 | 109746,00 | -1,800 | 0,073 |
| Not treated with hypertension | 1364 | 2,59 | 0,63 | | | |
| Treated with hypertension | 173 | 2,53 | 0,59 | | | |
| 9 child | 1194 | 2,64 | 0,79 | 80556,00 | -0,607 | 0,544 |
| Not treated with hypertension | 1035 | 2,64 | 0,80 | | | |
| Treated with hypertension | 159 | 2,71 | 0,68 | | | |
| 10 relatives | 1432 | 2,05 | 0,84 | 80556,00 | -0,607 | 0,871 |
| Not treated with hypertension | 1266 | 2,05 | 0,84 | | | |
| Treated with hypertension | 166 | 2,06 | 0,84 | | | |
| 11 helper | 800 | 0,98 | 0,94 | 30541,00 | -0,564 | 0,574 |
| Not treated with hypertension | 711 | 0,99 | 0,94 | | | |
| Treated with hypertension | 89 | 0,93 | 0,95 | | | |
| 12 church group | 805 | 0,81 | 0,94 | 31689,5 | -0,253 | 0,801 |
| Not treated with hypertension | 715 | 0,81 | 0,93 | | | |
| Treated with hypertension | 90 | 0,85 | 1,00 | | | |
| 13 civilian group | 833 | 0,96 | 0,96 | 33495,50 | -0,459 | 0,450 |
| Not treated with hypertension | 738 | 0,85 | 0,96 | | | |
| Treated with hypertension | 95 | 0,92 | 0,95 | | | |

Health Orientational Questionnaire (HOS) (Table 15) questionnaire results show that people without hypertension have higher personal health consciousness (p=0001), as well as higher health-related self-esteem (p=0.000). They are more motivated to avoid unhealthiness (p=0.002) and to preserve their health (p=0.009). They feel in a better state of health (p=0.000) and are confident that this will be maintained in the future (p=0.000). Hypertension patients have higher health concerns (p=0.045). They have higher levels of both internal and external health control (p=0.000; P=0.001) and health anxiety (p=0.000).

**Table 15.** Correlation of HOS and hypertension (edited by authors)

| | n | M | SD | U | Z | p |
|---|---|---|---|---|---|---|
| 1 Personal Health Consiousness (PHC) | 1668 | 17,81 | 3,54 | 120770,00 | -3,346 | 0,001 |
| Not treated with hypertension | 1476 | 17,91 | 3,55 | | | |

| | n | M | SD | U | Z | p |
|---|---|---|---|---|---|---|
| Treated with hypertension | 192 | 17,08 | 3,30 | | | |
| 2 Health Image Concern (HIC) | 1669 | 9,73 | 3,99 | 129436,00 | -1,980 | 0,045 |
| Not treated with hypertension | 1477 | 9,68 | 4,01 | | | |
| Treated with hypertension | 192 | 10,18 | 3,87 | | | |
| 3 Healt Anxiety (HA) | 1668 | 8,84 | 3,23 | 110498,50 | -5,006 | 0,000 |
| Not treated with hypertension | 1476 | 83,69 | 3,15 | | | |
| Treated with hypertension | 192 | 10,02 | 3,59 | | | |
| 4 Health-esteem and Confidence (HEC) | 1670 | 19,83 | 3,58 | 101347,00 | -6,6-565 | 0,000 |
| Not treated with hypertension | 1477 | 20,06 | 3,49 | | | |
| Treated with hypertension | 193 | 18,17 | 3,74 | | | |
| 5 Motivation to Avoid Unhealthiness, (MAU) | 1666 | 17,22 | 4,07 | 120897,00 | -3,105 | 0,002 |
| Not treated with hypertension | 1476 | 17,33 | 4,10 | | | |
| Treated with hypertension | 190 | 16,42 | 3,73 | | | |
| 6 Motivation for Healthiness (MFH) | 1667 | 16,77 | 3,65 | 124598,50 | -2,623 | 0,009 |
| Not treated with hypertension | 1476 | 16,86 | 3,66 | | | |
| Treated with hypertension | 191 | 16,18 | 3,44 | | | |
| 7 Internal Health Controll (IHC) | 1668 | 19,06 | 3,72 | 115875,50 | -4,034 | 0,000 |
| Not treated with hypertension | 1477 | 19,21 | 3,72 | | | |
| Treated with hypertension | 191 | 18,15 | 3,56 | | | |
| 8 Externall health Control (EHC) | 1671 | 10,39 | 3,19 | 120619,00 | -3,506 | 0,001 |
| Not treated with hypertension | 1478 | 10,30 | 3,18 | | | |
| Treated with hypertension | 193 | 11,14 | 3,21 | | | |
| 9 Health Expectations (HE) | 1665 | 18,79 | 3,70 | 98458,00 | -6,702 | 0,000 |
| Not treated with hypertension | 1475 | 19,01 | 3,65 | | | |
| Treated with hypertension | 190 | 17,05 | 3,66 | | | |
| 10 Health Status (HS) | 1668 | 18,27 | 3,40 | 105671,00 | -5,851 | 0,000 |
| Not treated with hypertension | 1475 | 18,46 | 3,35 | | | |
| Treated with hypertension | 174 | 2,4 | 0,99 | | | |

### *Characteristics of people treated for hypertension*

Overall (Table 16; Figure 12), 11.5% (n=196) of the respondents were treated for hypertension, of which 90.8% were men. Most of them have secondary education qualificatins (66.7%). In terms of length of service, there are few who have been in the workforce for less than 16 years (10.3%). The highest number of them (35.3%) have between 21 to 25 years of service.

More than half (64.4%) of people with hypertension work on command work schedule. The proportion of smokers is 32.5%, and 67.5% are currently non-smokers. Regarding alcohol consumption, the biggest proportion (41.0%) drink alcohol monthly or less often. 52.0% exercise weekly, the other respondents less often than once a week or never. The proportion who never do any other physical activity is 5.6%. 32.7% do physical activity every week, and 57.1% several times a week.

The proportion of those who always pay attention to their diet is 14.3%, but 48.5% of those treated for hypertension pay attention to this most of the time. The overall proportion of those who sometimes (32.7%) or never (4.6%) pay attention to their meals is 37.3%. Typically, they are not on a special diet (93.5%) and do not take any nutritional supplements (61.7%).

We found a significant difference for gender, educational level and length of time in the workforce. When examining the relationship between social support and hypertension, we found a significant difference between grandparents and parents (p=0.002; p=0.012). Those with hypertension were less likely to rely on parental and grandparental support.

**Table 16.** Characteristics of people treated for hypertension (edited by authors)

| Gender | frequency n (%) |
|---|---|
| male | 178 (90,8) |
| female | 18 (9,2) |
| Level of education | |
| secondary school | 47 (25,7) |
| police post-secondary school | 75 (41,0) |
| BA degree | 47 (25,7) |
| MSc degree | 14 (0,9) |
| Length of service | |
| 0-5 years | 0 |
| 6-10 years | 11 (6,0) |
| 11-15 years | 8 (4,3) |
| 16-20 years | 48 (26,1) |

| Alcohol consumption | |
|---|---|
| never | 36 (18,5) |
| monthly or less frequently | 80(41,0) |
| 2-4 times per month | 48 (24,6) |
| 2-3 per week | 28 (14,4) |
| at least 4 times per weekHetente 4-szer | 3(1,5) |
| Sport | |
| never | 11 (5,6) |
| less than 1 per week | 83 (42,3) |
| 1 time per week | 49 (25,0) |
| several times per week | 53 (27,0) |
| Physical activity | |
| never | 11 (5,6) |
| 1 time per week | 73 (32,7) |
| several time per week | 112 (57,1) |

| | | | |
|---|---|---|---|
| 21-25 years | 65 (35,3) | Pay attention to diet | |
| 26-30 years | 37 (20,1) | always | 28 (14,3) |
| 30+ years | 15 (8,2) | mostly | 95 (48,5) |
| Work schedules | | sometimes | 64 (32,7) |
| office | 14 (8,6) | never | 9 (4,6) |
| command | 105 (64,4) | Special diet | |
| shift 1 | 39 (23,9) | yes | 11 (6,5) |
| shift 2 | 5 (3,1) | no | 158 (93,5) |
| Smoking | | Nutritional supplements | |
| never smoked | 90(46,4) | yes | 72 (38,3) |
| quit | 41 (21,1) | no | 116(61,7) |
| smoke | 63 (32,5) | | |

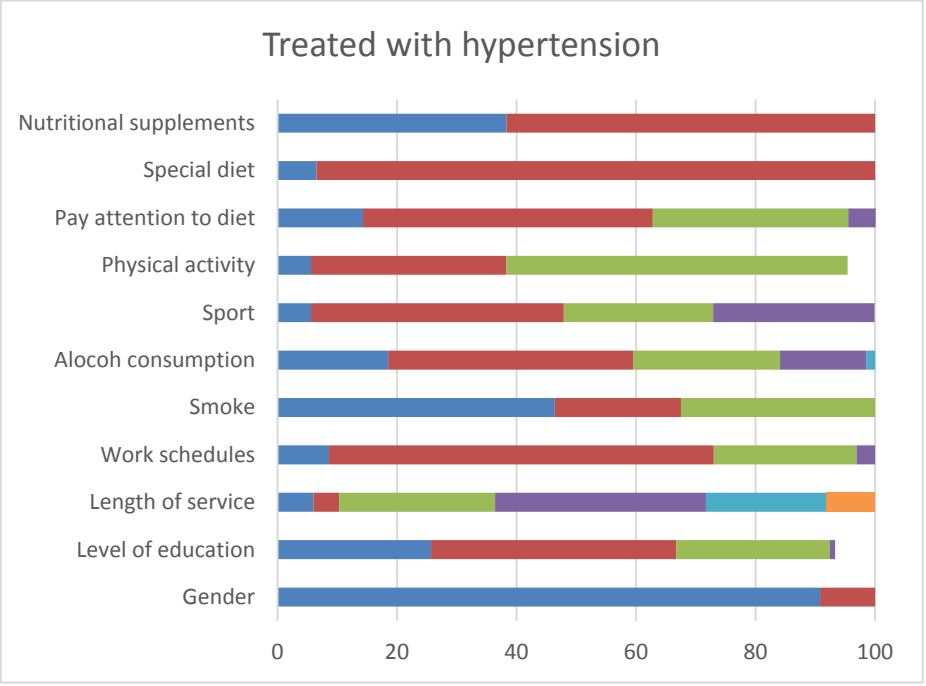


**Figure 12.** Characteristics of people treated with hypertension

## DISCUSSION

Looking at the sociodemographic data of law enforcement officers, males are present in a higher proportion than females in the sample. The prevalence of hypertension is significantly higher among males. The prevalence

of developing hypertension increases with age, which is also confirmed by the significant value for age, and is probably the reason why the development of hypertension is strongly associated with length of service.

In terms of educational level, the highest proportion is given by those who graduated from the law enforcement school, which also showed a significant association with high blood pressure. More than half of the staff work on a command work schedule, and although a correlation with hypertension could be assumed, no significant correlation was found.

For lifestyle factors, no differences were found between those treated and untreated for hypertension in smoking and alcohol consumption. In terms of physical activity, almost half of hypertensives (47.9%) exercise less often than once a week, and as the proportion of physical activity is similar and the proportion of sport is smaller, it is likely that hypertensives do less daily physical activity.

In the case of social support, there was a significant difference in support from parents and grandparents, which may be due to the loss of parental or grandparental support as age advances.

In terms of health motivation, they seem to have higher health concern and anxiety, but they lack real action. They are neither motivated to avoid ill health nor to maintain their health, despite being more pessimistic about their health. There is no significant difference in lifestyle between those treated for hypertension and those not treated, and even less activity characterizes those treated for hypertension.

A diagnosis of hypertension alone is not enough to change behavior, it is necessary to raise awareness of the importance of a healthy lifestyle and to develop strategies to encourage behavior change and to assess knowledge about healthy lifestyles. Ijzelenberg (2012) also draws attention to the fact that lifestyle improvement programs are very useful, even with appropriate treatment, as a comprehensive lifestyle intervention has a beneficial effect on cardiovascular risk factors.

### *Limitations*

A limitation of the results is that the questionnaire was self-reported. In future studies, it is advisable to link the diagnosis of hypertension to objective data, and to observe the course of medical interventions in already diagnosed cases.

Males are over-represented in the study, but this reflects the gender distribution of police officers. The data are cross-sectional, so it is not possible to know how health behaviours had been changed by the diagnosis of hypertension, or whether they had been present even before that.

The limitations of the survey are that we did not specify which tobacco product we mean by smoking: traditional smoking habits or the use of newer electronic devices? However, data from the 2018 Public Health Survey (Brys, 2022) reveal that the proportion of those who try and use e-cigarettes shows an increasing trend in Hungary.

With regard to sport and physical activity, the possibility of comorbidity was not investigated, which may make it difficult to move. However, it is likely that, as they are employable as law enforcement officers according to their health status, they do not have a major health problem that would really prevent people with hypertension from moving. The "healthy worker effect" (McMichael, 1976) prevails here as well, the survey only includes individuals who are healthy enough to be employed.

We did not examine factors that could lie behind the change in behavior, e.g. financial reasons, health literacy, self-efficacy, taking medication properly and the correlation of hypertension with stress. Taking antihypertensive medication correctly is important because in Hungary, 70% self-reported non-adherence to antihypertensive medication, which increases the risk of adverse health consequences and entails significant health costs (Morrison, 2015).

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# Text-Based Inference Instruction for Elementary Grade Children with Reading Comprehension Difficulties: An Intervention Research

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**ABSTRACT.** The current study investigated the effects of inference instruction on text-based inferences by third graders who are below average in reading comprehension but average in reading fluency and cognitive abilities. Text-based inferences occur when the preceding text has an identifiable causal antecedent. Participants were randomly assigned and attended twelve 30-minute sessions of the inferences training intervention. We have included strategies for integrating information from the text to improve reading comprehension skills. We provide an overview of how specific text-based instruction influences reading comprehension processes and outcomes and can lead to increased reading comprehension. The comparison of pretest and posttest results in the experimental group showed a significant gain in the following variables: generating inferences and providing arguments for using rules and constraints. Finally, we discuss how consideration of these potential sources of instruction has practical implications for designing and selecting instructional materials.

**Key-words:** reading comprehension, text-based inferences, reading comprehension instruction, inferences, inference instruction, reading comprehension difficulties

## INTRODUCTION

Language comprehension requires the skills to create coherent mental representations, such as formulating concepts. These conceptual representations or mental models include textual content and background knowledge about

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semantic relations (e.g., causal relations) (Cervetti & Wright, 2020; Kintsch, 2018; McCrudden & Schraw, 2010). The reader can identify such semantic relationships through inference generation (Perfetti, Rouet, & Britt, 1999; van den Broek et al., 2005). The capacity for inference generation plays a pivotal role in the development of coherence in comprehension. By making connections between explicit information and drawing upon background knowledge, readers fill in gaps in the text, constructing a cohesive understanding that transcends the literal meaning of the words on the page (Smith, Snow, Serry, & Hammond, 2021). This skill is fundamental in facilitating the development of coherent representations during the comprehension of written material. A study conducted by Oakhill, Hartt, & Samols, 2005) underscored the significance of inference production in comprehension. They observed that proficient young readers demonstrated a propensity to integrate the meaning of sequences of sentences consistently, reflecting their adeptness in generating inferences to establish coherence in comprehension. Thus, producing inferences is a crucial skill that enables coherent representations during reading comprehension. In a study reported by Cain & Oakhill (1999), good young readers' comprehension was written to integrate the meaning of sequences of sentences consistently. In contrast, poor comprehenders were less likely to do so. In a study involving 7- and 8-year-old readers, the authors demonstrated that poor comprehenders made more inferences than a younger group with matching comprehension ages, as the groups were equated based on their knowledge of meaning. These differences between groups of the understanding generation were not dependent on comprehension ability but rather something that preceded comprehension gains (Rubman & Waters, 2000; Spooren & Sanders, 2008). Children who are weak in making inferences almost inevitably fail to comprehend all but the most straightforward texts because they need help identifying meaningful connections that lend coherence to their text representations. Such weakness may result in difficulty recognizing the proper referential links that indicate that an object or person referred to in one sentence is identical to another (Long, Oppy, & Seely, 1994; Oakhil & Cain, 2012; Oakhill, Hartt, & Samols, 2005; Rouet, Britt, & Durik, 2017). Inference difficulties also manifest in problems making inferences that fill conceptual gaps between the text's clauses, sentences, and paragraphs (Magliano, Wiemer-Hastings, & McNamara, 2002; Oakhill, Yuill, & Donaldson,1990). Even if a reader can make such inferences, weaknesses may arise if they adopt standards of coherence that do not align with the goal of reading the text, leading to insufficient or inadequate inferences (Lehmann, Rott & Schmidt-Borcherding, 2019; van den Broek, Bohn-Gettler, Kendeou, Carlson, & White, 2011). Finally, weakness in inferential ability may result when the reader needs more background knowledge necessary for meaningful inferences (Cook, Limber, & O'Brien, 2001). This background knowledge includes both content knowledge (e.g., when a ball hits a glass, the

glass is likely to break) and knowledge about text structures (e.g., narratives usually begin with a setting and problem and end with some resolution; different types of informational texts have other formats (Duke (2004). Readers who struggle to infer meaningful connections, apply appropriate standards of coherence, or lack background knowledge are likely to form inadequate representations of the texts they read, leading to a failure to understand their meaning.

Several types of inferences can be generated because readers can track events along a variety of text dimensions, and readers can rely on various sources of input (i.e., the current text, the previous text, and prior knowledge) to build causal relations in a text (Bohn-Gettler et al., 2011). Nonetheless, conclusions can be divided into two categories: text-based and knowledge-based (Marianne, van Moort, Koornneef & van den Broek, 2018). Text-based inferences are links readers make to specific ideas offered earlier in a text. Such conclusions can connect to information from the text immediately preceding it (i.e., near text information; local coherence) or earlier text sections (i.e., distant text information; global coherence). Knowledge-based inferences are links readers make to underlying knowledge (i.e., global coherence) that can be explanatory, associative, and predictive. When compared to the text, these inferences can also be merged with related or unrelated prior knowledge (Carlson et al., 2014; McNamara & Magliano, 2009; Rapp, van den Broek, McMaster, Kendeou, & Espin, 2007).

Next, our study will focus on text-based inferences. However, we identify two opposed positions relative to the prerequisites to induce text-based inferences. The first position accredits the idea that the ability to selectively update some knowledge from the text (premises), from whose combination an inference may result, is the guarantee of initiating the inferential process. The second position postulates that although poor readers update linguistic inputs necessary to generate inferences, they still need help relating these inputs (Oakhill, 1994). The cause of these difficulties is that generating an inference involves more than simply activating and associating two pieces of information. It is a combination operation and involves the idea of a qualitative leap. We aim to test the extent to which some competencies of text-based inference generation can be improved. The strategy we will employ will focus on the feedback technique.

Some general principles synthesized from the literature are relative to providing feedback (Weaver, 1994). It is recommended as follows: (a) Providing feedback immediately after a student gives the correct answer; this feedback should emphasize the simple correctness of the answer (Harvey, Stephanie & Goudvis, 2000). (b) Providing feedback after an incorrect answer should be immediate; underline the correct answer and argue why the latter answer is the correct one. If a task aims to understand how a specific rule works (such as

learning a notion based on discrimination against examples of counterexamples), feedback should illustrate the functionality of that rule based on examples/ counterexamples.

Starting from the studies of Bassiri (2007) and Kucan & Beck (1997), we designed an instructional procedure that uses explicit feedback on constructing text-based inferences. Through this procedure, we highlight (a) the role of explanatory feedback in developing the skills to generate deductions and (b) the extent to which these skills can be transferred in the processing of other materials.

The main objective of the present study is to transfer the potential of the following aspects:

(1) Ways of identifying premises and constraints in a passage.
(2) Procedures for setting up chunks based on the combination of premise and constraint. Both elements must be simultaneously activated in working memory for the subject to provide relevant answers to inferential questions; procedural knowledge is required to generate inferences independently of the passage's content.

Carnine et al. (1982) instructed students to read passages containing two specific categories of information. The two types of information were components of an inference. Thus, the first piece of information provides the basic framework for a probable event to occur, and we call it the rule. A rule describes either (a) a goal that one of the characters in a narrative is trying to achieve or (b) a general process that proceeds with some regularity. The rule in this latter sense corresponds to what he calls Kintsch's (1998) strategy or algorithm. The second type of information is constraint and aims at the contextual application of the rule, more precisely circumscribing the limits within which the rule can be applied. The inference resulting from combining the two premises is an approximate judgment. The events contained in this judgment occur with a certain probability. This inference is an extension of the facts of everyday life. Following this principle, we have formulated several passages. For instance, one of the stimulus passages used in the experiment was as follows:

> *"Once upon a time, there was a boy named George who adored music. Even though his family didn't have much money, George did really well in school. One sunny day, a mysterious uncle George had never met before came to visit. George felt a mix of excitement and nervousness as he watched this new uncle. As the day turned into evening, George's uncle surprised him with a fun idea. With a kind sparkle in his eye, he said he wanted to give George a special gift. Then, he pulled out two presents: a shiny smartphone and a beautiful guitar. George's heart raced as he looked from the phone to the guitar and back again. Both were tempting in their own way. The phone offered limitless possibilities and adventures with just a touch. Now, George had a tough choice to make. Which one do you think he picked?"*

In the realm of semiotics, it becomes apparent that most everyday occurrences unfold with varying degrees of likelihood. Rarely does one event (A) unequivocally lead to another (B) without any intervening factors. There are two abstract models for comprehending sequences of events. The dyadic model illustrates A directly causing B without mediation, such as when striking someone's leg with a hammer prompts a reflexive movement. However, consider requesting someone to move their leg; their response becomes uncertain, suggesting numerous intermediate steps between A and B. This triadic model introduces a space of options (C) and uncertainty between A and B, contrasting with the definitive determination in the absence of such a space. Human actions often conform to this triadic pattern. Drawing from various experiences (e.g., observing that a dropped vase usually breaks, albeit with mitigating factors like a sponge), we formulate rules and seek explanations to clarify communication events. By applying a rule ("George adores music") and its constraints ("Deciding between two options while knowing that having both is not possible"), one might hypothesize, as in the example given, that "George decided to pick the guitar as his gift," opting for this interpretation. The most plausible inference arises from the alignment of the rule (intentionality) with coercion: "George made the choice to select the guitar as his gift instead of the smartphone." This conclusion is subject to debate, but it encapsulates the event with the highest likelihood of occurrence. Given a rule and constraint, inducing a bridge inference (by answering the question "Which one do you think he picked?") necessitates three conditions to be fulfilled: First, subjects must recall from the passage the information typically represented; Secondly, the students must update the information corresponding to the constraint, i.e., the condition that allows the application of the rule; Finally, students must form two independent chunks of information and maintain them activated simultaneously in the text's long-term working memory (Kintsch, 1998). The two chunks form the input of a cognitive procedure called text-based inference, resulting from combining rule and coercion. The third condition concerns procedural knowledge. This procedural knowledge in the form of rules is the processing of information carried out by an adult, usually in an automated way. In contrast, we hypothesize that this procedural knowledge only works sometimes in children, especially those with a deficit understanding. Logically, all three conditions – access to both terms and application of the procedure, which transforms the two inputs, are necessary and sufficient conditions for constructing plausible text-based inference. Finally, the study aims to provide detailed explanatory feedback on the terms of an inference (rule + constraint) on generating bridge inferences in students with comprehension difficulties. Based on the provided text, here are two objectives formulated:

*Objective 1:* To investigate the effectiveness of providing detailed explanatory feedback on the components of an inference (rule + constraint) in enhancing the ability of students with comprehension difficulties to generate bridge inferences.

*Objective 2:* To explore how the triadic model of event sequencing in semiotics (where A causes B with intervening factors C) applies to the comprehension of narrative texts among students, particularly in scenarios requiring the inference of choices based on contextual clues and constraints.

These objectives aim to concentrate the study on improving inference generation and understanding the cognitive processes involved in interpreting narratives with varying levels of certainty and likelihood.

*Hypothesis:* The study hypothesizes that offering comprehensive explanatory feedback on the components of an inference (rule + constraint) will significantly enhance the ability of students with comprehension difficulties to generate bridge inferences.

## METHOD

### *Participants*

In this study, 36 participants were involved, comprising 19 males and 17 females aged between nine and ten years old, all from grade three. These students were selected from various schools in Cluj-Napoca based on their classification as less proficient comprehenders, determined by their performance on The Reading Comprehension Test (TECC) (Mih, 2004). The TECC is a standardized assessment tool designed to measure reading comprehension levels among students in grades 2 to 5. The test's standardization was conducted by considering the following inferences: (a) Connection inferences aim to deduce and establish simple cause-and-effect relationships. (b) Anaphoric inferences entail integrating information from the text to infer pronominal or anaphoric relationships. For instance, this involves linking the pronoun "together" to the verb "entered" occurring two sentences later, thereby arriving at the correct answer. (c) Elaboration inferences describe combining information from the text with the child's general knowledge, appropriately selected from their knowledge base and personal experience, capturing the topographical representation of relationships derived from constructing the spatial model of narration. (d) Predictive inferences aim to formulate predictions based on textual data. (e) Factual information operationalizes the accurate selection of information from the text

to answer factual questions. The test comprises eight stories, each progressively increasing in difficulty level. The narratives are categorized into four levels of difficulty: A, B, C, D; each level further divided into two sub-levels, 1 and 2. Each story is printed on a single page, followed by 4, 8, and for the highest level, 11 comprehension questions. One point is awarded for each correct answer. The maximum possible score achievable by participants is the sum of points awarded for all items. The total raw score amounts to 64. The internal consistency coefficient value calculated for the comprehension test, α Cronbach, is 0.78. This coefficient falls within the typical range of coefficients obtained in practice (between 0.70 and 0.98). The students selected in the experiment group were in the bottom three normalized classes of TECC. Half of the students were integrated into the experimental group, and the other half into the control group. The two groups of children were equivalent in cognitive abilities, vocabulary, and verbal fluency. We did not include children diagnosed with dyslexia or attention deficit hyperactivity disorder, as reported by parents or teachers. Only children whose parents gave written informed consent were allowed to participate. The children were tested in schools during school hours.

### *Instruments*

*Cognitive abilities*. Raven's Standard Progressive Matrices (Raven SPM) (Raven, 1981) were used to measure children's nonverbal reasoning ability. There were five sets administered, with 12 items per set. Each item consisted of a target matrix with one missing part. Children were asked to select the item that best fits the matrix among six to eight choices, with a maximum score of 60. The dependent variable was the number of correct items given in the 30 minutes children were allowed to spend on the task.

*Vocabulary.* The Peabody Picture Vocabulary Test (PPVT) (Schlichting, 2005) was altered to enable group-administered testing. Instead of picking out the correct answer, children were asked to circle the correct answer on an answer sheet. This test was used as an indicator of receptive vocabulary. A participant's score was the number of items they answered correctly within 15 minutes. The PPVT consisted of 60 items with progressively increasing difficulty. In addition, a vocabulary test was administered as part of the individual test. His 20-point test required children to match words and meanings. A participant's score was the number of items they answered correctly within 3 minutes.

*Reading Fluency.* The children were given a Curriculum-Based Measurement (CBM) task to assess oral reading fluency (Deno, 1985). In this

task, children read aloud a text for one minute. The participant's scores were the number of words children read correctly minus the number of words children read incorrectly in one minute.

*Materials*. 10 passages of approximately 150 words were written and structured according to a method proposed by Carnine et al. (2004) and Carnine et al. (1982). Each passage contained (a) a problem, (b) a rule that required a solution to the problem, (c) a constraint that matched the rule to how to solve the problem, (d) distracting information that could solve the problem, and (e) irrelevant information. The instruments for the pretest and post-test phases consisted of six passages (three for each phase). The remaining four passages were used during the training sessions. Five questions were written, corresponding to each passage. The first question required the student to generate an inference based on the text, being structured in two parts: the first part concerned the actual deduction (*"Which one do you think George picked?"*); the second part required the student to justify the deduction (Why?). The answer to this last question requires reactivating both rule and coercion. It is important to emphasize that the two information chunks do not prime each other; in other words, no information (explicit element of text coherence) present in the inferential question facilitates recall of rule or constraint. The answer to the question "Why?" is a necessary clue to ensure the extent to which the learner can update and associate the knowledge in the text necessary for the inferential process.

### *Procedure*

Two groups of students participated in the experiment: an experimental one, subjected to a training phase to learn to generate text-based inferences, and a control phase. Initially, the two groups of students were equivalent, relative to (a) cognitive abilities ($t(34) = 1.13$, $p = .96$), (b) vocabulary ($t(34) = 1.27$, $p = .21$), and (c) reading fluency ($t(34) = .78$, $p = .43$), indicating insignificant differences between groups. All students underwent a pretraining phase beforehand. To determine the initial performance level of the two groups, immediately after the pretraining phase, both groups were given a pretest. The pretest consisted of three passages and three sets of six questions each. Immediately after reading the passages, the subjects would answer those questions.

In the training phase, the students of the experimental group were trained during twelve sessions by a group of three tutors (second-year undergraduate students) (each tutor being assigned a group of four students). To reduce variability in the instructional procedures implemented by the three

tutors during the training sessions, a standardized protocol was developed, outlining the primary sequences of the training phase. In addition, the tutors were provided with a second protocol, containing (a) the question items to be addressed to the students and (b) the answers related to these questions.

Finally, students underwent a post-test that mirrored the pretest (essentially a parallel version) to assess the transfer of procedural knowledge. The data collected from both protocols (pretest and post-test) underwent statistical analysis.

The pretraining phase was designed to avoid possible discrepancies between groups and implicitly to level the differences between subjects relative to the understanding of the task. The role of this phase was to familiarize the students with the task's requirements, i.e., to make the task transparent in the student's terms. To this end, we have developed two passages similar to those used in the pretest and post-test phases. During this phase, the tutor went through several steps with the student. Thus, the tutor initially read each passage aloud to prevent decoding issues and significant processing difficulties. Meanwhile, the student followed each word/line of the text read on a copy of the passage he had previously received. Immediately, the tutor (a) read the first item, i.e., the inferential question, (b) repeated the inferential question, (c) repeated the student's answer, (d) asked the student to underline the phrases in the passage on which he bases his answer. Given that students aged 9-10 years do not yet have a well-structured capacity for argumentation (and even more so those with difficulties of understanding) based on which they can provide well-founded answers to the question "Why?", we consider that the indication of the two expressions indirectly argues the answer to the questions concerned. We also postulate that the correct emphasis by the student on the two expressions denotes his ability to implicitly recognize the rule and constraint on the basis of which the inference is elaborated.

Control group. In the pretraining phase, in the control group, after the child emphasized the answer, the tutor repeated the inferential question and indicated the correct answer. There were two situations. Given that the student's oral answer to the deductive question was correct (i.e., the inference was formulated based on a paraphrase of rule and coercion), the tutor thanked the student for listening carefully to the text and emphasizing the answers. If the student's answer was incomplete or incorrect, the tutor indicated the correct answer. In both cases, the tutor used a coloured pencil to emphasize the student's copy of the information given by the rule and the critical fact.

*Training group*. Compared to the students in the control group, the students in the experimental group were given feedback based on repeated explanations (Duffy et al., 1987). Thus, as a general principle, the tutor

explained and demonstrated to the students, on the one hand, how the rule can be applied and, on the other hand, how coercion can be used to generate a correct deduction based on the information of the text. This process involved (a) the learner's awareness of the issue raised by the passage, as well as (b) indicating and underlining the rule and constraint (the tutor indicating the two components again, even if the learner made the correct choice) during reading aloud. It also discussed why it was considered a constraint about the problem posed and circled every expression in the text (Table 1).

**Table 1.** The synthesis of variables within the experiment and their operationalization

| Variable | Operationalization |
|---|---|
| Inference | Inference refers to the process of deriving conclusions or making deductions based on evidence and reasoning rather than explicit information. |
| Update the rule | Updating the rule involves revising or modifying the existing knowledge or principle used to interpret or make sense of new information or situations. |
| Update constraint | Updating the constraint entails adjusting or refining the limitations or conditions that influence decision-making or interpretation in a context. |
| Reasons for the rule | Reasons for the rule are the justifications or rationale behind the principles or guidelines used to interpret information or make decisions. |
| Reasons for coercion | Reasons for coercion refer to the motivations or explanations for compelling or influencing someone to take specific actions or make certain decisions. |

Describing and exemplifying how to corroborate the rule with coercion, during the explanations, the tutor circled the expressions corresponding to the rule and those corresponding to the constraint and joined them with a line. The explanation ended with an explicit description of how to infer from this information. The tutor demonstrated how to confirm a rule alongside a constraint by circling corresponding expressions and linking them. This process was followed by a clear explanation on deducing conclusions from this information. Subsequently, the tutor elucidated five other literal comprehension questions, emphasizing the significance of both distracting and irrelevant details in influencing deductions. Towards the end, there was a repetition of essential information aimed at prompting deductions, accompanied by explicit instructions on the deduction process. This instructional approach, akin to the one outlined by Winograd & Hare (1988), encompasses defining, justifying, demonstrating, and situating the strategy.

## RESULTS

The results are presented in Table 2 and Table 3, which summarise the means and standard deviations corresponding to the different types of variables evaluated for the experimental and control groups in the pretest and post-test phases. As shown by statistical data processing, the pretest showed no significant differences in the number of generated inferences between the two categories of subjects (control group vs experimental) ($t(34) = .89$, p=ns). As such, we are entitled to consider that from the start, the two groups of subjects were equivalent in inferential capacity. There were also no significant effects in the control group between the pretest-post-test phases for any of the variables considered (Table 2).

**Table 2**. Differences between pretest and post-test in Control Group

| Variable | | Pretest | Post test | t | p | df |
|---|---|---|---|---|---|---|
| Inference | M | 1.12 | 1.32 | .38 | .70 | 34 |
| | σ | .33 | .41 | | | |
| Update the rule | M | .81 | .68 | .31 | .75 | 34 |
| | σ | .27 | .31 | | | |
| Update constraint | M | .43 | .48 | .12 | .90 | 34 |
| | σ | .25 | .33 | | | |
| Reasons for the rule | M | .60 | .47 | .39 | .69 | 34 |
| | σ | .27 | .19 | | | |
| Reasons for coercion | M | .44 | .35 | .23 | .81 | 34 |
| | σ | .26 | .19 | | | |

**Table 3**. Differences between pretest and post-test in Experimental Group

| Variable | | Pretest | Post test | t | p | df | d |
|---|---|---|---|---|---|---|---|
| Inference | M | 1,07 | 1,85 | 2.10 | .04 | 34 | 2.97 |
| | σ | .32 | .27 | | | | |
| Update the rule | M | .76 | .93 | .38 | .70 | 34 | .53 |
| | σ | .30 | .33 | | | | |
| Update constraint | M | .40 | .54 | .43 | .66 | 34 | .71 |
| | σ | .24 | .22 | | | | |
| Reasons for the rule | M | .53 | 1.26 | 2.03 | .05 | 34 | 5.60 |
| | σ | .18 | .24 | | | | |
| Reasons for coercion | M | .39 | 1.08 | 2.34 | .02 | 34 | 3.31 |
| | σ | .17 | .24 | | | | |

Given that the hypothesis requires evaluating the impact of training on the two groups of subjects, we analysed performance differences in the post-test for the following variables: inferences, motivation of inferences, updating rule, and constraint (Table 3). Comparison of pretest and post-test results in the experimental group showed significant profit on the following variables: inferences ($t(34) = 2.10$, $p < .05$, $d=2.97$) and motivation of rule ($t(34) = 2.03$, $p < .05$, $d=3.50$) and constraint ($t(34) = 2.34$, $p < .02$, $d=3.31$). These data confirm partially the hypothesis.

It is important to note that no significant differences were revealed between the pretest and post-test between rule and constraint updating performance in the two groups of students.

We propose for discussion - starting from the experimental data obtained - the two theoretical positions presented in the introductory part regarding the induction of deductions. (1) The first position holds that the mere selective updating of the text's information to constitute an inference guarantees the actual elaboration of that inference. (2) In contrast, the second position states that, although less skilled comprehenders update the inputs necessary to start the inferential process, they resist combining those inputs to derive an inference.

Given a rule and constraint, inducing an inference based on text information (by answering the question, " *Which one do you think George picked?*") involves three steps. First, subjects must recall the information usually represented from the passage. Secondly, children must update the information corresponding to the constraint, i.e., the condition that makes it possible to apply the rule. Finally, it is necessary to create two independent chunks of information, which must be simultaneously kept activated in long-term working memory. The two chunks form the input of a cognitive procedure called text-based inference. This inference results from combining the rule with the constraint.

The third condition concerns the acquisition of procedural knowledge. Procedural knowledge is presented as rules/procedures and represents information processing that readers perform automatically. In contrast, we postulate that these procedures need to be revised in children, especially children with a deficit of understanding. Logically, all three conditions – access to both terms and application of the procedure, which transforms the two inputs, are necessary and sufficient prerequisites for constructing a plausible inference based on the content of the text. Based on this flow of argumentation, we can infer a specific resistance shown by less skilled comprehenders in joining the two pieces of information and their simultaneous compatibility.

Three factors can be identified as potentially responsible for the presence of lower inferential performance of the control group students in the post-test: inefficient access to information corresponding to the rule; ineffective access to coercion.

The procedure's inefficient functioning depends on which of the rules' content is accessed and combined with that of coercion. One of the causes of the difficulty of inducing inferences in students is that ordinary classroom instructions do not require the generation of such inferences. Lessons with weak students mainly focus on regular reading skills and word recognition. Thus, the temporary resources allocated to comprehension instructions are minimal (Kos, 1991), and an even smaller share is allocated to the inferential process based on the contents of the text. In conclusion, the study attests to and reinforces that students who participate in explicit instructions for learning inferences understand the task's demands much faster and implicitly understand the meaning of the text.

## CONCLUSIONS

Our research has shown that directly teaching reading strategies can improve students' reading comprehension. Meanwhile, this study was designed to deliver an intervention that included the direct teaching of 5 of the most widely researched reading comprehension strategies. The techniques used in previous strategy teaching approaches, such as modeling, scaffolding, and cooperative learning, were included.

The study attests and reinforces that students who participate in explicit instructions for learning inferences understand the task's demands much faster and implicitly understand the meaning of the text. One issue for the current study is that the training during the causal questioning activity may have been limited in encouraging readers to generate knowledge-based inferences. The questions were developed to help readers make causal connections in the text. To make these causal connections, readers draw on memory from previous texts (e.g., character goals, events, causality). This questioning activity may have been more text-based than knowledge-based, resulting in fewer knowledge-based than text-based inferences generated when answering the questions. However, readers can still utilize background knowledge to understand the text, and how they do so, beyond the encouragement of causal text-based questions, might provide vital information for understanding additional processes that can help or hinder comprehension. Future research developing additional questioning tasks based on text and knowledge could provide further insight into individual processing differences during reading.

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