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## Technical Subjects and Their Popularity in Context of Technical Education Support

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### Abstract

Considering the great social demand for qualified technically oriented workers, it is necessary to develop the interest in technical fields. The article introduces research focused on mapping the current situation of (non)interest of primary-school students in technical fields and especially verification of whether the (non)interest is linked to the popularity of technically oriented subjects at primary schools. Primary schools in the Czech Republic involve pupils at the age of 6–15. The reasons, why technically oriented subjects are not popular, will be evaluated to provide possible solutions.

**Keywords:** school, technical education, popularity of subjects, technical fields

### Introduction

In the Czech Republic, there is currently a significant shortage of craftsmen from all the areas and fields, but also there are missing workers with technical orientation for modernized and automated operations. There is also a lack of people in construction, there are not enough qualified technicians, welders, smiths, ... Either pupils are not interested in preparation for that kind of work at all, or they do not finish the studies, or they find a job outside the field. How to motivate and make pupils more interested in technical fields, then? Recently, there has been much better support of technically oriented subjects in the Czech Republic. Technical education is supported by the government through various projects as well as by the companies, which provide potential job applicants with scholarships and allowances for meals and accommodations already during their

studies. Primary, secondary and high schools also develop various activities to make technical education more popular, e.g. in the form of entertainment events or competitions. There are well-known events, such as “Řemeslo má zlaté dno” (Handicrafts Have Golden Bottom), where pupils demonstrate their hand-made products, or “Dny vědy a techniky” (Days of Science and Technology) in the streets, where children may try out various activities directly outdoor. (Hončíková, Fadrhonic, 2019) Obviously, there is still a question whether these forms of support are effective and whether we shall not start with it already at the level of primary education. Yet, that requires qualified teachers.

### **Problem of Research**

In the Czech society, there is a great demand for technically qualified employees. Unfortunately, the demand does not correspond to the supply. This problem is not encountered just in Czechia, similar problems are in Slovakia too (Pavelka et al., 2019).

The research was focused on the popularity of subjects, because from our point of view it is important to work with pupils from an early age and to support their interest in technical education. The popularity of the subjects with technical orientation at primary schools is actually an important indicator, whether the goal has been successfully achieved.

### **Research methodologies and tools**

While analyzing the current situation, the main focus was on primary-school pupils and their interest in subjects relating to the selection of their future studies at a high-school. There were interviews with the teachers to analyze The Frame Educational Programme and the specific School Educational Programmes for the primary schools in Pilsen Region. Some of the contents from the curricula seemed truly attractive, others not that much. The popularization of the study field has also a great impact on the choice of another study field, no matter whether by the state, media or schools themselves. Currently in the Czech Republic, there are many efforts and intentions to increase the popularity of technical fields, in spite of the fact that the subject of Technical Education is not so popular at school. Why this is the case will be a matter of further research.

### **Sample of Research**

The respondents of our questionnaire survey were pupils of the last years of the primary schools, that means 14–15 years old. In total, 180 pupils from randomly selected primary schools in the Pilsen Region were included in the research.

### **Instrument and Procedures**

A questionnaire survey was chosen as the main method of the research. For the needs of the questionnaire survey, a non-standardized questionnaire was

created including several parts related to primary-school pupils and their interest in professional fields of study and individual subjects.

### **Hypothesis**

As mentioned above, the basic research question is how much interest in technical field studies at high schools primary-school pupils show and whether the interest is demonstrated already in primary schools like the interest in technically oriented subjects. Another question was what subjects are popular for the primary-school students and in what way is their interest reflected in preferences for selecting a high-school study with a technical orientation.

For the needs of the research, the basic hypotheses of the research were set as below:

- **H1 – In high schools, there is greater interest in technical fields than in other fields.**
- **H2 – Primary-school pupils are more interested in technically oriented subjects than in other ones.**
- **H3 – The popularity of the technically-oriented subject affects the choice of the technical field of the high school.**
- **H4 – Pupils who prefer in their high-school selection technically oriented fields prefer a technically oriented subject already in their primary school.**

### **Results of Research**

Within the research, the hypotheses will be verified one by one and the obtained data will be presented in charts.

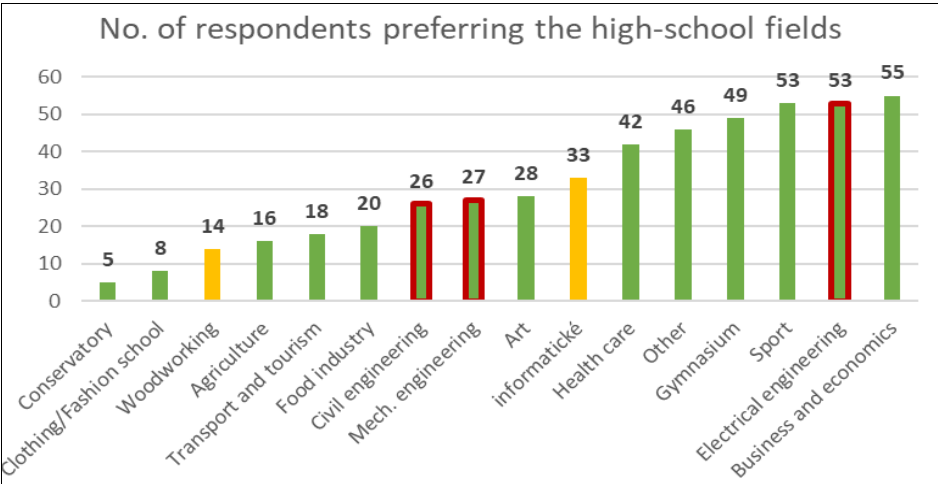
The first to be verified is the hypothesis H1 – In high schools, there is greater interest in technical fields than in other fields.

Regarding the research, the technically oriented study fields include, besides electrical engineering, civil engineering and engineering, also the fields of woodworking and informatics. Chart 1 presents the preferred selection of high-school fields, based on the interest of pupils from last years of their primary schools. The pupils could select up to three preferred fields.

Based on the Graph 1, it is obvious that the pupils are interested the most in high schools oriented on business and economics.

The interest in civil engineering and engineering oriented high schools is rather below the average, informatics is slightly better and the worst is woodworking. Compared to the other technically oriented fields, it was surprising that electrical engineering is highly popular.

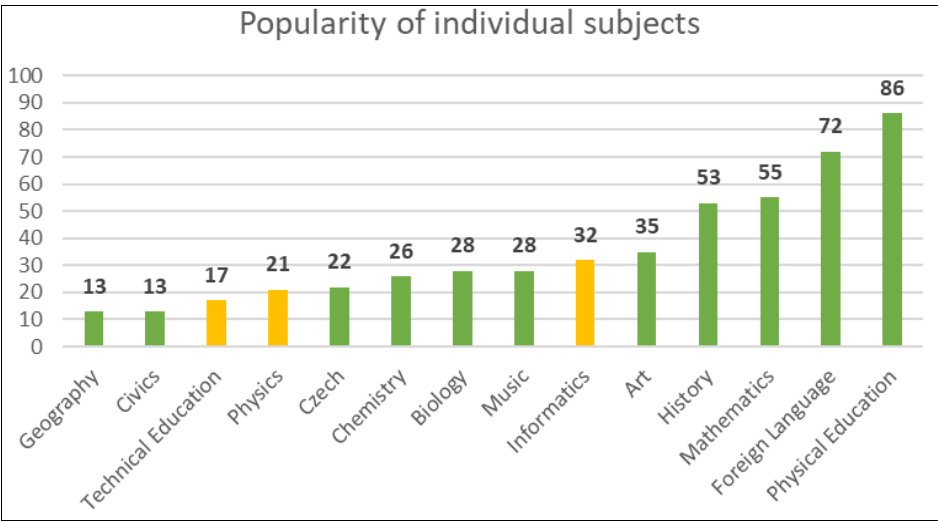
Therefore, we may state that H1 has not been confirmed.



Graph 1. High-school fields preferences

The verification of the hypothesis *H2 – Primary school pupils are more interested in technically oriented subjects than in other ones.* will answer the question, whether pupils are interested in technically oriented fields already in primary schools.

The hypothesis H2 expects that the interest in technically oriented subjects will be higher than in other subjects. Regarding the research, the technically oriented subjects may include Technical Education, Physics and Informatics. Each pupil could select up to three subjects that he liked the most.



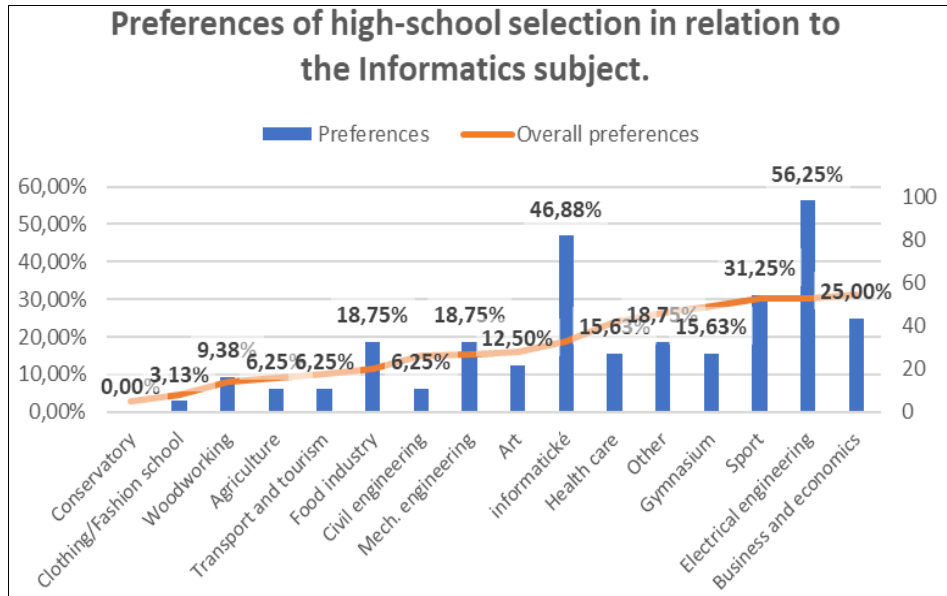
Graph 2. Popularity of the individual subjects

Based on the Graph 2, it is obvious that the most favorite subject for the respondents is Physical Education. Among other really popular subjects belong: Foreign Language, Mathematics and History. Geography, Civics and Technical Education then remain as the least popular subjects. The interest in PE was surprising, as teachers mean that children are not much into the sports. Nevertheless, why are subjects such as Geography, Civics or Technical Education so little popular? The question remains the subject of further investigation.

However, based on the survey, Physical Education, Foreign Language, Mathematics and History may be considered the most popular subjects by primary-school pupils from the last years. These subjects were selected by more than half of the pupils. Rating the popularity of 14 subjects, Informatics took the 6th place, Physics the 11th place and Technical Education even the 12th place.

Altogether, the conclusion may be that the interest of pupils in technically oriented subjects is lower than in other languages, which means that *the H2 was not confirmed either*.

Regarding the *H3 – The popularity of the technically-oriented subject affects the choice of the technical field of the high-school*, the research observes whether a popular technical subject (Informatics, Physics, Technical Education) has an influence on choosing the field of the high-school. To confirm the hypothesis, it is necessary to have the overall preferences of high-school selections of pupils with the favorite subject higher at least for two technical fields of high-school compared to the preferences.

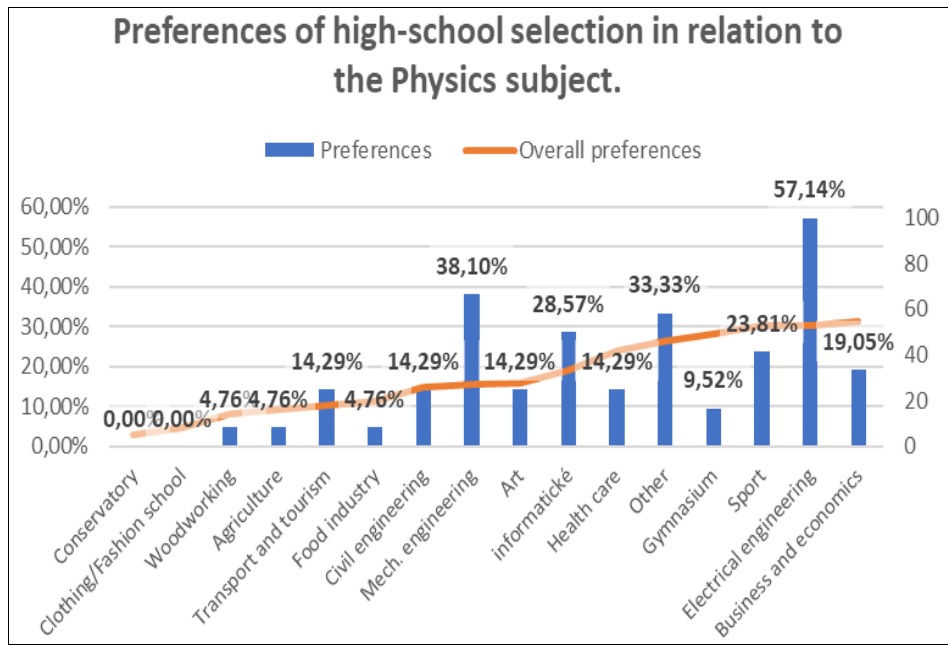


Graph 3. Preferences of high-school selection in relation to the subject called Informatics

Pupils were allowed to choose up to three options, the values are displayed in Graph 3 and Graph 5. For better clarity, the subjects in the Graph 3 and 6 are ordered according to total preferences of selected fields they received. The overall preferences of high-school selection are also displayed by the line part of the bar graph, the values may be read on the minor axis. It is simple to compare the preferences of selecting a high school for pupils with the specific favorite subject proportionally with the total preferences and to observe deviations.

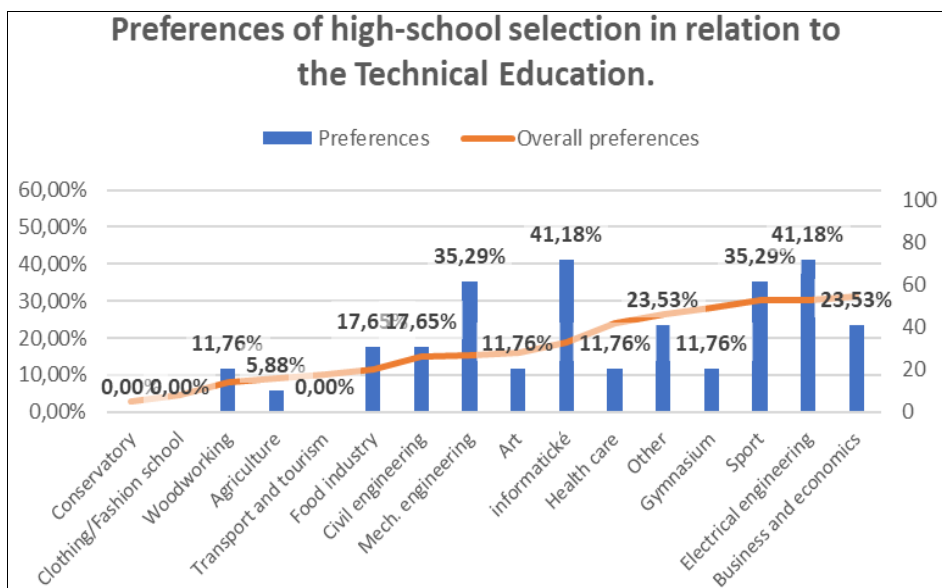
The Graph 3 displays preferences of pupils who prefer Informatics, as expected, there is a higher interest in the field of Informatics. Besides this field, the pupils also mentioned the interest in electrical engineering and a bit of interest may be marked in the food processing too. The interest in other fields is basically evenly reduced, only the interest in (secondary)grammar schools is significantly lower.

The preferences of pupils who prefer Informatics confirm the hypotheses H3.



**Graph 4. Preferences of high-school selection in relation to the subject called Physics**

The chart 4 displays the great interest of pupils who prefer Physics in electrical and civil engineering, together with an increased interest in future school oriented on informatics, compared to the overall preferences, In this case, it may be stated that the hypothesis H3 was confirmed.



**Graph 5. Preferences of high-school selection in relation to the subject called Technical Education**

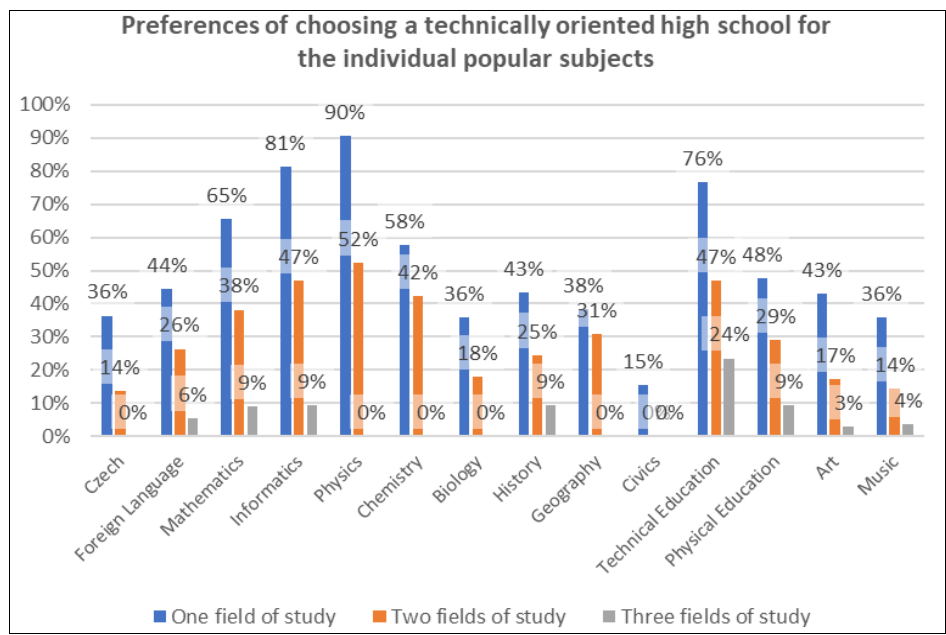
The Graph 5 does not provide any great value regarding the reasons for a lack of preferences in Technical Education, hence there were only 17 respondents who had selected Technical Education to be their favorite subject. Yet, there is visible a great interest in Informatics and education in mechanical engineering, therefore the H3 was confirmed once more.

For all the monitored subjects, the hypothesis H3 – The popularity of the technically-oriented subject affects the choice of the technical field of the high-school was confirmed.

The following hypothesis asks about the pupils who plan to study technically oriented high school. H4 – Pupils who prefer in their high-school selection technically oriented fields prefer a technically oriented subject already in their primary school should clarify whether they are interested in technically oriented subjects already in their primary school.

The hypothesis was verified on three levels. The first level included in technically oriented high schools the ones oriented on mechanical engineering, electrical engineering, civil engineering, woodworking and informatics. The second level omitted woodworking schools and the last level included clearly technically oriented fields, such as high schools with mechanical, electrical and civil engineering. Other criteria were set as follows: The technically oriented subjects at primary schools are considered Technical Education, Physics, Mathematics and Informatics. To confirm the hypothesis, it will be necessary that more than a half

of the pupils, who prefer one of the above mentioned subjects, would choose at least one technically oriented high-school and at the same time, at least 1/3 of the pupils would choose at least 2 technically oriented schools.



**Graph 6. High schools oriented on mechanical engineering, electrical engineering, civil engineering, woodworking, informatics**

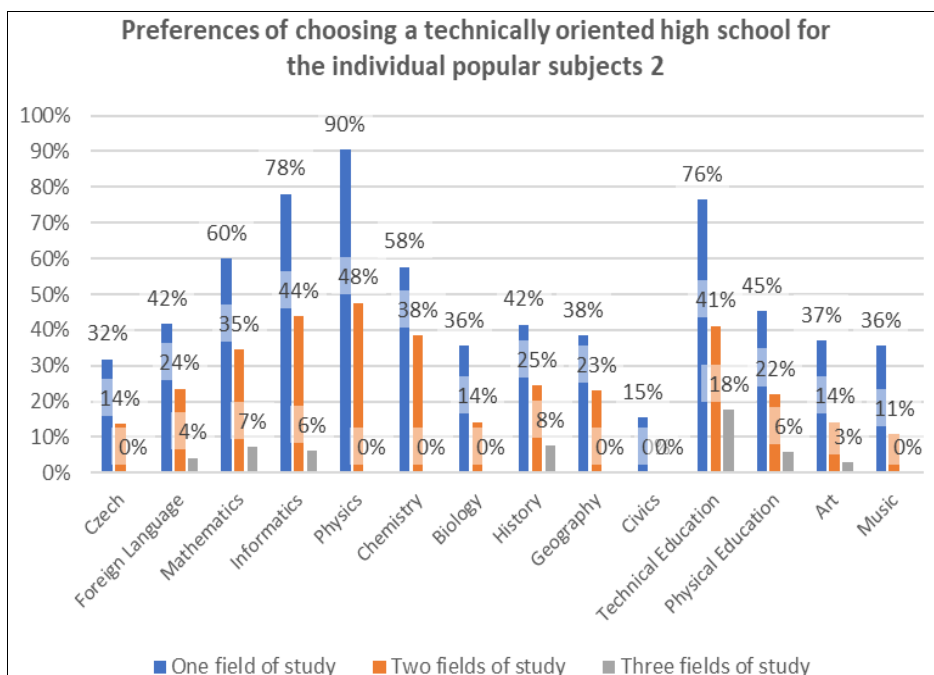
The Graph 6 presents the preferences of choosing a technically oriented high school for the individual popular subjects. In this case, the choice of technical schools was rather benevolent, a technically oriented high school in the chart means the school with mechanical, electrical or civil engineering field, wood-working or informatics.

In this case, the hypothesis H4 was confirmed, hence the technically oriented subjects in primary schools reached the preferences of at least one technical school with 65% and at least two technical school with 38%.

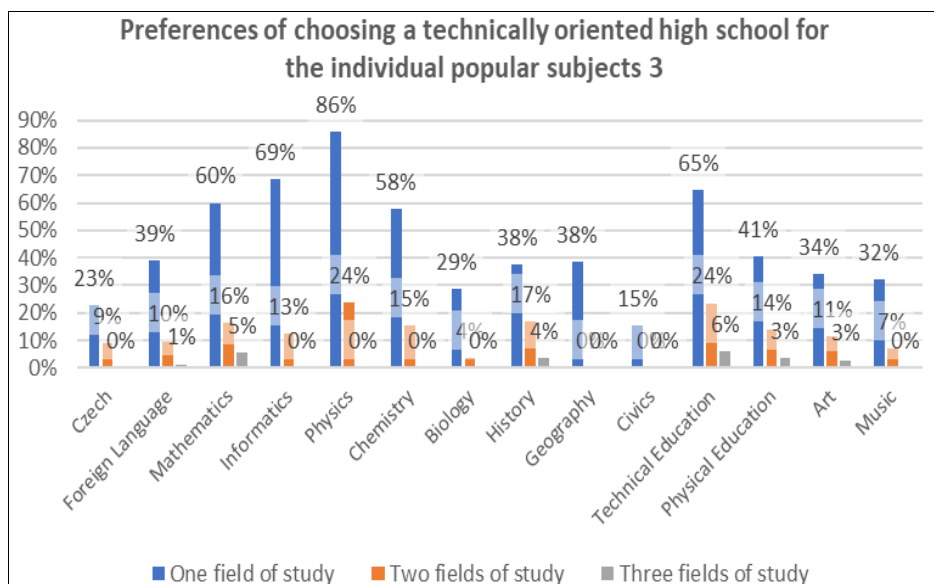
The chart 7 shows the preferences of choosing a technically oriented high school for the individual popular subjects. In this case, the technical high schools are considered the ones focused on informatics, mechanical, civil and electrical engineering character.

Despite the fact that woodworking was removed from the list of technically oriented high schools, the H4 was confirmed as the preferences of one technical-ly oriented high school achieved at the individual subjects at least the value of 60% and at two subjects 35%.





**Graph 7. High schools oriented on mechanical engineering, electrical engineering, civil engineering, informatics**



**Graph 8. High schools oriented on mechanical engineering, electrical engineering, civil engineering**

The selection of technical schools in relation to the favorite subject is shown in the Graph 8. In the graphs of technically oriented high-schools, there prevail high-schools oriented on mechanical, electrical or civil engineering.

In this case, when the technically oriented high schools mean only the technical schools of mechanical, civic or electrical engineering, the hypothesis ***H4 was disproved***. Although the preferences of pupils who prefer technically oriented subjects are still high regarding the selection of one technical field, the second criterion was not met. In this case, the pupils did not prefer two technically oriented high schools at any of the favorite subjects.

Considering the fact that the hypothesis H4 was successfully confirmed in 2 from 3 levels, the ***hypothesis H4 may be partially confirmed***.

## Discussion

Social demand in terms of the need of qualified employees is obviously given and there is no need to argue against it. But how shall be this demand met? There are plenty of popularizing events (Pavelka, Honzík, Ďuriš, Tomková, Šoltés, 2019), which are unfortunately aimed at elite groups – either from the specific school, field or interest group. That's why the results of the activities may be doubted.

According to our opinion, it is necessary to develop the interest in these fields for one thing all over the society and for another at an early age. That corresponds to “the new measures” to support the vocational education, where the first thing is to stress out the motivation of primary school students while choosing a technical field: “To motivate primary school pupils to choose secondary education fields based on their interest, skills and abilities and secondary and higher vocational school pupils to a positive attitude towards the chosen field in the process of vocational training and further education” (MEYS, 2013). Therefore, there should be invested particularly to make technical subjects learning more attractive already in primary schools. The research clearly shows that the popularity of the subjects corresponded to the consecutive selection of the high-school study. If the greater popularity of technical subjects is achieved, then there will be a high probability that the interest in technically oriented high schools will increase as well. It is necessary to invest financial resources in primary schools, be it on purchasing the equipment or in the form to encourage technically oriented and qualified teachers.

The need to innovate technical education in primary schools is a frequently discussed question. Primary school learning shall correspond to the front burners of the society (Dostál et al., 2017). The necessity to innovate technical education is required in a similar way in Slovakia too (Stebila, 2015).

## Conclusions

The task of the research survey was to verify the following hypothesis:

- ***H1 – In high schools, there is greater interest in technical fields than in other fields.***

The hypothesis was disproved.

- ***H2 – Primary-school pupils are more interested in technically oriented subjects than in other ones.***

The hypothesis was disproved.

- ***H3 – The popularity of the technically-oriented subjects affects the choice of the technical field of the high-school.***

The hypothesis was approved.

- ***H4 – Pupils who prefer in their high-school selection technically oriented fields prefer a technically oriented subject already in their primary school.***

The hypothesis was partially approved (2 out of 3 levels were approved)

Based on the results, the conclusion may be that technical fields are not more preferred than the other ones and at the same time, the technical subjects are little popular. Based on the hypothesis H3 and H4, the interconnection between the popularity of the technical subject and the selection of the technically oriented high school was proved.

Considering the results of the research, it is necessary to update the less popular subjects teaching. This considers particularly subjects such as Geography, Civics and Technical Education. It would be convenient that these subjects will be taught by a specialist, meaning a qualified teacher. As it happens, due to the low amount of lessons allocated, teachers get to teach these subjects to complete their work-time load. Only a qualified teacher knows the specifics of the learning subject. That is obviously related to the support of faculties of education, more precisely the support of teaching technically oriented subjects. It is not sufficient for teachers to know just a theory to pass it on to their pupils. They shall be also aware of the principles of the field and the ways how to motivate them. That is particularly important nowadays, when the Framework Education Programme is described really briefly and provides a large space for different approaches and implementations of teaching the individual subjects in primary schools.

Naturally, another question is the learning based on memorizing only. The issue can be seen not only in primary schools, but at any level of schooling. Knowledge of the terminology is important, nevertheless, the pupil shall be able to put them in the context. Therefore, teaching shall be more demonstrative. Bored students learning through memorizing terminology with no context turn into simple data banks with no context. This undesirable impact can be observed already in current universities, when a part of students is able to write a written

exam with almost no mistake, yet their results at an oral exam are not that good, since they are not able to explain the terms.

That applies particularly on technically oriented subjects, where the study content does not need to mean any trouble, however its real implementation does. That links especially to the form and means of the information transfer, skills, knowledge, abilities and terms. Yet during workshop lessons, it is necessary to teach pupils how to use basic tools at least regarding woodworking. However, couldn't those lessons be taught in a more attractive way? Is it necessary to push pupils to create technical drawings by actual drawing during lessons or would there be any more modern way to teach it?

There are plans to implement a subject called Technology, when primary schools shall have well equipped workshops and elementary computer-controlled machines. (Dostál, 2018) Of course, the equipment is not all. The important thing is not only that the teacher shall be able to use the technology, but he shall be also interested in it so that it would not end stored in a locked wardrobe. Certainly, the question whether and to what extent shall be the Framework Education Programme remains (NUV, 2017). Based on its brevity, the required innovations are not in conflict with this programme for primary school education. However, on the other hand they are not supported either, which is quite inappropriate considering the needs of the society.

Reasons why the technical subjects are not popular in primary education will be analyzed in detail in a follow-up research survey.

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