GRANT journal
ISSN 1805-062X, 1805-0638 (online), ETTN 072-11-00002-09-4
Vol. 8, Issue 1
EUROPEAN GRANT PROJECTS | RESULTS | RESEARCH & DEVELOPMENT | SCIENCE

Factors influencing the choice of Czech pupils to study at a secondary school with a focus on engineering

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Grant: TJ 02000083
Název grantu: Education in engineering and its optimization for the needs of labour market
Oborové zaměření: AM – Pedagogika a školství

Abstract The aim of the study is to point out selected motivational factors that influence the students' choice of studying at a secondary school with a specialization in engineering in the Czech Republic. The text focuses on the influence of parents and other key persons who have significantly contributed to strengthening pupils 'motivation to study at a selected secondary school. Furthermore pupils' interest in technology and other important phenomena influencing the choice of their future education, such as an interest in vocational subjects in their final year, are monitored. The study presents partial pilot research conducted by the Faculty of Education of the University of Ostrava within the project of the Technical Agency of the Czech Republic (TAČR, Zéta).

***Key words**: motivational factors, values, motivation to study, interest in engineering*

1. INTRODUCTION

The interest of Czech youth in secondary schools with focus on engineering is currently socially desirable but due to the difficulty level of this type of secondary industrial school, interest of primary school pupils is stagnating. The main goal of this pilot research carried out by the Faculty of Education of the University of Ostrava in the Moravian-Silesian Region of the Czech Republic was to find out factors which influence pupils' interest or lack of interest in technology or engineering.

2. CLEAR PURPOSE IN EDUCATION

Employers are highly interested in graduates of secondary schools with specialization in engineering. This interest is supported by the National Engineering Cluster, the Chamber of Commerce and other regional and national technically oriented companies and corporations. A number of factors plays a role in pupil's decision of secondary school such as the value and purpose pupils see in school education. „The value of school success is important not only for a child, but also for its parents, because children take over their parents' attitude unconditionally and reflects their approach to school work" (Vágnerová, 2012, p. 259). It is essential for both family and school to work on creation of the same key values, as the meaning of education should not be seen as a mere formality by pupils. Therefore, from early childhood, pupils should be encouraged to pursue learning activities, to be eager to learn, discover and be curious. Pupils' attitudes towards learning, such as independence and activity towards acquiring new knowledge, perseverance, flexibility in thinking, positive motivation, should be related to teaching. „Motivation is related to human needs, time, hope, aims, performance, self-respect, interest in an activity and searching for causes of success and failure" (Mareš, 2013, p. 252). The approach to learning can be an important factor affecting the pupil's school success, as Mc Wayne (2004) pointed out. Thoughts about causality in relation to the process and the importance of education are changing during school-age. At the end of primary school education period, pupils are aware of decentering, which is part of formal logical thinking. In the older school age, pupils are aware of the need to think about their future, which is related to the level and choice of professional orientation in the next stage of study, which allows for a path to a selected, (eg. engineering) profession. A high-quality engineering-oriented high school helps with the change of pupil's approach to searching, processing and evaluating information and with solving everyday problems as well as developing rational and critical thinking.

In the Czech Republic, Císařová (2018) focused on identifying motivational factors influencing the pupil's completion of secondary school studies and factors in the selection of secondary schools (eg. family, friends, school accessibility).

3. ABILITY TO APPRECIATE ONE'S OWN COMPETENCY

The ability to appreciate one's own competence is related to the level of metacognition and meta-motivation of the pupil. A fifteen-year-old student can already estimate their ability, potential, eg. in the field of study. It is therefore obvious that metacognition can also influence the level of knowledge of the requirements and possibilities in the area of planning further studies with a specific focus, which is connected to development of executive functions ie. the ability of the individual to judge a particular situation from several perspectives. In the process of refining self-esteem, pupils acquire new experience during secondary school studies, which result from comparing their own school performance with those of their peers and older people.

4. PUPIL'S PERSONALITY AND THE QUALITY OF RELATIONSHIPS WITH DIFFERENT PEOPLE

Each pupil is a part of different social group in which they play different roles (in family, school, in a group of peers). Norms and values which the individual acquires in different social groups can be potent influential factors that can determinate one's expectations of their school performance, their assessment, and the problem of satisfying the need for self-fulfilment, social prestige, etc. Also, school requirements for pupils' behaviour might be factors in the further social exercise of individuals, such as how a pupil should react if they fail a partial examination of a particular subject, etc. Family, school, different age and interest groups create certain templates (patterns) which should serve pupils as indicators of how to behave in the near and far future in different life situations in their personal and professional lives. Pupil's attitude towards learning is changing, it is not static, which is due to the level of pupils' cognitive abilities development, their own experience and playing social roles in different social contexts, etc. Classmate's role may be less influential in career decision-making when selecting a secondary school with engineering specialization than a friend's role or family member's role but that is not always the case. During secondary school period, norms are no longer determined by adults. It rather seems that authorities, that possess a certain kind of respect, are the main determinants of norms. In adolescence, the personality is greatly changing as a whole thanks to changes that are dependent on biological, but also mental and social factors. The path to further education is linked to the period of adolescence by the transformation of motivation to learning. School success may not only be a cognitive goal, but also a pragmatic goal, leading to the success of admission to secondary school with a specific (eg. engineering) focus.

5. PUPIL'S ATTITUDE TOWARDS INDIVIDUAL SUBJECTS

Differences in pupils' attitudes towards particular subjects are evident during adolescence. The attitude varies depending on whether the pupil likes or dislikes the subject, whether the pupil is successful or unsuccessful in terms of content, curriculum, teacher's personality, pupil's personality, class specifics, etc. Also the subjectivity of the importance of the subject matter, the level of motivation for work, etc. is obvious. Thanks to the degree of certain social differentiation, the adolescent is also aware of the importance of their social standing, namely in relation with the choice of a future profession or the choice of further education. Many students who desire better social status and greater financial rewards in the future show a strong motivation to learn. Choosing to study at a secondary school with specialization in engineering can be linked to both school grades and focusing on other values and preferences. Entering employment is perceived differently by many adolescents. Relationship to education, future job, technology is a dynamic value that cannot be interpreted unambiguously. The school can be seen as an environment that implements educational equalizing processes. The „relationship to school itself can be interpreted as a transformed relationship to the whole society, its values and norms, and to one's own position in it" (Vágnerová, 2012, p. 421). It is likely that many high school students recognize a large number of values, but are unable to tell which of them takes the priority. However, secondary school engineering-oriented education represents an assurance to pupils that they are going to be able to find an employment in the future.

6. MOTIVE AS A DRIVING FORCE TOWARDS THE GOAL

The motive as a driving force for activating an individual towards a certain goal is primarily influenced by two factors, namely the needs and impulses that manifest themselves with various intensity. During adolescence, there is an obvious performance based motivation that is associated with both education and professional motivation. "Based on their motivation, people have different levels of performance. These differences in performance have been shown to correlate with commitment and success in the respective area of focus. Not only that, it has also been shown that companies with a high level of performance-motivated people are more dynamic, more productive - they show a higher level of overall prosperity"(Helus, 2018, p. 133). A person's aspiration can be perceived as a key mental phenomenon in which motivation based on internal needs and external incentives plays an important role. Pupil's motivation to study at a secondary school specialized in engineering contains a strong potential of the individual to succeed in the labour market, so it is an expression of motivation for a certain performance, but on the other hand, this motivation can carry many risks in terms of personality development. "The goal of education is primary dominant orientation on spiritual values" (Kohoutek, 2002, p. 215).

7. METHODOLOGY

As part of the Technical Agency of the Czech Republic (TACR) project with patronage of the National Engineering Cluster, the Faculty of Education implemented in April - May 2019 a partial pilot research focusing on the motivation of pupils to study at an engineering school, which has a long tradition associated with the engineering industry in Czech Republic. A partial pilot questionnaire survey was carried out on a sample of 79 pupils at the end of the secondary school period, focusing on engineering, computer science, or the automotive industry. The questionnaire for pupils contained a total of 28 items, of which 20 were closed and 8 were semi-open. In this study, we present 5 items, which are presented in selected research outputs in descriptive and statistical form. The aim of the study is to point out some statistically verified relationships between variables.

7.1 Descriptive Analysis Results

Question 1: The highest level of education achieved by mother was (three options choice): trained without GCSE, or secondary school with GCSE, or college education?

The first item examined (by choosing from three options), what is the highest education achieved by the mother (trained without GCSE, or secondary education with GCSE, or college education).

Tab 1 Frequency of answers (question 1)

category	frequency	relative frequency %
trained without GCSE	23	29,11
secondary education with GCSE	36	45,57
college	19	24,05
fault	1	1,27
TOTAL	79	100,00

Source: self-processing

Table 1 shows that 36 (45.57 %) respondents stated that the highest education level achieved by the mother is secondary education with GCSE, 23 (29.11 %) respondents stated that the highest education level achieved by the mother is trained without GCE and 19 (24.05 %) respondents stated the mother's highest education level achieved was college education.

Question No. 2: The highest level of education achieved by father was (three options choice): trained without GCSE, or secondary school with GCSE, or college education?

The second item examined (by choosing from three options), what is the highest education level achieved by the father (trained without GCSE, or secondary education with GCSE or college degree).

Tab 2 Frequency of answers (question 2)

category	frequency	Relative frequency %
trained	28	35,44
secondary education	28	35,44
college	21	26,58
fault	2	2,53
TOTAL	79	100,00

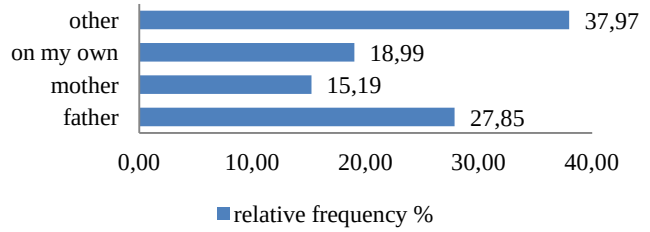
Source: self-processing

Table 2 shows that 28 (35.44 %) respondents stated that their father's highest level of education was secondary education with GCSE, 28 (35.44 %) respondents stated that the highest education of their father was trained without a GCSE and 21 (26.58 %) respondents stated that father's highest education is college education.

Question 3: My decision to study influenced (choose from 4 options): father, mother, myself, other.

The third item examined (by choosing from 4 options), who influenced the pupil's decision to study at a secondary school with which specialized in engineering (the 4 options are listed in question 3).

Chart 1 Frequency of responses (question 3)



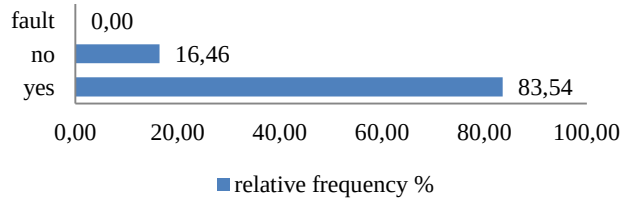
Source: self-processing

Chart 1 shows that 22 (27.85 %) respondents stated that the decision to study at secondary school specialized in engineering was influenced by a father, 12 (15.19 %) respondents said that the decision to study at a secondary school specialized in engineering was influenced by a mother. 15 (18.99 %) respondents stated that their decision to study at a secondary school specialized in engineering was their own desire. Further research data (outputs) are shown in Chart 1.

Question 4: Do teachers of vocational subjects lead you to think about a technical problem?

The fourth (dichotomic) question asked whether teachers of vocational subjects lead pupils to think about technical problems.

Chart 2 Frequency of answers (question 4)



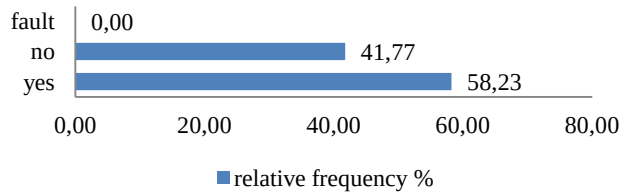
Source: self-processing

Chart 2 shows that 66 (83.54 %) respondents stated that teachers of vocational subjects lead them to think about a technical problem and 13 (16.46 %) respondents stated that teachers of vocational subjects do not lead them to think about technical problems.

Question 5: Does your school deepen your interest in the field?

The fifth (dichotomic) question investigated whether secondary school deepened pupils' interest in engineering.

Chart 3 Frequency of answers (question 5)



Source: self-processing

Graph 3 shows that 46 (58.23 %) respondents stated that the school was deepening their interest in the field of engineering and 33 (41.77 %) respondents said that the school did not deepen their interest in the field of engineering.

7.2 Results of statistical analysis

Below we provide complex hypotheses with the results of their verification.

Hypothesis No. 1 „Students who take an interest in technology in their free time (eg. machines, cars) are more likely to acquire certain pieces of knowledge in vocational subjects more often than students who don't take interest in technology in their free time", was not confirmed.

Tab. 5 Observed and expected frequencies (H1)

Contingency Table Pearson´s chi-squared test = 2,00065 degree of freedom = 1 significance p= 0,15723			
Question No. 8	Question No. 9 - yes	Question No. 9 - no	Line totals
Yes	26 (23,038)	26 (28,962)	52
No	9 (11,962)	18 (15,038)	27
Columm totals	35	44	79

Source: self-processing

Conclusion: Since the calculated chi-square value is less than the test criterion value and the significance value is greater than the selected significance level of 0.05, it was not shown that there is a statistically significant relationship between the answers to both questions. Therefore, we reject the H1 hypothesis at the significance level of 0.05.

Hypothesis No. 2 „Students who applied for the secondary school on which they study, as their first choice, are more likely to state that their study there corresponds with ideas they had about it before being accepted to the school than the students who did not chose this secondary school as their first option", was not confirmed.

Tab. 6 Observedand expected frequencies (H2)

Contingency Table Pearson´s chi-squared = 0,76623 degree of freedom = 1 significance p= 0,38139			
Question No. 6	Question No. 7 - yes	Question No. 7 - no	Line totals
Yes	32 (30,190)	21 (22,810)	53
No	13 (14,810)	13 (11,190)	26
Columm totals	45	34	79

Source: self-processing

Conclusion: Since the calculated chi-square value is less than the test criterion value and the significance value is greater than the selected significance level of 0.05, it was not shown that there is a statistically significant relationship between the answers to both questions. Therefore, we reject the H2 hypothesis at the significance level of 0.05.

8. CONCLUSIONS

The main conclusions of the partial pilot research showed that:

- 36 (45.57 %) respondents said the mother's highest education level was secondary school education (GCSE);
- 28 (35.44 %) of respondents stated that father's highest education level was secondary school education (GCSE);
- 22 (27.85 %) respondents said that the decision to study at an engineering school was influenced by their father;
- 52 (65.82 %) respondents said they take an interest in technology in their free time, such as machinery, cars;
- 66 (83.54 %) of respondents said that vocational subjects teachers teach them to think about technical problems;
- 46 (58.23 %) respondents stated that the school is deepening their interest in the field of engineering.

We will follow up the pilot research with further research in a broader context, implemented at 8 secondary engineering schools in the Czech Republic.

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