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Student Motivation in Teaching Chemistry in Slovakia

Milan Veselský
Faculty of Natural Science, Commenius University in Bratislava / Slovakia
veselsky@fns.uniba.sk

Abstract

This paper deals with the importance of interests in student learning motivation. It investigates the level of interest in chemistry for the high school students and its relations to the evaluation of chemistry and various aspects in teaching chemistry.

Introduction

The importance of functional and effective natural science education of individuals for life and work in modern cognitive society is constantly growing. However the quality of teaching is being judged as rather negative. It was confirmed by the PISA 2006 and PISA 2009 researches. According to them the Slovak students reached underaverage score within OECD member countries in the natural science knowledge. Approximately one fifth of Slovak students (20% in 2006 and 19% in 2009) are included in the risk group of pupils finishing compulsory school education without acquiring basic level of scientific literacy. More authors pointed out this worsening of the scientific literacy level. As main causes are primarily regarded educational culture with an emphasis on factual knowledge, the separation of education from first-hand experience of the child, and ignoring real life in education. In an effort to modernize teaching and activate learning activities of the students, teachers apply such forms of teaching as problem-solving teaching, project-based teaching and investigative methods of teaching.

Even the assumption that these forms of learning are sufficiently attractive to the students, will their motivation be enough to apply deep learning activities, overcome difficulties in meeting the challenges and problems, discover the importance of information obtained and shape the structure of the knowledge structure.

In terms of students' motivation to learn is internal motivation more effective than the external one. Teaching activity is sufficient for student reward or satisfaction. When the object of interest is learning content, learner is willing on his own initiative, by arousing curiosity and mental effort, perform various cognitive activities, receive and search for information, report them to integrate the prior knowledge structures, to overcome obstacles in meeting the cognitive needs, which interest is linked to. Even the tasks or problems solved by a pupil with self-interest are a challenge he is trying to manage them, even if the solutions requires a major effort. It is important that the teacher in the classroom gives students generous opportunities to apply and meet their personal interests. It is also important that the pupils will gain situational interests, eg. by demonstrating impressive experiments, inducing controversial discussion topics, introducing paradox data or surprising videos.

Internal motivation of students to learn is closely related to their confidence in the ability to organize and manage their activities so they can handle the job and come to a positive result. Students who have a positive opinion of their abilities and success in school, exhibit spontaneous activity in school activities, while students who have doubts about themselves and expect more failures, avoid classroom tasks and tend to give up on learning because these activities are not associated with being successful.

Research

The primary goal of the research was to find out the level of interest in the subject of chemistry for the students. Another goal was to find out the evaluation of the subject of chemistry for the students of both genders in tems of its contribution to life preparation, for knowledge enrichment and the use of the obtained knowledge and skills in the future carrers of the students. The last goal refered to was to quantify and interpret the relations among various aspects of schooling as they are evaluated by the students as well as their interest in the subject of chemistry.

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A five level verbal scale questionnaire with a mean was used as a research tool. It was developed by upgrading the original questionnaire of M. Jurču.
The sample consists of 223 first year students (93 boys and 130 girls) of the secondary schools in Bratislava, Banska Bystrica (major cities), Banska Stiavnica, Martin (mid-size cities), Skalica and Moldava nad Bodvou (small towns). High school students expressed their opinions and attitudes toward teaching chemistry at the elementary school level.

Gender	Scale values									
	Strong interest		Interest		Cannot say		Low interest		No interest	
	N	%	N	%	N	%	N	%	N	%
Male	14	15,1	39	41,9	9	9,7	22	23,7	9	9,7
Female	20	15,4	64	49,2	22	16,9	22	16,9	2	1,5

Table 1 Answer frequency for... express the level of your interest in the subject of chemistry... In the subject I had 1 – strong interest, 2 – interest, 3 – I cannot prefer any answer 1, 2, 4, 5, 4 – low interest, 5 – no interest at all

Table 1 shows that interest in chemistry had 57.0% of boys and 64.6% of girls. Conversely, lack of interest showed 33.4% of boys and 18.4% girls. Higher interest of girls in chemistry was also confirmed by the statistical analysis ($X2 = 11.20$, $p < 0.05$).

Comparing these results with the results of research that we conducted in the past (Veselský 1999), when interest in chemistry declared 66.7% of respondents and lack of interest 14.4% of respondents allow us, even in the absence of statistical analysis, to note a decline in interest in the subject of chemistry. A more obvious decline of interest in chemistry was found in second year high school students who were reflecting on the subjects and teaching at the high school level (Veselský, Tóth 2004). In the latter research interest in chemistry reported only 38.1% of respondents, compared with 42.7% of respondents who declared a lack of interest in chemistry. Similarly, however, as in the current research, girls showed more interest in the subject of chemistry than boys.
Higher interest of girls in chemistry is somewhat surprising. There are several possible explanations. Learning chemistry is related to the requirements for acquiring of facts. As the girls are learning more diligently they are also eager to learn more mechanically. It can also be assumed that girls associate chemistry more with such practical activities as cooking, washing and cleaning, and also the use of perfumes and fragrances.
The importance of chemistry in preparing for life declared 43.1% of boys and 46.9% of girls of our study. Chemistry as a subject is considered less important or unimportant from the point of view of 43% of the boys and 39.2% of the girls. Boys and girls, however, were not significantly different in the evaluation ($X2 = 3.06$, $p > 0.05$). The results can be viewed as negative. The results indicate a requirement for the teachers to teach chemistry with more emphasis on the practical issues of everyday life, to give students the opportunity to address the challenges and problem solving that include realistic contexts and ill-structured problems.
Chemistry as a subject is considered for the development of self-knowledge as an important or very important for 64.6% of boys and 66.1% of girls. Conversely, little important or unimportant in this context was considered by 18.3% of boys and 14.6% of girls. Students by gender, however, in its assessment were not significantly different ($X2 = 4.21$, $p > 0.05$). Again, the research results can be evaluated as not too favorable. Solutions require teachers emphasize active learning that is meaningful for the students, the use of cross-curricular activities. Students would be provided by more comprehensive knowledge enabling them to understand the world more deeply. Higher cognitive value of the curriculum would probably encourage the students not only to study but to deeper cognitive strategies as well. For teachers can also be recommended the implementation of elements of autonomy as an opportunity to influence the content of teaching students, choose the tasks and issues that are important and interesting to their knowledge.

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Chemistry was positively appreciated in terms of use of the acquired knowledge and skills in their future careers by 36.6% of the boys and 37.7% of girls. For less important or not important it was considered by 51.6% of boys and 40.8% girls. The assessments of boys and girls did not show a significant difference ($X2 = 4.68$, $p > 0.05$). Observed data are not positive and reflect the relatively low interest for adolescents in chemistry and its further study in vocational training. In evaluating these results, however, should be taken into account the fact that these attitudes are a sample of high school students and not a wider group of secondary school students. In addition, is the fact that in this age they still do not know their professional focus.

According to our findings, the highest value of chemistry students see in enriching their own knowledge (mean 2.30), followed by consideration - general preparation for life (average 2.92) and finally aspect - the use of knowledge and skills in their future careers (average 3.01). Statistical analysis (ANOVA and Fisher LSD test) confirmed the significance of the differences between the first and second order of consideration, but not between the second and third consideration order. This means that most students appreciate the study of chemistry to enrich their knowledge and less so for its importance to the life and future career. It is a challenge for the teachers to interlink the evaluation aspects in teaching chemistry. It can be reasonably assumed that the emphasis on practical use of chemistry in real life, hobbies and extracurricular interests of students and in extending and deepening their knowledge can significantly stimulate students' interest in learning the subject of chemistry and, ultimately, their interest in the study of chemistry in future.

In fulfillment of the third objective of the research, we found a significant relationship interest of students in chemistry and the understanding of the students of the subject matter ($r = 0.531$, $p < 0.05$). This finding confirms that meaningful learning of students is closely linked to the interests of students in the subjects. Such learning can only contribute to satisfying the interests of the students, as well as arouse them.

Because meaningful learning is inherently active, it can be expected that the activity of students in the classroom will find its way into the sphere of interest of the students. This assumption was fulfilled, since we found a relationship between the interest of students in chemistry and how the study requires and encourages their mental activity ($r = 0.356$, $p < 0.05$).

We also assumed the possibility of students to apply in study independence and their own approach as well as the motivating effect and relationship to the focus on chemistry. This was confirmed ($r = 0.458$, $p < 0.05$). This assumption corresponds well with the outcome of the theory of self-determination motivation (Deci, Ryan, 1985), where self-determinating behavior (conducted by an individual of their choice from their own internal approval) is closely related to the internal motivation and thus the interests, in terms of learning also with the depth and durability of learning.

The research-based learning is characterized by students thinking about various issues, analyzing problems or tasks proposed, looking and trying different solutions. The dominant motive is curiosity, manifested by a desire to solve problems, find answers or explanations. In this form of teaching pupils also have opportunities to express and pursue their own interests. Our research confirmed the expected relationship between the interest of students in chemistry and teaching opportunities to discover knowledge, procedures, find explanations of phenomena and contexts ($r = 0.343$, $p < 0.05$), as well as opportunities to show students and satisfy his own curiosity ($r = 0.400$, $p < 0.05$). It is not a surprising finding that the relationship between the interest of students in chemistry and evaluation studies is quite high as chemistry develops creative thinking, creativity and a sense for new issues ($r = 0.516$, $p < 0.05$). The explanation is that the implementation of creative activities for many students is a manifestation of their autonomy and spontaneity that connect these activities with interest. Interest and creative activities are also accompanied by not only intensive "immersion" into implementation, and therefore the learning activities, but also by significant related positive emotions.

We did not expect, however, that there will be showed no relationship between the interest of students in chemistry and opportunities to ask questions, what they do not understand or what interests them ($r = 0.101$, $p > 0.05$). Asking questions in class is not only an opportunity for students to deepen their understanding of the curriculum, but also to show their curiosity and interest. The reason for our findings could be the lack of opportunity for the students to ask the teacher and class mates questions in the class, and also experiencing that their questions often do not get satisfactory answers.

Similarly equally low, even though important can be considered the relationship between the opportunities for the students to handle experiments in the class and their interest in chemistry ($r=0,185$, $p<0,05$). We assume that one reason can be the insuffiecient amount of the opportunities for the students to perform such activities in the class, or as well their unsatisfactory realization. It is a paradox however, because the laboratory classes in chemistry are irreplaceble source of skills and knowledge, as well as situation experience for the students.

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Conclusion

The solution for natural science education, including chemistry, is teaching focused on students, with a strong use of constructive approach in knowing the students. It assumes rich communication environment, research approaches with an opportunity for the students to show and satisfy their curiosity and interest in learning, authenticity of the teaching environment and also the use of ICT.

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