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The Impact of Training on Cognitive and Interpreting Performance in the Short and Medium Term

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Abstract: *The paper focuses on improving cognitive skills and interpreting performance in university education of future interpreters. In empirical research, the authors analyzed cognitive and interpreting performance of students (n = 60) in order to determine whether the quality of their performance is more influenced by predispositions in the form of specific cognitive skills or practical interpreting training in the short to medium term. The research sample consisted of students in the 3rd year of the bachelor's (N=28) and 1st year of the master's studies (N=32) in translation and interpreting. The research analyzed students' performance in the d2 test of attention (overall performance, accuracy, error rate and fluctuation), cognitive process regulation test (multitasking - task combining the addition test and listening span task) in both consecutive and simultaneous interpreting, taking into account the length and extent of practical interpreting training of students of individual levels of study.*
We assumed that interpreting performance, and thus the ability to regulate cognitive skills, is improved with training. Overall, master's students of all language combinations achieved on average higher score in consecutive interpreting than bachelor's students. The results show that master's students performed better in consecutive interpreting as well as in the cognitive processes regulation test, which significantly correlates with consecutive interpreting. On the other hand, bachelor's students performed better in simultaneous interpreting, and they had also higher scores in the CPRT addition test, which significantly correlates with simultaneous interpreting. These results suggest that students' interpreting performance is likely to be more influenced by their cognitive performance (and thus certain predispositions) than by training and experience to the extent and length offered by university education. When the difference of participants' experience in interpreting is relatively small, their interpreting performance is probably more influenced by personal predispositions (e.g. performance of working memory in complex, cognitively demanding tasks, ability to cope with stressful situations, level of motivation) than by training. These

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personal predispositions will presumably develop in individuals during their interpreting practice, while this development is likely to be (under the same conditions) more intense in participants with better ability to regulate cognitive processes who are therefore likely to perform better, after acquiring certain amount of experience, in consecutive interpreting than their colleagues with a weaker ability to regulate cognitive processes. From the overall perspective, it can be states that the extent and length of practical experience in interpreting, which is offered by university studies in the form of interpreting seminars at bachelor's and master's level, are sufficient to practice basic modes, procedures and strategies and provide graduates with a basic set of interpreting skills. Nevertheless, in the longer term, it will be crucial how future interpreters will further develop their individual skills in practice. It can be assumed that cognitive and personal preconditions, drawing the starting line for further education and development, will also play an important role in this process.

Keywords: *attention, cognitive skills, consecutive interpreting, interpreting training, simultaneous interpreting.*

Résumé : *L'article se concentre sur l'amélioration des compétences cognitives et des performances en interprétation au cours de la formation universitaire des futurs interprètes. Dans une recherche empirique, les auteures ont analysé la performance cognitive et la performance en interprétation des étudiants (n = 60) afin de déterminer si la qualité de leurs performances est davantage influencée par des prédispositions sous forme de compétences cognitives spécifiques ou la formation pratique à l'interprétation à court et moyen terme. L'échantillon était composé d'étudiants en 3ème année de licence (N=28) et 1ère année de master (N=32) en traduction et interprétation. La recherche se penchait sur l'analyse des performances des étudiants au test d2 d'attention (performance globale, précision, taux d'erreur et fluctuation), au test de régulation des processus cognitifs (CPRT) (multitâche - tâche combinant test d'addition et tâche d'empan d'écoute), en interprétation consécutive ainsi que simultanée, en tenant compte de la durée et l'étendue de la formation pratique à interprétation des étudiants de chaque niveau d'études.Nous avons supposé que la performance en interprétation, et alors la capacité à réguler les compétences cognitives, s'améliore lors de l'entraînement. Dans l'ensemble, les étudiants en master de toutes les combinaisons linguistiques ont obtenu en moyenne des scores plus élevés en interprétation consécutive que les étudiants en licence. Les résultats montrent que les étudiants en master ont obtenu de meilleurs résultats en interprétation consécutive ainsi qu'au test de régulation des processus cognitifs, qui est significativement corrélé à l'interprétation consécutive. De l'autre côté, les étudiants en licence ont obtenu de meilleurs résultats en interprétation simultanée et ils ont également obtenu des scores plus élevés au test d'addition CPRT, qui est significativement corrélé à l'interprétation simultanée. Ces résultats suggèrent que les performances des étudiants en interprétation sont susceptibles d'être davantage influencées par leurs performances cognitives (et donc certaines prédispositions) que par la formation et l'expérience dans la mesure et la durée offertes par la formation universitaire. Lorsque la différence d'expérience des participants en interprétation est relativement faible, leur performance en interprétation est probablement plus influencée par des prédispositions personnelles (par exemple, performance de la mémoire de travail dans des tâches complexes et exigeantes sur le plan cognitif, capacité à faire face à des situations stressantes, niveau de motivation) que par la formation. Ces prédispositions personnelles se développeront vraisemblablement chez les individus au cours de leur pratique d'interprétation, alors que ce développement est susceptible d'être (dans les mêmes conditions) plus intense chez les participants ayant une meilleure capacité à réguler les processus cognitifs et alors susceptibles d'être plus performants, après avoir acquis une certaine quantité de expérience, en interprétation consécutive, que leurs collègues ayant une plus faible capacité à réguler les processus cognitifs. D'un point de vue global, on peut dire que l'étendue et la durée de l'expérience pratique en interprétation, qui est offerte par les études universitaires sous forme de travaux dirigés d'interprétation aux niveaux licence et master, sont suffisantes pour pratiquer les modes, procédures et stratégies de base et fournir les diplômés avec un ensemble de compétences de base en interprétation. Néanmoins, à plus long terme, il sera crucial comment les futurs interprètes développeront davantage leurs compétences individuelles dans la pratique. On peut supposer que les conditions préalables cognitives et personnelles, qui tracent la ligne de départ de la poursuite de l'éducation et du développement, joueront également un rôle important dans ce processus.*

Mots clés : *attention, capacités cognitives, formation à l'interprétation, interprétation consécutive, interprétation simultanée.*

1. Introduction

In regard to university studies requirements in Slovakia, interpreting can only be studied in combination with translation. Applicants can opt for philological studies with a focus on translation and interpreting already at the bachelor's level and further pursue their studies at the master's level. Although the credit system allows a certain degree of specialization in translation or interpreting by selecting compulsory and optional courses, to successfully complete their studies, students need to master basic principles, strategies and procedures of both the written and oral transfer. At the same time, many teachers acknowledge the fact that most students lean more towards translation, as interpreting seems, for its procedural specifics, too demanding (Melicherčíková, 2017), and sometimes even unmanageable. This is underlined by the fact that study programs are usually designed as follows: in the initial stages of their studies, students are offered practical translation seminars with increasing difficulty level, and only later (i.e. in the 2nd or 3rd year of the bachelor's studies), they can attend seminars aimed at basic interpreting disciplines (Djovčoš & Šveda, 2021). Therefore, the aim of the practical training of interpreting at Slovak universities should be, in the medium term (i.e. one or two years at the bachelor's level and two years at the master's level), to provide students with knowledge, skills and competencies that will enable them to effectively ensure the transfer from and to specific working languages in both basic interpreting modes - consecutive and simultaneous, or their variations. The key is therefore the question of the effectiveness of interpreting training and its impact on students' performance in the short and medium term. In this paper, we focus on comparing the cognitive and interpreting performance of students from different levels of translation and interpreting studies in the context of the variable "experience" and the findings will be interpreted from the viewpoint of the penetration of cognitive psychology into interpreting.

2. Intersections of Cognitive Science and Interpreting Research

The lay and professional public is often fascinated by the ability of interpreters to perform several linguistic and cognitive processes at the same time. Therefore, simultaneity in interpreting has relatively early become the focus of psychologists (cf. e.g. Treisman 1965, Goldman-Eisler 1972, Gerver 1976, Daróo, Lambert and Fabbro 1996) as well as researchers in the field of neurophysiology and neuropsychology (cf. e.g. Fabbro 1989, Kurz 1996, Tommola et al., 2000).

With increasing number of findings, especially in regard to the short-term or working memory function (cf. e.g. Atkinson & Shiffrin 1968, Baddeley & Hitch 1974, Cowan 2000), attention has been gradually shifted also to the issue of innateness or the possibility to develop specific cognitive processes and skills, that are applied in interpreting, with training and long-term practice.

To this end, several authors have compared performances of experienced professional interpreters and performances of bilingual individuals who do not practice interpreting or performances of students of interpreting who lack experience in an effort to identify differences in specific cognitive processes between these groups.

In her mid-term research, Moser-Mercer (2000) examined various partial skills needed in the interpreting process in professional and beginner interpreters: the ability to simultaneously understand a heard text and speak, the quality of speech production

processes, verbal fluency, and short-term working memory. In the majority of the monitored skills, no difference was observed between the two groups. However, the speech production processes of professional interpreters were less prone to losses due to interference than the processes of beginner interpreters. This finding can be explained by the restructuring of specific memory processes as a result of several years of practice within the understanding of the skilled memory theory, as formulated by Chase & Ericsson (1982).

In the free recall test, Darò & Fabbro (1994) and Padilla et al. (1995) found an order of magnitude higher extent of memorizing numbers in interpreters compared to semi-professional interpreters or "non-interpreters". The authors interpreted this finding as interpreters having a better function of the phonological loop of short-term memory than "non-interpreters". Padilla et al. (1995) identified the performance of second-year interpreting students as comparable to the one of "non-interpreters". Using a task in which participants had to memorize a series of words (presented visually, in the written form), while simultaneously articulating the syllable "blah" to ensure articulatory suppression, the group of interpreters were able to recall significantly more words than "non-interpreters" and students. When comparing the performances of individual research groups in a memory span test (in the form of a reading span task), which besides storing information also requires its processing and thus involvement of more complex processes, the authors found a significantly larger memory span in professional interpreters than in students and "non-interpreters".

Köpke and Nespoulous (2006) compared performances of a group of experienced interpreters, beginner interpreters, bilingual participants and students of interpreting in different cognitive tasks. They did not find any differences between the groups in the classic tasks aimed at short-term memorization of items and selective attention. However, significant differences between the groups of interpreters and control groups were identified, similarly as by Padilla et al. (1995), in the memory task using articulatory suppression, which is largely based on executive processes. However, the highest scores were achieved by beginner interpreters despite the hypothesis that the task requires specific skills that interpreters acquire with practice. However, the authors themselves acknowledged shortcomings in the selection of the research sample, which caused the occurrence of uncontrolled variables (age, length of practice) in the research, and thus could reduce the validity of the results.

It is also necessary to point out the difference between the tasks examining memory processes and the nature of the interpreting process, which does not require the retention of information for later recalling, but only for the amount of time strictly necessary for interpreting. In this regard, studies by Liu et al. (2004) found that the interpreting performance of persons with approximately the same general cognitive skills, but different skills specific to the interpreting activity, differs. To determine the general capacity of working memory, a memory span test (in the form of listening span task) was used and the authors examined specific skills – the selective coding skill (distinguishing essential thought units from secondary ones) and the skill of efficient resource allocation in simultaneous interpreting. The results showed that professional interpreters, who did not differ from students of interpreting in the general capacity of working memory, performed

better, which the authors explained by the specific skills of experienced interpreters – the ability to regulate the use of limited cognitive resources.

Melicherčíková (2017) researched interpreting performances of students in different years of university studies and examined the relationship between the length of interpreting training and the quality of simultaneous and consecutive interpreting. With regard to consecutive interpreting, the author did not identify any significant difference between the performances of 1st and 2nd year students of the master's studies in translation and interpreting, which was in her opinion caused by the poorer quality of interpreting of 2nd year students. The author offered several possible explanations for this finding: students either do not possess sufficient predispositions for quality interpreting performance, do not work ambitiously enough to develop their interpreting competence or the interpreting training aimed at the specifics of consecutive technique is not effective enough.

In the case of simultaneous interpreting, the author found a statistically significant difference between individual groups of students, favoring the 2nd year students, i.e. according to the author, the length of training aimed at the simultaneous technique in this case probably reflected on better performance of senior students.

3. Comparison of Cognitive and Interpreting Performance of Students - Empirical Research

The length of interpreting training and its potential impact on cognitive processes and interpreting performance of students in the study field *translation and interpreting* was also one of the examined factors in our empirical research (Hodáková, 2009; 2021). The research sample consisted of students in the 3rd year of bachelor's and 1st year of master's studies in translation and interpreting and was created by purposive sampling, as the participants had to meet several requirements:

- master the minimum basics of note-taking and the principles of consecutive interpreting (CI)
- master the basics of working with technical equipment in interpreting booths and the principles of simultaneous interpreting (SI)
- have at least two working languages in common (in our case Slovak and German)
- have Slovak as their mother tongue
- have approximately the same experience with individual modes of interpreting in practice, i.e. outside of university education.

Based on the answers to the questionnaire, we decided to also include in the research students who had no or only minimum previous experience with interpreting outside the academia, as, in this way, it was also possible to control the impact of the variable "experience" on the interpreting performance of participants.

The above-given requirements were met by students of the 3rd year of the bachelor's and 1st year of the master's studies in translation and interpreting at the Faculty of Arts, Constantine the Philosopher University in Nitra, as they have already attended at least the basic interpreting disciplines, where they have gotten acquainted with the principles of specific modes of interpreting, but did not have experience with real interpreting in practice, which could have a significant impact on their interpreting performance.

The research sample consisted of a total of 60 students, whose average age was 21.85 years. Of the total number, there were 28 students in the 3rd year of the bachelor's and 32 students in the 1st year of the master's studies. 17 students studied German in combination with Slovak, 35 students with English and 8 students with Russian. All students had Slovak as their mother tongue.

The students of the 3rd year of the bachelor's studies in translation and interpreting completed within their studies the following interpreting disciplines:

- *Basics of Interpreting I* (practical discipline, aimed at the basics of CI and note-taking, 90 minutes per week, a total of 12 weeks),
- *Basics of Interpreting II* (practical discipline, aimed at the basics of SI, 90 minutes per week, a total of 12 weeks),
- *Methodology of Interpreting* (theoretical discipline, aimed at procedural specifics of CI and SI, interpreting strategies and procedures, 90 minutes per week, a total of 12 weeks).

The students of the 1st year of the master's studies in translation and interpreting completed the following interpreting disciplines:

- *Basics of Interpreting I* (practical discipline, aimed at the basics of CI and note-taking, 90 minutes per week, a total of 12 weeks),
- *Basics of Interpreting II* (practical discipline, aimed at the basics of SI, 90 minutes per week, a total of 12 weeks),
- *Methodology of Interpreting* (theoretical discipline, aimed at procedural specifics of CI and SI, interpreting strategies and procedures, 90 minutes per week, a total of 12 weeks),
- *Consecutive Interpreting* (practical discipline, 90 minutes per week, a total of 12 weeks),
- *Simultaneous Interpreting, I* (practical discipline, 90 minutes per week, a total of 12 weeks).

It should also be noted that students who studied German together with English or Russian attended the mentioned interpreting disciplines as part of the study of each language, i.e. twice (unlike students studying German and Slovak). This fact may have had an impact on their interpreting performance.

Table 1.

Research sample

Total number of participants	**60**
Women/ men	48/12
Age range	20-24
Average age	21,85
Bachelor's/ master's level	28/32
TNS/ TAN/ TNR[1]	17/35/8

[1]TNS - students studying German and Slovak
TAN - students studying German and English
TNR - students studying German and Russian

3.1 Research methods

The presented research of memory in simultaneous and consecutive interpreting is by its nature an empirical research using the following methods:

- **Questionnaire** for collecting basic factual data, e.g. on age, gender, level of studies, working languages, subjects completed and experience with interpreting outside of the university studies.
- Standardized methodology of **The d2 test of attention** - a time-limited test of selective attention representing a standardized improvement of the so-called strike test. The d2 test presupposes a concentrated performance in the area of external visual stimuli. Successful concentration, in turn, presupposes an adequate function of motivation and management. This will be reflected in three performance components in this test:
  1) *speed or amount of work performed*, i.e. number of stimuli processed in a certain amount time (it concerns the motivation aspect)
  2) *quality of work performed*, i.e. degree of accuracy, which is opposite to the number of errors (attention control area)
  3) *the ratio of speed and accuracy of work performed*, which allows to draw conclusions on the characteristics of work performance such as the degree of activity, stability and coherence of performance, fatigue, level of attention and attenuation of disturbances.
- **Cognitive processes regulation test** (CPRT – a combination of the addition test and a modified auditory version of the Reading Span Task – Listening Span Task). We assume that the cognitive skills regulation test does not examine only one isolated cognitive characteristic, but rather represents a task in which the participant must involve several components of working memory:
  1. procedural aspect (deciding on logicality/illogicality or correctness/incorrectness of the heard sentences - comparison of patterns),
  2. storage aspect (storing last words) and
  3. executive aspect - selective attention (addition test, listening), splitting or switching attention (between the addition test and comprehension of the heard text) and, at the same time, regulation of all processes (supervision).

The cognitive processes regulation test (CPRT) therefore focuses on examining a specific skill, i.e. regulation of cognitive processes or capacity stocks available to the individual. According to many authors, the ability to regulate cognitive processes is a basic prerequisite for interpreting being successful.

The methodology that we designed combines a modification of the auditory version of the Reading Span Task – Listening Span Task (LST) (Daneman & Carpenter, 1980)[2]

[2] In our research, we used a modified version of the listening span task, which consisted of three series of auditorily presented sentences (on recordings). Each series contained sets of 2 - 5 sentences. The sentences used in the test were randomly selected from various texts, presented in the Slovak language and contained 12 to 15 words.

After each set of sentences, participants were required to write the last words of all sentences in the given set on the answer sheet. At the same time, to prevent participants from not focusing on the content of what was heard, but only on the last word, some sentences in the text have previously been modified so that they

and the attention addition test[3]. The total score in the cognitive processes regulation test was obtained by adding up the percentage performances in both tests (LST and the addition test).

- **Consecutive interpreting**

The task of the participants in this performance test was to consecutively interpret the heard discourse from German into Slovak. The source-language text was a *thank you speech* consisting of 612 words. The presentation of the source-language text took 5 minutes and 14 seconds. During the presentation, the participants were taking notes and, after the presentation, they consecutively interpreted the heard text. The target-language speeches were recorded on a CD and then transcribed into the written form so that they could be scored. For scoring purposes, we divided the source-language speech into meaningful units, which the participants had to interpret into the target language.

For each correctly interpreted meaningful unit, the participant gained 1 point. The term "correctly interpreted" meaningful unit in this case refers exclusively to interpreting the meaning of a particular statement, independently of other criteria such as grammatical correctness, use of specialized terminology, intonation, etc. Performance in consecutive interpreting was determined by two evaluators, while the final score in the whole text subsequently consisted of the arithmetic average between the scores given by both evaluators.

- **Simultaneous interpreting**

The task of the participants in this performance test was to simultaneously interpret an auditorily presented speech from German into Slovak. The source-language text was a *thank you speech* consisting of 620 words. The presentation of the source-language discourse took 5 minutes and 26 seconds. The target-language texts were recorded on a CD and then transcribed into the written form so that they could be scored. For scoring purposes, we divided the source-language speech into meaningful units, which the participants had to interpret into the target language. For each correctly interpreted meaningful unit, the participant gained 1 point. The term "correctly interpreted" meaningful unit in this case, as in consecutive interpreting, refers exclusively to interpreting the meaning of a particular statement, independently of other criteria such as grammatical correctness, use of specialized terminology, intonation, etc. Performance in simultaneous interpreting was determined by two evaluators, the final score in the whole discourse subsequently consisted of the arithmetic average between the scores given by both evaluators.

The performance of participants in interpreting was assessed with a week's interval from the d2 and CPRT tests in order to prevent the impact of students' mental fatigue on performance.

are illogical or grammatically incorrect. These sentences were to be identified by the participants and marked in the answer sheet with a cross next to the last word of the given sentence.

[3] The addition test belongs to the serial tests of attention and consists of the addition of two adjacent one-digit numbers distributed on the template. Through the addition test, it is possible to identify the speed and quality (accuracy) of attention performance.

3.2 Data Analysis

When determining the impact of the length of interpreting training on students' cognitive and interpreting performance, we formulated the following hypothesis:

A: We assume that interpreting performance, and thus the ability to regulate cognitive skills, is improved with training.

For the purpose of statistical analysis, we formulated the following working hypotheses alongside the main hypothesis:

A.1: Master's students will achieve a higher score in CPRT than bachelor's students.

A.2: Master's students will achieve a higher score in consecutive interpreting than bachelor's students.

A.3: Master's students will achieve a higher score in simultaneous interpreting than bachelor's students.

A.4: Students studying two foreign languages will achieve a higher score in CPRT than students studying German language and Slovak language.

A.5: Students studying two foreign languages will achieve a higher score in consecutive interpreting than students studying German language and Slovak language.

A.6: Students studying two foreign languages will achieve a higher score in simultaneous interpreting than students studying German language and Slovak language.

When analyzing the performances of all participants in specific interpreting modes (techniques), regardless of the level of their studies, we also examined a possible relationship between the performances of individuals in simultaneous and consecutive interpreting. In this case, the correlation was **0.408**, but it was not statistically significant, i.e. there was no significant relationship between the individual's performance in simultaneous and consecutive interpreting in our research sample. Participants who interpreted better consecutively did not necessarily perform better in simultaneous interpreting and vice versa. It is therefore possible to assume that in addition to common cognitive skills, distinctive cognitive skills are applied in specific techniques (SI and CI) as well.

Table 2.

Correlation between performance in simultaneous and consecutive interpreting

		SI	**CI**
SI	Pearson correlation	1.000	**0.408**
	Total number	60	60
CI	Pearson correlation	**0.408**	1.000

For the purposes of comparing the performances of students in individual groups, we considered necessary to analyze mutual relationships between interpreting and cognitive tasks, i.e. whether and what relationship exists between the cognitive performance of an individual in complex tasks (CPRT and its partial tasks) and in

individual interpreting techniques (SI, CI) regardless of the level of their studies and the number of attended interpreting disciplines.

We found a positive correlation r = 0.595**[4] between the total score in the cognitive processes regulation test and the performance in consecutive interpreting, statistically significant at the level of 0.01, which represents a positive, moderately strong relationship (Table 3). Participants who achieved higher score in CPRT also performed better in consecutive interpreting.

Table 3.

Correlation between performance in the cognitive processes regulation test and consecutive interpreting

		CPRT	**CI**
CPRT	Pearson correlation	1.000	**.595****
	Total number	60	60
CI	Pearson correlation	**.595****	1.000

When analyzing the relationship between consecutive interpreting and performance in partial tasks of the cognitive processes regulation test, a positive correlation **r = 0.448*** was observed between the listening span and performance in consecutive interpreting. This correlation was significant at the level 0.05, i.e. there is a positive, moderately strong relationship between the listening span and individual's performance in consecutive interpreting (Table 4).

Table 4.

Correlation between listening span and performance in consecutive interpreting

		CI	**Listening span**
CI	Pearson correlation	1.000	**.448***
	Total number	60	60
Listening span	Pearson correlation	**.448***	1.000

A positive correlation r = **0.400** was observed between the addition test in the cognitive processes regulation test and consecutive interpreting, which, however, was not statistically significant (Table 5). Thus, there is no direct significant relationship between the addition test and performance in consecutive interpreting.

Table 5.

Correlation between performance in the addition test and consecutive interpreting

[4] * – significance level α = 0.05
** – significance level α= 0.01

		Addition test	**CI**
Addition test	Pearson correlation	1.000	**.400**
	Total number	60	60
CI	Pearson correlation	**.400**	1.000

We observed a positive correlation r = **0.427** between the total score in the cognitive processes regulation test and performance in simultaneous interpreting, which, however, was not statistically significant (Table 6). Thus, there is no statistically significant relationship between CPRT and the quality of simultaneous interpreting.

Table 6.

Correlation between performance in the cognitive processes regulation test and simultaneous interpreting

		CPRT	**SI**
CPRT	Pearson correlation	1.000	**.427**
	Total number	60	60
SI	Pearson correlation	**.427**	1.000

When analyzing the relationship between simultaneous interpreting and performances in partial tasks of the cognitive processes regulation test, we found a positive correlation r = **0.237** between the listening span and performance in simultaneous interpreting. However, this correlation was not significant, i.e. there is no direct significant relationship between the listening span and the performance of an individual in simultaneous interpreting (Table 7).

Table 7.

Correlation between listening span and performance in simultaneous interpreting

		SI	**Listening span**
SI	Pearson correlation	1.000	**.237**
	Total number	60	60
Listening span	Pearson correlation	**.237**	1.000

In regard to the relationship between the addition test in the cognitive process regulation test and simultaneous interpreting, we observed a positive correlation r = **0.658****, which was statistically significant at the level of 0.01 (Table 8). Therefore, there is a positive, moderately strong relationship between the addition test and performance of simultaneous interpreting.

Table 8.

Correlation between the addition test and simultaneous interpreting

		SI	**Addition test**
SI	Pearson correlation	1.000	**.658****
	Total number	60	60
Addition test	Pearson correlation	**.658****	1.000

Based on the above, the question of the relationship between the cognitive and interpreting performance of students regardless of the level of their studies, and thus regardless of the number of completed practical interpreting seminars, can be answered in the following way:

We found a positive, statistically significant, moderately strong correlation between performance in the cognitive processes regulation test and performance in consecutive interpreting. The listening span also correlated significantly with performance in consecutive interpreting.

A positive correlation was observed between performance in the cognitive processes regulation test and simultaneous interpreting, however, this was not statistically significant, hence we did not identify any significant direct relationship. However, we found a significant correlation between simultaneous interpreting and the addition test in CPRT.

The ability to manage cognitive skills in complex tasks is therefore a good predictor of the quality of students' consecutive interpreting regardless of the level of their studies, and thus their previous experience with practical training in interpreting. The fact that specific cognitive skills (e.g. the ability to regulate limited cognitive resources) are used in interpreting rather than general cognitive skills (e.g. memory span) is confirmed by several studies (e.g. Conway et al. 2005; Timarová et al. 2014).

Subsequently, in testing the main hypothesis, we were interested in whether the interpreting and cognitive performance of students with different length of practical training will differ, i.e. whether there will be a significant improvement in students' cognitive and interpreting performance in the short to medium term, or, rather the opposite, previously innate or previously acquired abilities and skills (linguistic, cognitive and intrapersonal) will be decisive in this case.

In working hypothesis A.1, we assumed that master's students would achieve higher scores in CPRT than bachelor's students. When analyzing the performance of students from both levels of study in this test, we also took into account the language combination.

Master's students studying a combination of two foreign languages (TAN, TNR) achieved on average lower scores in the cognitive processes regulation test **(133.70)** than bachelor's students studying a combination of two foreign languages (**141.90**).

Master's students of the language combination TNS achieved on average higher scores in the cognitive processes regulation test **(154.93)** than bachelor's students of TNS **(115.60)**.

Table 9.

Scores of students in individual years of study in CPRT based on language combination

Level of study		**1TNS 2TAN+ TNR**	**Total number**	**Average**	**Standard deviation**
Bachelor	**CPRT**	**1**	9	**115.60**	57.42
		2	19	**141.90**	9.48
Master	**CPRT**	**1**	8	**154.93**	21.43
		2	24	**133.70**	34.68

Overall, master's students (all language combinations) achieved higher average score (**137.95**) in the cognitive processes regulation test than bachelor's students (**123.66**) (Table 10).

Table 10.

Scores of students in individual years of study in CPRT, regardless of language combination

Bachelor	Total number	28
	Average	**123.66**
	Median	135.20
	Mode	75.00
	Standard deviation	33.90
	Minimum	75.00
	Maximum	156.20
Master	Total number	32
	Average	**137.95**
	Median	152.40
	Mode	79.00
	Standard deviation	32.98
	Minimum	79.00
	Maximum	176.20

The working hypothesis A.1 was confirmed. However, the performance of students at different levels of their studies differed in the partial tasks of the CPRT. Bachelor's students gained on average higher scores in the addition test (**14.60**) than master's students (**13.91**). On the other hand, bachelor's students achieved on average lower scores in listening span (**3.45**) compared to master's students (**3.59**).

Table 11.

Scores of students in individual years of study in the addition test and the listening span task

Level of study		**Addition test**	**Listening span**
Bachelor	Total number	28	28
	Average	**14.60**	**3.45**
	Median	13.40	3.50
	Mode	14.00	2.00
	Standard deviation	4.43	1.07
	Minimum	9.30	2.00
	Maximum	29.50	5.00
Master	Total number	32	32
	Average	**13.91**	**3.59**
	Median	14.90	4.00
	Mode	15.10	3.00
	Standard deviation	3.8019	1.0641
	Minimum	6.10	2.00
	Maximum	20.20	5.00

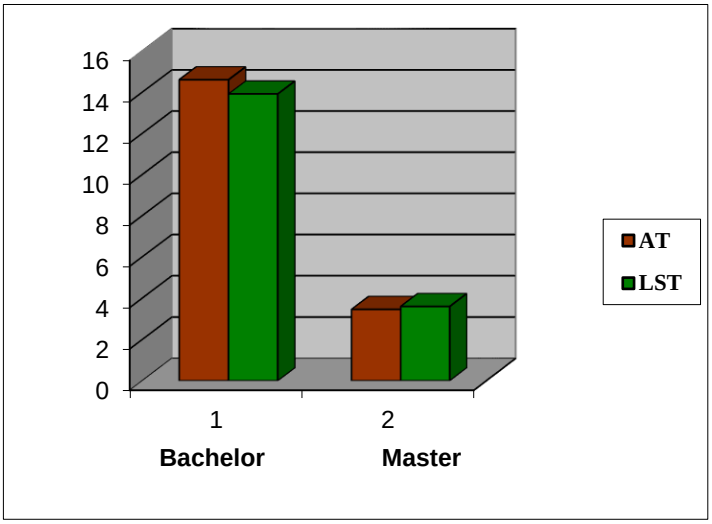

Figure 1. Comparison of the performances of students in individual years of study in the addition test (AT) and the listening span task (LST)

In working hypothesis A.2, we assumed that master's students would achieve higher scores in consecutive interpreting than bachelor's students.

When analyzing performances of students of individual levels of study in consecutive interpreting, we again took into account the language combination. Master's students studying a combination of two foreign languages (TAN, TNR) achieved on average higher scores in consecutive interpreting (**21.25**) than bachelor's students with a combination of two languages (**13,25**). Similarly, master's students studying only one foreign language (TNS) achieved on average higher scores in consecutive interpreting (**18.75**) than bachelor's students (TNS) (**27.00**).

Table 12.

Scores of students in individual years of study in consecutive interpreting based on language combination

Level of study		**1TNS 2TAN +TNR**	**Total number**	**Average**	**Standard deviation**
Bachelor	**CI**	1	9	**18.75**	6.01
		2	19	**13.25**	6.72
Master	**CI**	1	8	**27.00**	5.27
		2	24	**21.25**	6.44

Overall, master's students of all language combinations achieved on average higher score in consecutive interpreting (**14.10**) than bachelor's students (**22.56**). Hypothesis A.2 was confirmed (Table 13).

Table 13.

Scores of students in individual years of study in consecutive interpreting, regardless of language combination

Bachelor	Total number	28
CI	**Average**	**14.10**
	Median	14.50
	Mode	6.50
	Standard deviation	6.78
	Minimum	6.50
	Maximum	23.00
Master	Total number	32
CI	**Average**	**22.56**
	Median	24.50
	Mode	25.00
	Standard deviation	6.31
	Minimum	10.00
	Maximum	32.50

In hypothesis A.3, we assumed that 4th year students would achieve higher scores in simultaneous interpreting compared to 3rd year students.

When analyzing performances of students of individual levels in simultaneous interpreting, we also took into account the language combination. Master's students studying a combination of two foreign languages (TAN, TNR) achieved on average lower scores in simultaneous interpreting (**34.17**) than bachelor's students also studying a combination of two foreign languages (**43.25**). On the other hand, master's students studying only one foreign language (TNS) achieved on average higher scores in simultaneous interpreting (**45.83**) than bachelor's students of TNS (**45.00**), but since the difference between these groups was very negligible, their performances can be considered comparable (Table 14).

Tables 14.

Scores of students in individual years of study in simultaneous interpreting based on language combination

Level of study		**1TNS 2TAN +TNR**	**Total number**	**Average**	**Standard deviation**
Bachelor	**SI**	1	9	**45.00**	10.61
		2	19	**43.25**	17.32
Master	**SI**	1	8	**45.83**	5.25
		2	24	**34.17**	10.78

Overall, bachelor's students scored better in simultaneous interpreting (regardless of language combination) (**39.60**) compared to master's students (**36.22**), therefore, working hypothesis A.3 was not confirmed.

Table 15.

Scores of students in individual years of study in simultaneous interpreting, regardless of language combination

Bachelor	Total number	28
SI	**Average**	**39.60**
	Median	37.50
	Mode	21.50
	Standard deviation	14.36
	Minimum	21.50
	Maximum	55.50
Master	Total number	32
SI	**Average**	**36.22**
	Median	36.50
	Mode	17.00
	Standard deviation	10.58
	Minimum	17.00
	Maximum	54.00

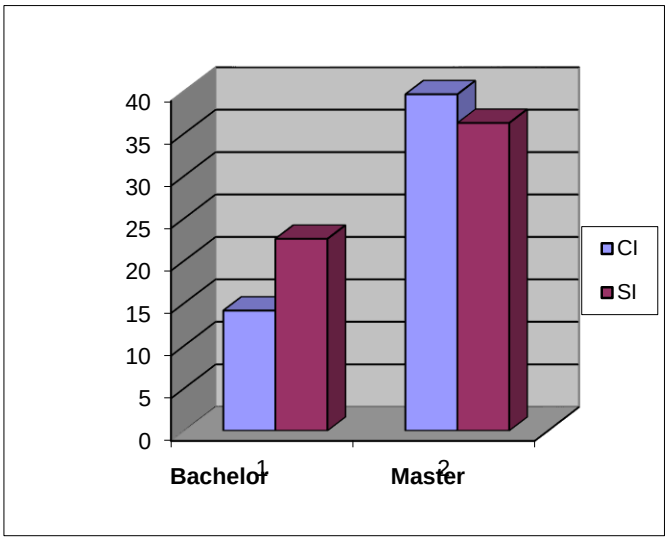

Figure 2. Comparison of performances of students in individual years of study in consecutive (CI) and simultaneous interpreting (SI)

The results show that in our case, master's students performed better in consecutive interpreting as well as in the cognitive processes regulation test, which significantly correlates with consecutive interpreting. On the other hand, bachelor's students performed better in simultaneous interpreting. Interesting data are that bachelor's students, who performed better in simultaneous interpreting, had also higher scores in the CPRT addition test (which significantly correlates with SI), while master's students who interpreted better consecutively achieved higher scores in the CPRT listening span task (which significantly correlates with CI).

This phenomenon can be interpreted as follows: interpreting performance of participants was influenced to a greater extent by their cognitive performance (and thus certain predispositions) rather than practice and experience they have gained during their studies.

When the difference in the participants' interpreting experience is relatively small, as in our case with bachelor's and master's students (1 year), their interpreting performance is probably more influenced by personal predispositions (performance of working memory, attention, ability to regulate cognitive processes, level of motivation, workload management strategies, etc.) than relatively short-term training.

In hypothesis A.4, we assumed that students studying two foreign languages would achieve higher scores in the CPRT than students studying German and Slovak.

Overall, in the CPRT, students studying two foreign languages achieved a lower score (**134.87**) than students studying only one foreign language (TNS) (**139.20**). Hypothesis A.4 was therefore not confirmed.

Table 16.

Performance of students of individual language combinations in CPRT

1 TNS	Total number	17
CPRT	**Average**	**139.20**
	Median	156.20
	Mode	156.20
	Standard deviation	38.96
	Minimum	75.00
	Maximum	175.70
2TAN+ TNR	Total number	43
CPRT	**Average**	**134.87**
	Median	141.90
	Mode	79.00
	Standard deviation	32.14
	Minimum	79.00
	Maximum	176.20

We also examined the scores of students of individual language combinations in the partial tasks of CPRT (Table 17). TNS students scored higher in the addition test (**14.50**) compared to TAN and TNR students (**13.91**) and TNS students scored lower in the listening span task (**3.25**) compared to TAN and TNR students (**3.75**).

Table 17.

Performance of students of individual language combinations in the addition test and in the listening span task

		Addition test	**Listening span task**
1TNS	Total number	17	17
	Average	**14.50**	**3.25**
	Median	13.75	3.50
	Mode	9.70	4.00
	Standard deviation	4.04	.89
	Minimum	9.70	2.00
	Maximum	20.20	4.00

2TAN +TNR	Total number	43	43
	Average	**13.91**	**3.75**
	Median	14.20	3.75
	Mode	13.40	5.00
	Standard deviation	3.38	1.01
	Minimum	6.10	2.00
	Maximum	20.00	5.00

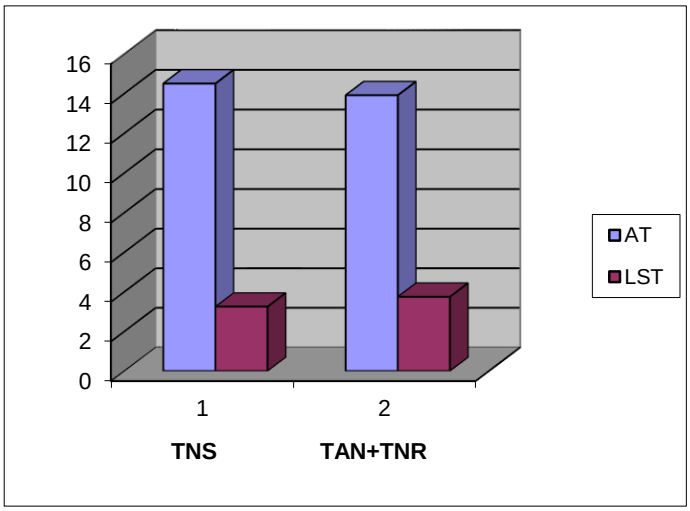

Figure 3. Comparison of performance of students of individual language combinations in the addition test (AT) and in the Listening Span Task (LST)

In hypothesis A.5, we assumed that students studying two foreign languages would achieve higher scores in consecutive interpreting compared to students studying German and Slovak.

In consecutive interpreting, TNS students achieved on average higher score (**23.70**) than TAN and TNR students (**20.11**). Hypothesis A.5 was therefore not confirmed.

Table 18.

Performance of students of individual language combinations in consecutive interpreting

1 TNS	Total number	17
CI	**Average**	**23.70**
	Mode	14.50
	Minimum	14.50
	Maximum	32.50

	Median	23.00
	Standard deviation	6.58
2 TAN+TNR	Total number	43
CI	**Average**	**20.11**
	Mode	10.00
	Minimum	8.50
	Maximum	30.50
	Median	20.00
	Standard deviation	6.85

In hypothesis A.6, we assumed that students studying two foreign languages would achieve a statistically significantly higher score in simultaneous interpreting than students of the same level of study studying German and Slovak.

In simultaneous interpreting, TNS students scored better (**45.5**) compared to TAN and TNR students (**35.46**). Hypothesis A.6 was therefore not confirmed.

Table 19.

Performance of students of individual language combinations in simultaneous interpreting

1 TNS	Total number	17
SI	**Average**	**45.50**
	Mode	37.50
	Minimum	37.50
	Maximum	52.50
	Median	46.00
	Standard deviation	6.49
2TAN+TNR	Total number	24
SI	**Average**	**35.46**
	Mode	31.00
	Minimum	17.00
	Maximum	55.50
	Median	35.75
	Standard deviation	11.50

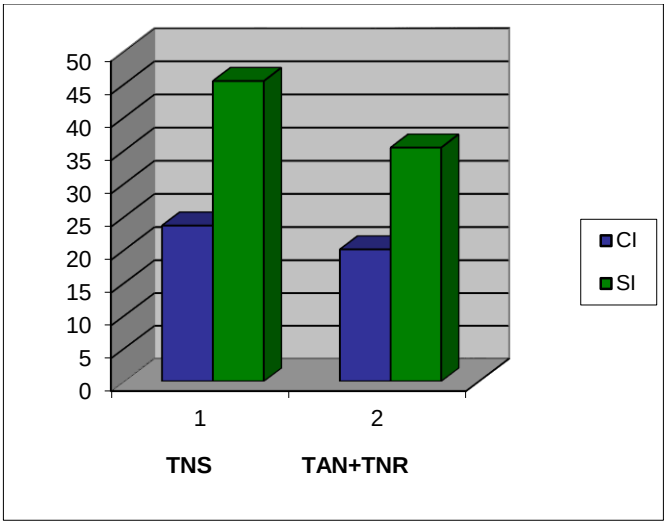

Figure 4. Comparison of performance of students of individual language combinations in consecutive (CI) and simultaneous interpreting (SI)

In both interpreting modes, students studying the language combination German-Slovak (only one foreign language) achieved a higher score compared to students studying two foreign languages; our hypothesis was therefore not confirmed. TNS students scored higher in the CPRT addition test (which positively correlates with SI performance), but lower in the CPRT listening span task (which positively correlates with CI performance).

The fact that, in general, TNS students performed better in interpreting can be explained by the fact that their performance was not affected by smaller number of completed interpreting seminars (compared to TAS and TNR students). On the other hand, the fact that the study of only one foreign language allows them to deal with it more intensively was reflected in their better performance. Likewise, the probability of interference between several foreign languages was lower in their case.

4. Concluding Remarks and Discussion

With regard to the issue of the impact of interpreting training in the short and medium term on the interpreting performance, we assumed that master's students would perform better than bachelor's students both in SI and CI as well as in the cognitive processes regulation test, as they completed more interpreting disciplines during their studies. The difference between the groups was one year of study. We also expected better performance of students studying two foreign languages (TAN and TNR) than students studying only one foreign language (TNS) since students of TAN and TNR completed all interpreting disciplines within the study of each foreign language, i.e. twice. These hypotheses were partially confirmed. In our case, master's students performed better in consecutive interpreting as well as achieved better score in the cognitive processes regulation test, which significantly correlated with consecutive interpreting.

On the other hand, bachelor's students performed better in simultaneous interpreting. When comparing individual years, bachelor's students, who achieved better performance in simultaneous interpreting, also had a higher score in the CPRT addition

test (which significantly correlates with SI), and vice versa, master's students who interpreted better consecutively achieved a higher score in the CPRT listening span task (which significantly correlates with CI).

These results suggest that students' interpreting performance is likely to be more influenced by their cognitive performance (and thus certain predispositions) than by training and experience to the extent and length offered by university education. When the difference of participants' experience in interpreting is relatively small, their interpreting performance is probably more influenced by personal predispositions (e.g. performance of working memory in complex, cognitively demanding tasks, ability to cope with stressful situations, level of motivation) than by training. We also consider likely that these personal predispositions will develop in individuals during their interpreting practice, and this development is likely to be (under the same conditions) more intense in participants with better ability to regulate cognitive processes who are therefore likely to perform better, after acquiring certain amount of experience, in consecutive interpreting than their colleagues with a weaker ability to regulate cognitive processes.

In both SI and CI, TNS students achieved a higher score than students studying two foreign languages, which means that our hypothesis was not confirmed. TNS students scored higher in the CPRT addition test (which positively correlates with SI performance), but lower in the CPRT listening span task (which positively correlates with CI performance).

The fact that TNS students generally better succeeded in interpreting can be explained by the fact that their performance was not affected by smaller number of completed interpreting seminars. On the other hand, the fact that the study of only one foreign language allows them to deal with it more intensively was probably reflected in their better performance, and also the interference between several foreign languages was less probable in their case. However, recommending students to specialize in only one foreign language and combine it with their mother tongue would be contrary to the requirements of the current market. We are currently seeing the opposite trend, where professional interpreters try to master as many working languages as possible in order to increase their chances of employment.

From an overall perspective, it can be stated that the extent and length of practical experience in interpreting, which is offered by university studies in the form of interpreting seminars at bachelor's and master's level, are sufficient to practice basic modes, procedures and strategies and offer graduates a basic set of interpreting skills. Nevertheless, in the longer term, it will be crucial how future interpreters will further develop their individual skills in practice. It is very likely that cognitive and personal preconditions, drawing the starting line for further education and development, will also play an important role in this process.

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