ACCURACY OF PUPILS´ SELF-ASSESSMENT

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Abstract

In this study, we investigated the accuracy of pupils´ self-assessment in two main school domains – mathematics and Czech language. The analysis explores whether pupils are able to evaluate adequately their own results in the didactic tests and then use some individual parameters to explain the level of self-assessment.

The aim of the study was to analyze whether groups of pupils with different self-assessments of school tasks in the Czech language and mathematics (significant underestimation, adequate self-assessment, significant overestimation) differ in some of the cognitive skills studied.

Our study questions were as follows: (1) Do pupils assess their achievements in particular school tasks accurately, or inaccurately? (2) Do pupils´ self-assessments differ in mathematics and language? (3) Do the pupil´s self-assessment correlate with individual parameters?

The main tool used in the study was a didactic test on mathematics and a didactic test on the Czech language based on the Czech National Curricula Document and created by an expert team. In addition, Raven's Color Progressive Matrices (CPM), Similarities from the Wechsler Intelligence (WISC-SIM), and the Rey-Osterrieth Complex Figure (ROCF) were used. Considering the nature of the data, the non-parametric Kruskal-Wallis ANOVA was used.

The present study is a part of the larger research project, involving 29 primary school classes, 657 pupils in total.

Based on the data obtained, it can be concluded that the accuracy of pupils' self-assessments is low, while the accuracy of pupils' self-assessments in mathematics and Czech language differs (in mathematics there are more children with more accurate estimates and more pupils who underestimate themselves, in Czech language there are more pupils who overestimate their performance. Statistically significant differences were observed in the domains of Raven's Color Progressive Matrices and Rey-Osterrieth Figure, and in terms of the focus of each test, it could be concluded that there are significant differences between the groups in the domain of non-verbal reasoning skills and in the domain of analytical and organizational perceptual activity and memory. In the area of verbal intellectual abilities, there were no significant differences between the groups.

Keywords: *Self-assessment, pupils, mathematics, the Czech language, cognitive abilities, school success*

INTRODUCTION

In the last decades, the self-assessment is emphasized as one of the dominant educational principles. It results from the great role of the individualization as a new paradigm that put in the centre the respect on individual educational needs. In this framework, the self-assessment is connected to the formative assessment on the one hand, and to the responsibility of students for their own learning on the other hand.

Self-assessment of pupils has received increasing attention in recent years, among other things also in relation to coping with school requirements, especially to the issue of school success and failure - respectively in the context of school performance assessment (cf. e.g. Urban, Urban, 2018). Experts not only focus on the importance of self-assessment in the academic environment, but also take into account the other following contexts: employment (e.g. Zimmerman, Moylan, Hudesman, White, & Flugman, 2011; McNall, & Michel, 2017; León, Augusto-Landa, & Carcía-Martínez, 2021; Tomšíková, Smékalová, & Slavík, 2014; Novotná, Nišponská, 2017; Fišer et al., 2016), the influence of self-assessment in the overall educational career of an individual (e.g. Karaman, 2021), the beginning of schooling, when it supports and maintenances during the first stage (Tesser, Campbell, & Smith, 1983, Towler, Broadfoot, 1992, Broadfoot, 1996, Rosecká, 2006, Rakoušová, 2008, Brücknerová, 2008, Sedláčková, 2009. Kratochvílová, Havel, 2012, Laufková, 2017).

Research focusing on self-assessment as part of metacognitive processes and its relation to e.g. cognitive abilities such as intelligence is also very important (Nelson, & Narens, 1994; Dunlosky, & Rawson, 2012; Urban, & Urban, 2018). A closer analysis of research reveals that the relationship between metacognition and intelligence depends on the components of metacognition (knowledge, monitoring, control) and the nature of intelligence (fluid or crystallized). According to this research, it appears that children of higher intelligence demonstrate better metacognitive knowledge (Alexander, Johnson, Albano, Freygang, & Scott, 2006) and metacognitive monitoring (Snyder, Niefeld, & Linnenbrink-Garcia, 2011). Outcomes looking at the effects of metacognitive knowledge and regulation on performance expectations and subsequent performance in different school subjects are also important (Stephanou, & Mpiontini, 2017), in which the authors focused on the assessment and metacognitive regulation when they are doing school work and homework and the role of metacognition in self-regulated learning styles and the impact on performance expectations (and subsequent performance) in the following subjects: language, mathematics and physical education. Other research also focuses on the importance of feedback in the accuracy of self-assessment (Urban, & Urban, 2018).

The importance of self-assessment in the notion of school success comes to the fore in the context of the increase in the number of pupils with so-called relative school failure (e.g. Hrabal, & Pavelková, 2010, Švamberk Šauerová, 2019). This is encountered in those pupils who have at least average aptitude and yet do not achieve at least average results at school. Frequent factors behind relative underachievement tend to be specific learning/behavioral disorders not correctly recognized (e.g. the teacher perceives the pupil as stupid, rude, without appropriate mental talent - see Švamberk Šauerová, 2016), anxiety or shy (see Švamberk Šauerová, 2022), specific classroom climate (e.g. incipient bullying, lack of a safe climate - see e.g. Čapek, 2010), specific communication/interaction between teacher and pupil(s) (again, lack of a safe classroom climate - Švamberk Šauerová, 2019). However, in addition to these factors, the influence of adequate self-assessment of one's own performance and the quality of self-efficacy can also be considered (Urbánek, & Čermák; 1996, Šolcová, 2009; Smetáčková, & Vozková, 2016; Wiegerová, 2020; Wiegerová et al., 2012; Švamberk Šauerová, 2022).

In order to appropriately motivate a child to cope with school demands, it is important to recognize to what extent the child can realistically estimate his/her performance, to what extent his/her assessment prediction matches the results of the work, and which personality characteristics interfere with the ability for healthy reflection (e.g., Hoskovcová, 2006).

Each type of assessment, also self-assessment, is based on a comparison. When an individual makes an assessment, he/she compares the current achievement using the social norm (achievements provided by two or more people), individual norm (achievements supplied by one person at different times), or curricula norm (achievement supplied by one person compare to best achievement given by curricula standards). Comparisons have low or high accuracy. In the case of self-assessment, the accuracy might be influenced by cognitive, motivational, and emotional factors as individual characteristics, and also classroom environment characteristics (Brown, Andrade, & Chen, 2015).

In the context of these considerations and the results of various research investigations in recent years, our paper focuses on the analysis of personality factors - specifically, the association of results in the set of measurements including verbal and nonverbal cognitive abilities and school knowledge in the Czech language and Mathematics.

AIM OF THE PAPER

In this study, we investigated the accuracy of pupils´ self-assessment in two main school domains – mathematics and language. The analysis explores whether pupils are able to evaluate adequately their own results in the didactic tests and then use some individual parameters to explain the level of self-assessment. Our study questions were as follows: (1) Do pupils assess their achievements in particular school tasks accurately, or inaccurately? (2) Do pupils´ self-assessments differ in mathematics and language? (3) Do the pupil´s self-assessment correlate with individual parameters?

The present study is a part of the larger research project focusing on pedagogical strategies to minimalize school failure. The research includes 29 primary school classes which were studied through various methods including interviews with teachers, observations of lessons, and data from pupils collected by standardized psychological instruments. The aim of the research was to find out what factors help pupils to succeed in school requirements. One of the factors might be cognitive abilities, including verbal cognition, non-verbal cognition, and metacognition. Metacognition has a crucial role because it enables structuring a solving problem and to plan a process of learning.

At age of 8 years, metacognition is not fully developed, only some of its components (see e.g. Urban, & Urban, 2018; Hrbáčková, 2009, Říčan, & Chytrý, 2016). Some research shows that children are able to monitor their uncertainty (i.e., are able to reflect on their performance) as early as age three (e.g. Lyons, & Ghetti, 2011) - e.g., asking for help, skipping an item in a task. However, one aspect of metacognition is that children are aware of their feelings about solving school tasks and estimate whether they did well or not. That is why the study was focused on the accuracy of pupils´ self-assessments. Our aim was to analyze whether groups of pupils with different self-assessments of school tasks in the Czech language and mathematics (significant underestimation, adequate self-assessment, significant overestimation) differ in some of the cognitive skills studied.

METHODOLOGY

Measurement

The main tool used in the study was a didactic test on mathematics and a didactic test on the Czech language. The didactic tests were based on the Czech National Curricula Document and created by an expert team. Pupils solved didactic tests individually, but in the presence of other classmates, their own teacher, and a researcher whom they already knew. The situation was relatively familiar to them and thus it was not a source of great stress. The tests had no time limit.

The Czech language test contained 10 tasks, half of which tested knowledge of spelling and half of reading literacy and language production. The mathematics test contained 7 tasks, three of which tested the ability to solve word problems. For each problem, after solving it, the students were asked the question: How do you think you managed to solve the problem? Pupils indicated one of three options: thumbs up (good performance), thumbs in central position (uncertain or average performance), or thumbs down (poor performance). The achievement and the self-assessment were compared. The index of accuracy was computed for each test.

Pupils also completed three independent standardized tests measuring cognitive abilities. Tests were assigned several weeks before the didactic tests. In the study, the following measurements were used: (1) Raven´s Coloured Progressive Matrices (CPM), which is a non-verbal cognitive assessment tool; (2) Similarities from Wechsler Intelligence Scale for Children (WISC-SIM), which is a verbal cognitive assessment tool; (3) Rey–Osterrieth Complex Figure (ROCF) which assess multiple cognitive dimensions, including attention and concentration, fine-motor coordination, visuospatial perception, non-verbal memory, planning and organization, and spatial orientation.

Sample

The study included 657 pupils, N = 321 boys (49%) and N = 336 girls (51%), from 29 classes in second grade primary schools. Class sizes ranged from 15 to 29 pupils. The average size was 23 pupils which corresponds to the Czech average. The classes were included based on the following criteria: a) experienced teacher (School management, colleagues, parents, and the Czech School Inspectorate agree that s/he is a highly successful teacher. S/he is highly respected.), b) average size school and class with a usual share of special-education-need pupils according to national statistics, c) class with no specific or alternative school educational program, d) the teacher, parents, and children agree to participate in the three-year research project with complex data collection using psychology and didactic tests, interviews, and observation.

Procedure

In this paper, we present the results of quantitative analysis based on pupils´ self-assessments. The basic analytical unit was the pupil. For each pupil, school characteristics were analyzed as assessed by two didactic tests as well as his/her achievements were ascertained with three independent standardized achievement measures.

Pupils' answers in didactic tests were recorded in electronic form and then evaluated. The sum of the points for the individual tasks resulted in the total score. For each task, the correctness of the answer and the student's estimate (the answer to the question "how do you think you succeeded in the task?") were compared. For each task, an accuracy index of the student's self-assessment was created, and their sum resulted in an overall accuracy index for the math test and for the language test. Based on the accuracy level, the students were divided into four groups: under-assessing, relatively accurate assessing, moderate over-assessing, and strong over-assessing. Average scores in cognitive tests (CPM, WISC-SIM, ROCF) were then determined for each group. The groups were statistically compared.

We employed SPSS and Statistica V 13.3. Following the recommendation of 72 world-known statisticians, we used 0.5% as the level of statistical significance (Benjamin et al., 2018). We supplemented this value with the measure of pragmatic significance according to Steiger and Fouladi (1997) and Vacha-Haase and Thompson (2004). The sample was calculated using Sample size Calculator (Confidence level 95%, Margin of Error 5%, Population Proportion 50%). The minimal sample was N = 383 respondents. The average number of missing answers per one item was 9. Byly využity primárně neparametrické statistické testy a to zejména z důvodu jiného, než normálního rozdělení dat a také jejich zešikmení. Dané testy jsou vždy uvedeny u příslušného výpočtu. Primarily non-parametric statistical tests were used, mainly due to a non-normal distribution of data and also their skewness. The given tests are always listed with the relevant calculation.

Background

The Pedagogical Dictionary defines self-assessment as: 'In general, any assessment in which a person evaluates himself or herself. It can be appropriate or inappropriate to reality, it can be high, average or low" (Průcha, Walterová & Mareš 2013, p. 258).

Mcnall and Michel define self-assessment as "the basic evaluation that people make of their own worth" (2017). To this essentially simple definition, one can add, in agreement with Kratochvílová (2011, p. 22), that through it the learner compares his or her performance against a set goal.

Thus, self-assessment is aimed at increasing the effectiveness of the process of achieving the pupil's cognitive, affective, social, and psychomotor goals, not preferentially in comparison with the 'norm', i.e. in relation to the performance of classmates, but in relation to a predetermined criterion, regardless of the performance of classmates. In the course of this process, either the causes of the pupil's errors are constructively worked out and a change in the approach to mastering the material or presenting what has been learned is inferred, or the existing practices are reinforced in terms of confirming the correctness of the learning strategies to master the set objectives and the ways of presenting them in the test situation.

In a narrower sense, from a didactic point of view, the aim of self-assessment is that it should become a competence that promotes the autonomy and independence of the pupil from the teacher and that it should be directed towards the development of an authentic personality (Rakoušová, 2008). This competence is important for application in later life when self-reflection occurs in the social, professional, or worldview domains. Self-evaluation is a long-term process that needs to be learned. It is dependent on the cognitive development of the pupil because the process of evaluation belongs to the highest level of human thinking. Self-assessment presupposes a certain transcendence of one's own personality, which is an extremely demanding activity at a young age and must be cultivated in an age-appropriate way.

Adequate self-assessment, if its specifics are used in teaching, is always an educational tool, it performs a formative (educational) function. It forms positive qualities and attitudes, participates in the regulation of the educational process, is a stimulus for the development of the pupil's personality, an impulse to further cognition (Dvořáková, 2015). Thus, it is not only focused on the cognitive component of the pupil's personality but also affects the conative and attitudinal areas. The pupil's self-assessment is also feedback for teachers and parents. This is related to the diagnostic function, allowing the teacher to make a pedagogical diagnosis regarding the pupil's self-esteem, learning style and determining the causes of failure (Olina, &Sullivan, 2004).

The fundamental psychological problem in this context is the unrealistic self-assessment of pupils - excessive self-criticism or, on the contrary, the absence of self-criticism (in the presented study, conceived in the categories of overestimation - underestimation). Research by Schunk and Pajares (2005) revealed that excessive self-confidence can hinder the adaptive use of feedback. A number of research investigations also show that students who engage in frequent self-assessment tend to perform better than those who do not self-assess (Kitsantas, Reiser, & Doster, 2004; Schunk, 1996; Schunk & Ertmer, 2000)

Of course, not all problems can be influenced or completely eliminated by the school. There are many factors that intervene in student self-assessment. The most significant of these is the family environment and the preferred parenting style (from authoritarian to hyper-protective, e.g., Baumrind, 1966, Matějček, 1992, 2005), within which we cultivate a child's healthy self-reflection, self-esteem, and belief in his or her own abilities - self-efficacy (Bandura, 1997, Zimmermann, 2020).

Research shows that self-efficacy beliefs directly predict academic achievement (Pajares, 1996), and low self-efficacy beliefs lead to avoidance of learning opportunities (Pintrich, 1999) or to cheating and making excuses (Švamberk Šauerová, 2021). A Czech study (Smetáčková, 2018) involving 1,380 pupils from 4th to 8th grade showed that lower self-efficacy in mathematics is significantly related to lower popularity of mathematics and worse results on the test. At the same time, student self-evaluation had a significantly higher predictive value than teacher evaluation in the form of school grades.

It is in the family that the preschool child develops self-esteem, on which self-evaluation and causal attributions of success or failure depend; the opinion of parents is accepted uncritically by the preschool child. In the same way, he initially identifies with the person of the teacher. It is therefore up to the teacher to regulate the pupil's self-assessment and to eliminate extremes in over- or under-estimating the pupil's own personality.

The pupil's evaluation of his or her own person is extremely important for school performance because, depending on the adequacy of the self-evaluation, the pupil is less afraid of failure. He willingly overcomes difficulties. As a result, school performance is stimulated. Conversely, low self-esteem results in work below one's own ability and can paralyze the pupil's activity. A mature child at the beginning of schooling usually has positive expectations, which should be built upon (Olina, & Sullivan, 2004).

In order to cultivate self-evaluative skills in pupils, it is necessary to provide pupils with appropriate conditions. These include: classroom climate, peer relationships, safety and belonging, and time (e.g. Kratochvílová, 2011). Broadly speaking, factors affecting school success can be divided into internal and external factors.

Internal factors influencing school success

Achieving school success depends substantially on the personal characteristics of the child. It depends on his psychomotor pace, the development of his qualities of the will, the level of abilities and skills attained, and his character traits. Among the most important characteristics influencing school success are the structure of the child's intellectual endowment, his or her motivation for schooling, beliefs about his or her own efficacy (Zimmerman, 2011), as well as innate or acquired dispositions that interfere with or hinder the educational process, i.e. various types of disability.

In addition to these personality factors, it is also necessary to consider the child's frustration tolerance and the ability to apply learned knowledge and skills adequately (or reasonably effectively) even when exposed to stress/fear in a test situation (written exam, oral exam, exam with a time limit (for more details see e.g. Ramdass & Zimmerman, 2008; Švamberk Šauerová, 2021). In our investigation, it is on the basis of this premise that the focus was on: (1) Non-verbal intelligence test (Raven's nonverbal progressive matrices), (2) Verbal intelligence test (subtest Similarities from WISC III), (3) Analytical and organizational perceptual activity (Rey-Osterrieth figure)

External factors influencing school achievement

Important external factors of school success include the influence of the educator-teacher and parent (stimulating environment, appropriate frequency and quality of reflection on the student's work, fostering a sense of security even in the face of failure, etc.), as well as the influence of classmates, the classroom climate, and a sense of security in the peer group.

The combination of both factors contributes to the subsequent formation of self-assessment - self-assessment of one's initial abilities, and skills to master the set school goal - from the perspective of various educational agents (parents, teachers, classmates), and in the expected quality and performance.

RESULTS

As part of the wider research investigation, a basic self-assessment scale was created for the entire group of pupils: underestimation of selfassessing, relatively accurate estimation of self-assessing, moderate overestimation of self-assessing, and strong overestimation of self-assessing. This calculation was based on the values of the bias index. We worked with the following intervals: Underestimation ..... <-1 to -0.1), Relatively accurate estimate .... <-0.1 to 0.055), Moderate overestimation .... <0.057 to 0.265), Strong overestimation .... <0.265 – 1>. The boundaries for individual intervals were determined by the nature of the distribution function. Tables 1 and 2 show the relative frequencies for both didactic tests on main school subjects – the Czech language and Mathematics.

Table 1 Self-assessment in the Czech language

Test on Czech language	%
Underestimation	4,78%
Relatively accurate estimation	10,21%
Moderate overestimation	37,00%
Strong overestimation	48,01%
Sum	100,00%

Table 2 Self-assessment in Mathematics

Test on Mathematics	%
Underestimation	32,52%
Relatively accurate estimation	31,38%
Moderate overestimation	29,92%
Strong overestimation	6,18%
Sum	100,00%

In a basic analysis of students' levels of self-assessment, we identified several groups of interest when analyzing pupils' self-assessment: i) children over-assessing in one or both subjects, ii) children realistically assessing themselves, iii) children under-assessing in one or both subjects. Of these groups, we subsequently identified only the outliers, i.e. children who overestimate and underestimate themselves in both M and CL, in various combinations (see Table 3).

Table 3 Groups of overestimating and underestimating pupils in both M and CL (including combinations).

Group designation	Group description in terms of self-assessment accuracy		Number + % of total population
	Test in Mathematics	Test in Czech language	
A	Strong overestimation	Strong overestimation	N = 29 (4,33%)
B	Underestimation	Underestimation	N = 17 (2,54%)
C	Underestimation	Overestimation	N = 78 (11,66 %)
D	Overestimation	Underestimation	N = 0

As shown in Table 3, the most numerous group are pupils who underestimate themselves in mathematics while overestimating themselves in the Czech language. On the other hand, we see that in the whole sample, out of the original N = 657 pupils - of which N = 336 (51 %) are girls and N = 321 (49 %) are boys - no one belongs to the group of underestimating themselves in the Czech language and overestimating themselves in Mathematics. A total of 17 pupils are in the underachieving group in both mathematics and the Czech language. Furthermore, an interesting phenomenon emerges on the basis of absolute frequencies. There are a total of 39 pupils who overestimate themselves strongly in Mathematics. Of these 39, 29 also overestimate themselves in the Czech language. In no case has there been a situation in which a pupil overestimates strongly in Mathematics and underestimates in the Czech language.

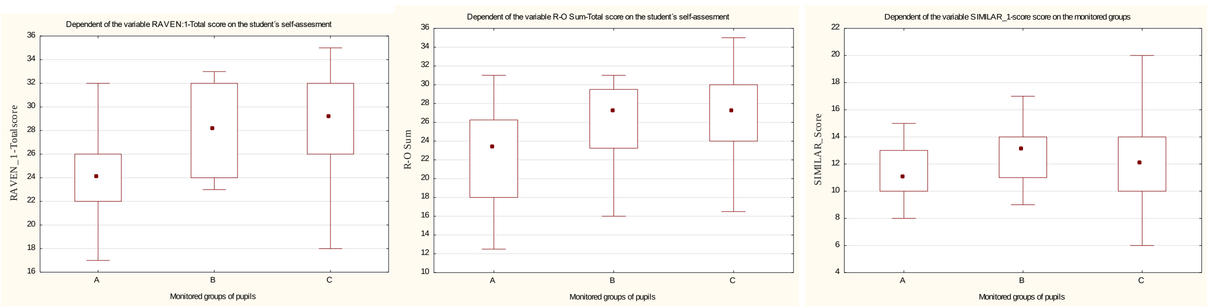
The differences in these groups can be observed by descriptive analysis for the variables of interest: i) RAVEN_1-Total Skore, ii) SIMILAR_Skore and iii) R-O Sum. The statistical variables reported in the tables for the descriptive part (Table 2) are in line with the Czech professional literature (Hendl, 2012). In particular, these are the following labels: **i)** max - maximum, **ii)** Ø - arithmetic average, **iii)** med - median, **iv)** mod. - mode, **v)** min. - minimum, **vi)** *N* - number of respondents, **vii)** *p* - significance level, **viii)** SD - standard deviation.

Table 4 Basic descriptive analysis of monitored variables (classif. into groups - see Table 3)

Group	Variable	Ø	Med.	Mod.	Min.	Max.	SD
A (29)	Raven	24,52	24,00	24,00	17,00	34,00	4,07
	Similar.	11,46	11,00	10,00	8,00	18,00	2,44
	R-O	22,18	23,25	27,00	12,50	31,00	5,19
B (17)	Raven	27,12	28,00	Multipl	6,00	33,00	6,71
	Similar.	12,94	13,00	13,00	9,00	17,00	2,33
	R-O	26,19	27,00	31,00	16,00	31,00	4,08
C (78)	Raven	27,94	29,00	28,00	0,00	35,00	6,80
	Similar.	11,97	12,00	11,00	6,00	21,00	3,19
	R-O	26,82	27,00	27,00	16,50	35,00	4,07

In all three measurements (Raven, Similarity, R-O Figure), children who overestimate themselves achieve worse results (A) than children who underestimate themselves (B) or children who overestimate themselves in the Czech language but underestimate themselves in Mathematics (C). For groups C and B (i.e., underestimating in some form), we see a more pronounced dispersion in pupils' performance on the Raven test. In group A (overestimation), we see pupils with the lowest score of 17 points (which represents 50% of the value of the highest score), while in groups C and B we also see very low scores (e.g. 0 or 6, but these are outliers and will not be shown in the graph). So the results in these groups are less consistent. At the same time, however, the very small sample size in group B must be taken into account when evaluating the results. In the context of the above, it is also useful to compare the distribution functions of the variables under study.

Fig. 1 Graph describing the distribution functions of the individual variables according to the selected groups



In the case of the first variable, it is possible that differences can be observed in the interquartile range as well as the shift on the v ertical. For the other two variables, the interquartile ranges (25-75 percentile) are almost identical, but there is a shift on the vertical. The largest shifts are seen for the first and second variables. Due to the nature of the data, a non-parametric Kruskal-Wallis ANOVA was used for inductive analysis. The findings are presented in the following table.

Table 5 Results in the three tests (Czech language) by groups A - D

Test	K-W ANOVA	Conclusion
RAVEN_1-Total score	H (2, N = 124) = 17,202 p < 0,001***	H0 was rejected and thus a post-hoc analysis was calculated
Post-hoc	A - C (p < 0,001)***; A - B (p = 0,047)**	
SIMILAR_Score	H (2, N = 115) = 3,578 p = 0,1671	Could not reject H0
R-O Sum	H (2, N= 115) = 15,288 p < 0,001***	H0 was rejected and thus a post-hoc analysis was calculated
Post-hoc	A – B (p = 0,042)** A – C (p < 0,001)***	

Significant differences were observed especially for the domains: **i)** RAVEN_1-Total Skore, **ii)** R-O Sum, at the one percent significance level. In the post hoc analysis, it then became ear that partial differences could be found between pupils who strongly overestimate in both areas (group A) and the other two groups, i.e.

pupils who strongly underestimate in both subjects (group B) and pupils who underestimate in mathematics and overestimate in Czech language (group C). In terms of the focus of the individual tests, it can therefore be concluded that there are significant differences between the groups in the area of non-verbal reasoning ability and in the area of analytical and organizational-perceptual activity and memory. On the contrary, no significant differences were found between the groups in verbal intellectual abilities.

DISCUSSION

Research investigating the adequacy of self-assessment in relation to numeracy/math tasks has reported that older students have relatively good estimation in mathematics (Zimmermann, 2011). The results of these studies can be explained by clear criteria that students can use already during the task. For example, it is the use of a check test, the estimation of the realism of the result given adequate mathematical ideas, or the possibility to discuss the result with other pupils shortly after the completion of the test. At the same time, it is necessary to consider that at the beginning of the first grade (in our case, the second grade), we can still observe a wide variance in the level of abstraction and generalization of the pupils (see the results of Piaget, 1961), since not only age variation is encountered in schools, but also the very course of development of thinking in each individual is an important factor, which may take place over a longer period of time within the school group.

The difference between Mathematics and the Czech language can be explained also through the different nature of both subjects. Pupils learn mathematics as a specific domain (math tasks are separated from others), while the Czech language they use as a tool all the time when they communicate and very often they do not receive any correction by adults. Thus, it is more difficult for them to be sure whether they get the optimal achievement or not. The difference can also be seen in the possibly different type of feedback provided in the two subjects; this may also play a role in the interpretation of the results (cf. Urban, & Urban, 2018; Stephanou, & Mpiontini, 2017). With respect to metacognition, based on our study, we can hypothesize that metacognitive and self-assessment in the Czech language must be developed in a different way than in Mathematics .

The ability to abstract and generalize is related to the ability to conceptualize. Pupils often do not yet have well-consolidated individual procedures for the correct application of mathematical operations and do not have sufficient experience in their mathematical estimation (adequately developed mathematical ideas, we can also consider reserves in the development of conceptual thinking). Deficiencies in mathematical ideas are encountered not only at the level of practical experience of counseling psychologists, but also in the literature (e.g. Bednářová, 2010), often related to the lack of experience of manipulating objects or the tendency of society to lead children/pupils to a mechanical approach to mathematics. This makes mathematics appear subjectively difficult for many pupils, they are afraid of the subject (cf. Hejný, 2015).

Mathematics as a subject is also not very enjoyable for pupils; moreover, their attitude towards mathematics deteriorates during their schooling, compared to the Czech language, where there is no such demonstrable trend (Chvál, 2013).

For example, let us imagine the difference in understanding of two numerical operations: 1x10 and 10x1. In mechanical processing, the child does not consider the different processes that the operation "represents", but, using a small multiplication table, automatically gives the result of 10. Using mathematical representations, the child can visualize a process in which he/she carries 10 apples in one trip and, vice versa carries ten apples from place to place one piece at a time. In both cases, the result is the same, but the process conveys many other circumstances. Related to the example is the difference in the teachers' approach, not only at the level of the approach using the Hejny´s method, but the teacher‘s veral approach to teaching the subject.

Compared to mathematics, the Czech language tends to be perceived in the first years of schooling as a set of natural activities (Palečková, & Tomášek, 2005; Hrabal, & Pavelková, 2012), which may also influence the already mentioned difference in pupils' attitudes towards both subjects. From a general social point of view, the Czech language is not used by parents as a "scarecrow", and for the Czech language, unlike mathematics, there is not such a strong assumption in society that mastery of the subject is dependent on the child's intellectual abilities (the author's experience from consultancy practice).

Let us return to our presented results. Let remind, that we showed no difference in verbal ability between groups of differently assessed children, but we do demonstrate a difference in nonverbal intellectual abilities and in analytical and organizational perceptual activity and memory. Similar results - the relationship between metacognitive monitoring accuracy and intelligence (fluid intelligence), using the same diagnostic tool CPM - have been reported, for example, by Urbans (Urban, & Urban, 2018) or Rozencwajg (2003) - demonstrated a high correlation of crystallized intelligence with metacognitive knowledge. In addition to the argumentation of the results presented earlier in the text, we can also consider that the results may indicate, that the pupils are better able to use verbal abilities and are more aware of these abilities (the ability to express oneself adequately tends to be well reflected by the environment), whereas they may not yet be aware of analytical abilities and organizational-perceptual activity, as capturing this quality of thought operations is indeed challenging and falls into the domain of metacognitive strategies (the formal thinking stage). Similarly, the teacher may not be aware of this quality, or may not be aware of how much this factor can contribute to the mastery of school mathematics tasks and consequently affect the adequate estimation of the child's performance.

In this context, it is important to point out that in both subjects we use very well-structured graphical workbooks at the beginning of schooling, which is better suited to children with well-developed analytical and organizational-perceptual skills, but in mathematics, the child can better use this graphical structure and visualization of the task. Mathematics at the first level is one of the most structured subjects, the tasks are usually well structured graphically, and the graphic structure is also used in the school workbook (compared to the Czech language), so the child has a better chance of achieving a good result even if he/she does not fully believe in it.

At the same time, it must be considered that the result in the Czech language is reflected in a language sensitivity of which the child is not usually aware (especially if he has a reduced language sensitivity).

Other important factors influencing the quality of self-assessment (adequate estimation) are social and envorinmental factors, the influence of the classroom team, the way the teacher teaches and evaluates, and the way parents are educated. Selected factors will be discussed in the following analyses.

SUMMARY

As the results show, groups of pupils according to different qualities of self-assessment in the area of task performance in the Czech language and mathematics differ not only in general reasoning abilities but also in the ability of analytical-organizational perceptual activity, which can be expected to contribute significantly to achieving a good result in a mathematical task. At the first level, mathematics tasks tend to be well structured, clear, and graphical, compared to higher grades, and also compared to tasks in the Czech language. Based on our results, we can recommend teachers to support the self-assessment of pupils. However, teachers should use different approach for mathematics and for the native language to get a higher accuracy of self-assessment.

At the same time, however, it appears that a child of a given age cannot yet adequately work with this quality and use it to his or her own advantage in self-assessment and planning for estimating school performance, especially in mathematics.Similarly, it can be concluded that this important factor of cognitive ability may not be noticed by teachers and parents at a given age, as opposed to the common reflection on general reasoning abilities, and they do not work adequately to support this factor.

LIMITATIONS OF THE STUDY

The focus of the study was on the self-assessment of first-grade pupils in relation to the assessment of the Czech language and mathematics test. In this context, it is necessary to note that the age of the probands must be considered as a limiting factor for obtaining an adequate self-assessment. At the same time, it is necessary to consider this data at the beginning of school attendance as one of the key factors that influence the further development of the school.

Another limitation is that the didactic tests were external. Although the tests were developed based on the National Framework Curricula, the tasks differed from what pupils in particular classrooms were used to it. The accuracy of their self-assessment might be higher in the tests created by their own teachers. The last limitation is that this study was focused on individual variables only. However, some classroom variables, such as teaching style, the role of metacognition in teachers´ approach, cognitive level across the group, etc., should be taken into account as well. We will keep working on analyses comparing individual and group characteristics.

The original sample of pupils on whom the research was carried out was adequate with regard to the needs of the stated research aim. However, in the context of the sub-analysis of the data obtained - aimed at assessing the cognitive characteristics of under- and above-average pupils - it is fair to acknowledge that the groups are not adequately large, which makes subsequent interpretation of the data analyzed difficult. Nevertheless, we believe that the differences found can be considered reasonably significant and the demonstration of a trend can be used psychologically to select appropriate methods for developing realistic self-assessment, promoting specific cognitive functions/processes, a healthy level of criticality, and developing self-efficacy in children from early school age.

CONCLUSIONS AND RECOMMENDATIONS FOR PRACTICE

As already mentioned, based on the findings, it can be concluded that among the cognitive characteristics studied, the school performance of the first-grade pupils, in addition to non-verbal intellectual abilities (with emphasis on the ability to use an analogy), is also influenced by the ability of specific analytical-organizational perceptual activity and memory (R-O figure), which unfortunately did not adequately translate into the quality of students' self-evaluation. Pupils who belonged to the underachieving group performed significantly better on this test (R-O figure). This analytical-perceptual activity may have an impact on good mastery of the school requirement, especially in the area of mathematics, while in the area of self-assessment, however, it is still difficult for the child to consider this level (see the mentioned limitations of the study). This 'quality' may not yet be noticed by the environment (teachers, parents) and therefore may not be targeted in the teaching and assessment of the pupil. Reflection on the child's giftedness is more common (the author's long experience of working in a pedagogical-psychological counselling centre).

Thus, depending on the result of the investigation, it can be clearly recommended to use well-perceptually organized activities and tasks in educational practice, to practice with children the perception of the structure of the assigned exercise, to focus attention on the evaluation of the pupil and to work in the field of analytical-organizational activity of the pupil. Equally important in the educational process is to focus attention on memory training, including formative assessment of the memory component in the short and medium term (in the sense of advice on how to better focus on the current task, how to remember the task or instructions for the task). In addition to using the principles of formative assessment, teachers can be advised to use specific types of tasks supporting analytical and organizational perceptual activities - e.g. activities within the so-called Feuerstein's method of instrumental enrichment (Feuerstein, Falik, Rand, & Feuerstein, 2006; Málková, & Májová, 2007; Frombergerová, & Pokorná, 2022) or the Ropratem technique primarily developing analytical-organizational perceptual skills, which subsequently accelerates the child's work pace (see Švamberk Šauerová, 2020).

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