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**COGNITIVE LEARNING IN RELATION TO FOREIGN  
LANGUAGES WITH THE SUPPORT OF MUSIC**



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**Abstract**

Cognitive learning is a prerequisite for the development of cognitive processes and their adequate use in the process of learning a foreign language. The relation between cognitive learning and foreign language teaching started to be researched in the 1970s. The effectiveness of cognitive learning depends on the achieved level of mental abilities, i.e. on the abilities of understanding mutual relations and of solving problems based on these relations. This paper discusses the issue of cognitive learning in the sphere of foreign language teaching supported by music. The paper presents results of a questionnaire survey in which Czech respondents aged 12-14 were involved. The study focused on music perceived as a possible tool for active foreign language learning. It tries to answer the question whether certain correlations can be found between learning of foreign languages and music. The interesting finding that emerged was that music does indeed play a significant role in the process of learning foreign languages related mainly to the perception of the melody, to memory training and acquiring of new knowledge of the cultural character of the given country.

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## 1. Introduction

One of the most interesting spheres in language research is the relation between language and thinking. It is necessary to distinguish between language acquisition and language learning. According to Chomsky (2014), language acquisition is genetically conditioned. However, language learning is an active process that expands the innate genetic program and possibilities of human beings. According to Čermák (2001), learning a foreign language is then based on analogy, association and repetition. Ondrakova and Tauchmanova (2020) point to the fact that knowledge and skills acquired during the process of acquisition and learning of their mother tongue are consciously and unconsciously transferred by learners into the process of learning their first foreign language.

Cognitive learning is an interdisciplinary concept occurring in various scientific fields. This concept refers to two terms - "cognitive" and "learning". "Cognitive" is defined by Hartl and Hartlova (2009) also as perceptive, evaluative and related to cognitive processes. The same authors characterize "learning" as an active and creative process which expands the innate genetic program and increases the potential of an individual being (Hartl & Hartlova, 2009). One of the main significances of learning is adapting to new situations. Průcha (2020) can see two significant factors in cognitive learning: 1. learning which is realized through cognitive processes, i.e. perception, observation, reasoning, memorizing, processing, linguistic expression of information, etc.; 2. learning which creates and improves the cognition of human beings, i.e. their knowledge and understanding. From the facts mentioned above, it can be concluded that cognitive learning is a way of learning focused on principles, approaches, knowledge, concepts and ways of solving problems. This type of learning is applied throughout all human life because human beings are in permanent contact with new information. Cognitive learning includes numerous aspects of intellectual functions and processes, such as attention, consciousness, perception, memory, thinking, language, imagination, and others. In our opinion, cognitive learning is one of the key psychological concepts; it conditions functional adaptation to the environment, and it is directly functionally connected with memory and perception.

## 2. Problem Statement

One of the variants of specifically human cognitive learning is the acquisition of general principles in which individual ways of cognition are manifested; these ways depend on the level of mental abilities of a particular human being. This does not concern a mere mechanical learning; this is about understanding which is a condition for an adequate application of the rule in the future. This general principle, which is important both for learning of foreign languages and for music itself, is useful only if we understand its meaning and if we are able to differentiate situations in which it can be applied. The dominant motivating factor for its application is the need for orientation and the need for meaningful learning.

For foreign language teaching, this means researching the cognitive functions of language in general. Černý (1996) adds that processing of information in all its complexity is concerned, i.e. the perception, analysis, analysis, interpretation, coding, storage, retrieval and evaluation of information. Čermák (2001) adds that each cognitive process is manifested in its behavior through a certain degree of rationality, i.e. focusing on a specific goal in a dynamically changing environment in which this process occurs. Thus, learning a foreign language should also show a certain degree of rationality. According to the cognitive

approach, individual beings should not only acquire new information, but at the same time they should also understand this information and various relations and more general rules. Acquiring of general principles is thus one of the variants of cognitive learning, which is associated with a number of other factors. One of them is the manifestation of an individual way of cognition, which depends on the level of mental abilities of the individual. This reflects the fact that it is usually not just about mechanical learning of a foreign language. The essential thing is to understand this language. Huneke and Steinig (2010) directly claim that "...the learner herself / himself knows best which language forms s/he should work on at a certain stage; forced instructions that are not in accordance with these internal processes completely disappear." Thus, it can be assumed that cognitive development in the age period of 12-14 is the result of the interaction of maturation and learning. During this period, analytical-synthetic activities increase, and deeper psychological processing of music is the result of a certain degree of musical empiricism, which is formed within musical activities and which is part of the overall life experience of pubescents. This fact was reflected in our research study which focuses on cognitive learning of foreign languages supported by music.

Concerning cognitive learning in foreign language teaching, we take Nakonečný's (2003) opinion. He distinguishes the following types of cognitive learning:

- **verbal learning**, which is based on verbally presented materials and which is typically used at schools;
  - **pair learning** is based on associations of concepts (this type of learning is very often applied in methodology of foreign languages, e.g. in case of vocabulary acquisition);
  - **serial learning** is learning the exact order of words (acceptance of so called Miller's magical number 7 ( $\pm 2$ ));
  - **according to the meaning** or free verbal reproduction of the text (also widely used in the methodology of foreign languages, e.g. when summarising the contents of heard or read texts);
- **non-verbal learning**, i.e. learning of non-verbal meaningful contents (maps, plans, motor skills, spatio-temporal orientation, etc.).

Research has already provided some insights into the impact of cognitive learning on foreign language teaching supported by music. For several years we have seen an unprecedented increase in practical proposals and ideas on how to work with music in foreign language teaching. These ideas are varied and dependent on specific foreign languages and specific foreign language teachers, and they depend also on publishers of foreign language textbooks. Badstübner-Kizik (2007) refers to the main potential for the practical application of music in foreign language teaching in the following way:

*... (music) in foreign language teaching primarily develops the linguistic receptive and evocative potential, which is largely fuelled by the fact that as a didactic material it is still considered by teachers and learners to be unused and innovative. The amount of specific pedagogical experience and knowledge proves a great sustainability of this concept; it can in principle be transferred to other language and learning contexts. Thus, foreign language teaching can increasingly benefit from it. (p. 11)*

In our study, we try to find out whether learners aged 12-14 consciously use music to learn foreign languages. The main goal of the paper is to present the results of research that focuses on cognitive learning in foreign languages taught with the support of music.

### **3. Research Questions**

Cognitive learning occurs within the framework of information processing, within the framework of revealing and understanding of various relations and general rules applied under given conditions. Cognitive learning is a prerequisite for the development of cognitive processes and for their adequate using. When formulating our research questions, we drew on the following ideas. We chose adolescents aged 12-14 to participate in the research for several following reasons. From the point of view of psychology (Vagnerova, 2012), these are individuals who can already better control memory functions, who can create a certain system that can make it easier for them to remember more information. They choose strategies that have proven to be effective enough to better coordinate memory and learning. In this age period, human beings create mnemonic aids during the learning process, and they are able to distinguish essential information from less essential information. And the approach to learning and reproducing of the learned issues is becoming more systematic in this age period. Thus, for learning foreign languages, this age is ideal from the point of view of systematizing the learning contents.

Summarizing all of the ideas presented above, we can formulate ask our main research questions:

RQ<sub>1</sub>: How important is the role of music if individuals aged 12 -14 actively learn foreign languages?

RQ<sub>2</sub>: How big is the difference between girls and boys aged 12-14 when their choice of songs depends on a foreign language?

Having formulated the main research questions, we specified the basic issues of our research study. As the issue of cognitive learning is relatively broad, it was necessary to subdivide the research into parts. To make the whole issue more specific, we formulated the following hypotheses:

H<sub>1</sub>: “Learners learning two or more foreign languages play music for active foreign language learning more often than pupils learning only one foreign language”.

H<sub>2</sub>: “The choice of songs listened to by girls and boys depends on the foreign language of the lyrics. The difference between girls and boys is not statistically significant in this case”.

### **4. Purpose of the Study**

The main objective of the study is to point to the obvious relation between cognitive learning and foreign language teaching supported by music. The results of numerous research cases (Crawford & Strapp, 1994; Särkämö, 2008; Schellenberg et al., 2007 and others) have confirmed the positive impact of music on the learning process. Our first hypothesis is based on Thurston's multifactor theory of intelligence, which is based on Spearman's first factor theory of intelligence. Unlike Spearman, Thurston states that the core of intelligence lies not in a single factor, but in seven factors, which he calls mental abilities and which correlate significantly with each other (as cited in Sternberg, 2002). These factors are: verbal comprehension, verbal fluency, working with numbers, spatial imagination, memory, speed of perception and speed of reasoning.

The other theory on which we based our hypotheses was Neisser's (1967) theory of the perception scheme. The theory includes the categorization of new information, the comparison of this information with the already existing schemes, and the subsequent identification. These were reflected in our hypotheses – the theory accepts a certain flow of information, it directs research and focuses its search activity on comparing the already acquired experience to obtain additional information. In connection with the development of formally logical operations, at this age of 12–14, the number of assessed aspects expands and the mutual relations become revealed. Referring to the theory of perception schemes, we can assume that cognitively more mature individuals (i.e. the respondents learning two or more foreign languages) have acquired more foreign language experience than the respondents learning only one foreign language. The individuals knowing two or more foreign languages can thus better confront their experience with new foreign language information.

## 5. Research Methods

The research was conducted systematically and it applied a questionnaire survey. The questions were formulated according to the degree of their openness. Selective, respectively scaled questions were used in the questionnaire. The respondents were asked to answer by selecting a point on the scale presented to them. For most of these questions, we used the so-called Likert-type scales; we asked the respondents to express the degree of their agreement, respectively disagreement on the seven-point rating scale.

### 5.1. Research sample of the respondents

The research was aimed at primary school pupils and students of lower secondary schools in the Czech Republic, specifically at the 7<sup>th</sup>, 8<sup>th</sup> and 9<sup>th</sup> grades of primary schools and at 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> grades of lower secondary schools, i.e. respondents aged 12–14. The respondents were grouped according to their age in the following way: the age of 12 = 2<sup>nd</sup> grade of lower secondary school and 7<sup>th</sup> grade of primary school, the age of 13 = 3<sup>rd</sup> grade of lower secondary school and 8<sup>th</sup> grade of upper primary school, the age of 14 = 4<sup>th</sup> grade of lower secondary school and 9<sup>th</sup> grade of upper primary school. Thus, three age-homogeneous groups were created, as it is shown in Table 1.

**Table 1.** Classification of the respondents according to their age

Primary school grade	Frequency	Frequency in %
7	129	40.8
8	96	30.4
9	91	28.8
<b>Total</b>	<b>316</b>	<b>100</b>

We tested **316** respondents in total (130♂, 186♀). Based on the probability of the error of the first type  $\alpha = 0.05$ , on the required test power  $1 - \beta = 0.95$  and on the minimum required effect size  $d = 0.5$ , the minimum required size of each group  $n > = 92$  was determined. This condition was met, as it is documented below (Table 2):

**Table 2.** Classification of the respondents according to their gender

Gender	Frequency	Frequency in %
boys	130	41.1
girls	186	58.9
<b>Total</b>	<b>316</b>	<b>100</b>

## 5.2. Statistical data analysis

The data were pre-processed in MS Excel, in which they were cleaned and checked. This was followed by the export of the data to the IBM SPSS Statistics 24 program, in which the calculations were performed. First of all, the detection of duplications was performed, metric variables were verified in terms of the range, i.e. whether the minimum and maximum correspond to the theoretically possible range of the monitored scales. The data groups were created according to the age of the respondents, i.e. the students of lower secondary schools were grouped with the upper primary school pupils according to the corresponding age. Descriptives and descriptive statistics were calculated, detection of incorrectly entered data in mutual control with the questionnaires was processed. The next step was a sociodemographic description of the research group - the total number of the respondents, the gender distribution, the age distribution and the classification into the relevant monitored groups.

Before testing the hypotheses, we applied the Kolmogorov-Smirnov test to verify the normality of the data distribution in the monitored variables. It was found that the obtained data do not have a normal distribution, so we decided to use non-parametric tests.

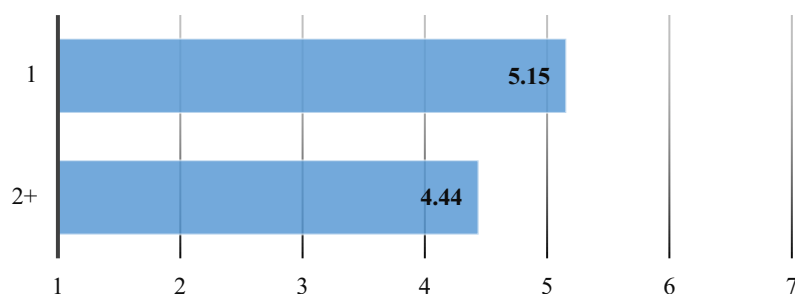
## 6. Findings

Cognitive learning occurs within the framework of information processing, of learning and understanding of various relations and more general rules applied under given conditions. It is also a prerequisite for the development of cognitive processes and their adequate use. Its effectiveness depends on the achieved level of human mental abilities, i.e. it affects the ability to understand mutual relations. Subsequently, our hypotheses will be tested and the results will be presented.

### 6.1. Testing of hypothesis No. 1: $H_1$

The  $H_1$  hypothesis: "Learners learning two or more foreign languages play music for active foreign language learning more often than pupils learning only one foreign language.", was discussed through the following item included in the questionnaire: "**I play music to actively learn a foreign language.**" For all the respondents, English was the first foreign language ( $N = 316$ ). The variable two or more foreign languages was created by adding other foreign languages listed by the respondents. These languages were: German ( $N = 260$ ), Russian ( $N = 110$ ) and French ( $N = 94$ ). Group 1 consisted of 26 respondents who learned only one foreign language, English. These were individuals who attended the 7<sup>th</sup> grade of primary schools and had not yet come into active contact with another foreign language. Group 2+ was represented by the total number of 290 respondents who learned two or more foreign languages and were from both primary schools and lower secondary schools.

The  $H_1$  hypothesis was tested through the non-parametric Mann-Whitney test. A semantic differential was used to find subtle differences in the attitudes of the respondents. The average values ( $N = 5.15$ ) measured in case of Group 1 are closer to the value  $N = 7$ , which referred to the negative answer in the questionnaire (I completely disagree). However, the average value ( $N = 4.44$ ) measured in case of Group 2+ is closer to  $N = 1$  on a seven-point scale (I completely agree). The difference between these measured values is  $n = 0.71$ . The average of both the groups falls into the negative pole of the scale (the value is  $> 4$ ), but testing showed a statistically significant difference ( $\text{sig} = 0.004$ ) between the two groups. The  $H_1$  hypothesis claiming that learners learning two or more foreign languages play music for active foreign language learning more often than pupils learning only one foreign language can be thus accepted. The testing of the  $H_1$  hypothesis is graphically illustrated in Figure 1.



**Figure 1.** Differences between respondents learning only one foreign language (1) and respondents learning two or more foreign languages (2+) in using music for active foreign language learning

## 6.2. Testing of hypothesis No. 2: $H_2$

The testing of the  $H_2$  hypothesis: “The choice of songs listened to by girls and boys depends on the foreign language of the lyrics. The difference between girls and boys is not statistically significant in this case.”, was related to item I/4 in the questionnaire: “**The choice of songs I listen to depends on the language in which the lyrics are. For each language, tick the percentage of the probability that you will play a song in this foreign language**”. The question was operationalized through a percentage axis (100 % – 0 %). The respondents indicated the possible probability of listening to songs in selected foreign languages. The Czech language, the mother tongue of most of the respondents (monolingual  $n = 307$ , bilingual  $n = 9$ ) was listed as the first language so that we could get a possible comparison with other foreign languages. The foreign languages were listed in the following order: English, as the respondents' first foreign language, and then German, Russian, French and Spanish (the order reflected the frequency in which the respondents mentioned the particular language as their second foreign language). We related the selection of the other foreign languages to our language listening memory test, in which the tested individuals listened to examples of the following languages: Turkish, Chinese, Malay, Vietnamese, Japanese and Hungarian.

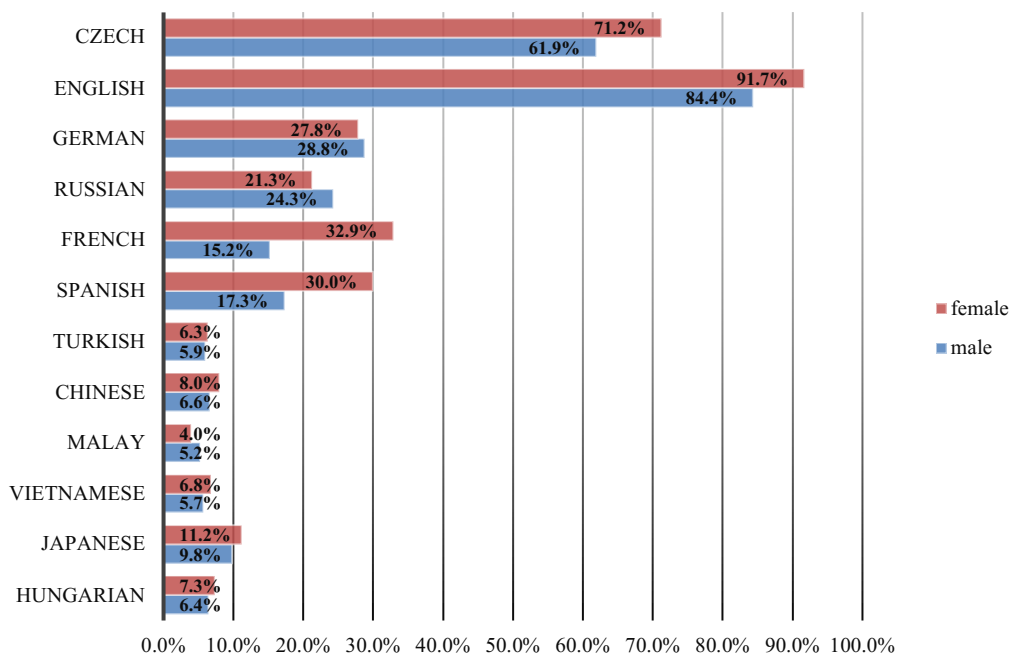
Within the framework of testing the  $H_{ku9}$  hypothesis, we monitored gender differences between girls ( $N = 186$ ) and boys ( $N = 130$ ). The testing was non-parametric (the Mann-Whitney test), one language

was always tested in correlation with both the genders. The first language tested was Czech, for which the following findings were made:

The girls chose Czech songs more frequently (71.2 %) than the boys (61.9%); the difference is statistically significant (sig = 0.018) in this case.

Then the foreign languages were tested with the following results:

The choice of songs in English was more frequently made by the girls (91.7%) than by the boys (84.4%), the difference in this case is statistically significant (sig = 0.000). The choice of songs in German was made as frequently by the girls (25.9 %) as by the boys (29.4 %), the difference is not statistically significant in this case (sig = 0.530). The choice of songs in Russian was made as frequently by the girls (21.3 %) as by the boys (24.3 %), the difference is not statistically significant in this case (sig = 0.868). The choice of songs in French was more frequently made by the girls (33.1%) than by the boys (15.2 %), the difference is statistically significant in this case (sig = 0.000). The choice of songs in Spanish was more frequently made by the girls (30.0%) than by the boys (17.3 %), the difference is statistically significant in this case (sig = 0.000). The choice of songs in Turkish was made as frequently by the girls (6.3 %) as by the boys (5.9 %), the difference is not statistically significant in this case (sig = 0.363). The choice of songs in Chinese was made as frequently by the girls (8.0 %) as by the boys (6.6 %), the difference is not statistically significant in this case (sig = 0.123). The choice of songs in Malay was made as frequently by the girls (4.0 %) as by the boys (5.2 %), the difference is not statistically significant in this case (sig = 0.520). The choice of songs in Vietnamese was made as frequently by the girls (6.8 %) as by the boys (5.7 %), the difference is not statistically significant in this case (sig = 0.571). The choice of songs in Japanese was made as frequently by the girls (11.2 %) as by the boys (9.8 %), the difference is not statistically significant in this case (sig = 0.230). The choice of songs in Hungarian was made as frequently by the girls (7.3 %) as by the boys (6.4 %), the difference is not statistically significant in this case (sig = 0.018). For a better data visualization, the measured values are graphically illustrated in Figure 2.



**Figure 2.** Gender differences in the choice of songs in different foreign languages



Summarising the gender issue of the song choices related to the offered languages, we can come to the following conclusion: Only four out of the twelve offered languages (Czech + 11 foreign languages) showed statistically significant differences (Czech, English, French and Spanish), the other eight foreign languages did not show significant differences. **The H<sub>2</sub> hypothesis claiming that the difference in the girls' choice and the boys' choice of songs depending on the foreign language is not significant** is accepted on the basis of the majority principle.

## 7. Conclusion

One of the interesting and very complex areas of language research is the relation between language, thinking and learning. The meaning of cognitive learning is not clearly defined. Our opinion is that in today's multicultural society, the interest in foreign languages increases with the growing age of individuals. This increasing interest occurs especially in case of English, which learners are regularly in contact with during their compulsory school attendance.

The theory of multifactor intelligence was applied to verify the H<sub>1</sub> hypothesis. We assume that pupils learning two or more foreign languages use music for their active foreign language learning more often than pupils learning only one foreign language. In our opinion, the learner's internal motivation plays an important role, too. The values measured in the monitored groups - learners learning two or more foreign languages (N = 4.44%) and learners learning only one foreign language (N = 5.15%) - clearly showed a statistically significant difference (sig = 0.004). This way, we verified our hypothesis claiming that **learners learning two or more foreign languages play music for active foreign language learning more often than pupils learning only one foreign language**. We explain the verification of the H<sub>1</sub> hypothesis by the fact that the cognitive horizon of a learner learning two or more foreign languages is significantly wider than that of a learner learning only one foreign language. We believe that in today's world, language learning is essential part for individual beings. A second foreign language should thus be a compulsory subject and a fixed component of the basic education from the beginning of the upper level of primary school, resp. the beginning of lower secondary school, so that the cognitive functions of the learners can to continuously increase in the field of foreign language learning. The issues of what can lead to the involvement of higher cognitive functions of foreign language learners and how to support foreign language teaching are to be discussed. The content- and language-integrated learning (the CLIL method) seems really meaningful. It involves teaching of a given school subject in a foreign language, and thus teaching of the subject itself and the foreign language teaching are interconnected. In our case, we can imagine interconnecting music classes and foreign language classes, in which the learners' own activity and creativity can be supported.

The H<sub>2</sub> hypothesis focused on the issue whether the choice of songs depends on the language of the lyrics. We tested the girls and boys for specific foreign languages, and we assumed, based on the theory of perceptual schemes, that the difference between females and males in their choice of songs in foreign languages would not be significant. From the measured values it is obvious that **the choice of songs in foreign languages is not gender-dependent**. This reality can be explained by the fact that girls show strongly developing interest in music, and by the fact that human beings of this age show different cognitive development (girls tend to be more mature and conscious).

The relation between music and teaching foreign languages to individuals aged 12-14 is conditioned by a number of factors, including cognitive learning, which cannot be separated from other psychological processes, such as perception, memory, thinking, etc. We see the goal of foreign language teaching in mastering of new, more effective ways of acquiring and processing foreign language information. These refer to better ways of learning that will lead to more effective thinking of learners. Heinrichova (2020) expresses a similar opinion, claiming that students can discuss the same situation from different perspectives, i.e. they can practice not only grammatical but also intellectual knowledge. The goal is not only to acquire knowledge, in our case knowledge of the grammatical-syntactic system of a foreign language, but above all to learn how to work better with this acquired knowledge. This goal can be reached by, for example, conceptually elaborated use of music in foreign language learning. The interest in music is abnormally high in case of individuals aged 12–14 years, and it can help us to achieve the main objective of foreign language teaching, i.e. the development of communicative competence of learners.

Concluding, we can answer our first research question, RQ<sub>1</sub>: How important is the role of music if individuals aged 12 -14 actively learn foreign languages? We believe that music can play a significant role in the process of learning foreign languages. Its role in the educational process is related mainly to the perception of the melody, to the memory training and to acquiring of new knowledge of the cultural character of the given country. The second research question, RQ<sub>2</sub>: How big is the difference between girls and boys aged 12-14 when their choice of songs depends on a foreign language?, can be answered in the following way - the differences in the monitored age are not significantly important; sexual preference does not determine the choice.

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