

The Relationship between Extracurricular Activities and Student Achievement in the Affective Domain: The Case of a Vocational Electrical Engineering School

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Abstract - Student achievements in the affective domain is important to the learning process, as adopted values and attitudes can promote the acquisition of knowledge and the development of skills. This paper examines the effects of extracurricular activities on student achievements in the affective domain and provides an analysis and comparison with the achievements of a similar group of students in traditional classes. The research was conducted through the extracurricular activity "Young Innovators", in which 18 third grade students of a vocational high school participated. The aim of activity is to develop new and innovate existing solutions in the field of electrical engineering and computer science. The achievements in the affective domain was observed and analysed in the students who participated in the extracurricular activity and in a similar group of students who did not participate. The results of the study indicate that students who participate in extracurricular activities communicate and cooperate better with other participants, and show a higher level of responsibility for completing classroom tasks than students who participate only in the traditional class. These findings suggest that there is a need to develop extracurricular activities that give every student the opportunity to participate in something that interests them.

Keywords - *affective domain, engineering education, extracurricular activities, technology education, vocational education*

I. INTRODUCTIONS

The education process is one of the fundamental processes that affects the development of the individual, but ultimately contributes to the entire society or community. In addition to the traditional teaching in the classroom by presenting and lecturing theoretical knowledge, the practical experience of students that complements theoretical knowledge is also very important for the learning process. Learning through extracurricular activities, outside of formal education in the classroom, additionally develops cognitive and intellectual abilities [1]. Following the scientifically verified Bloom's taxonomy, as a system of classification of educational goals, it is determined that it is correct to observe the achievements of students in the cognitive and psychomotor

domains, but it is also necessary to study the achievements of the affective domain. As stated by [2], the affective domain describes the level of adoption of socially acceptable beliefs and attitudes and related emotions on which the motivation for a certain action depends. According to the revised Bloom's taxonomy, the behaviour patterns of individuals are divided according to the degree of complexity, from basic listening and responding through evaluation and organization in accordance with priorities to the most complex pattern of characterization within which the individual cooperates in solving problems as a team and reconsiders his opinion while simultaneously appreciating the people in his environment [3]. The goal of education is for students, through primary and secondary education, to constantly improve their professional knowledge and skills, accompanied by the development of personal attitude and character. In order to achieve this, it is necessary to enable students to participate in extracurricular activities, because in this way each individual has the opportunity to apply his professional knowledge and comment on it with the rest of the participants he is surrounded by. Students in the current elementary school education system of the Republic of Croatia have very few options and opportunities to choose added teaching content or extracurricular activities in support of technical culture [4]. By integrating into programs of extracurricular activities, each individual chooses the activities that best enable him to achieve his goals, with work dynamics adapted to his own abilities [5]. Previous research has proven that this type of education indicates favourable opportunities in the segments of academic achievements and integration in communities [6], and also the quality of teachers as one of the factors of quality education. Analysis of the teaching process, in which extracurricular activities are integrated, showed that students aspire to knowledge in the fields of technology, engineering and mathematics [7]. The problems of today's education indicate that constant monitoring of the educational process is necessary since the environment in which we live is constantly changing. This is precisely why the educational field of science has the task of improving the educational process, i.e. achieving the synergy of the traditional form of teaching and learning based on work. One of the first examples was the People's Republic of

China, which focused its policy on a sustainable economy based on innovation, as opposed to the previous manufacturing economy, since its goal is to achieve the status of a world innovator by 2050 [8]. This is why today, in addition to traditional ways of learning and teaching, modern strategies and approaches in the field of engineering and technology, such as project learning, are increasingly being applied. Such an approach to learning and teaching enables participants to build their competencies and professional knowledge through learning based on the work process. Individuals in the education system, who are given the opportunity to learn through project-based learning, stand out with a higher degree of engagement and generic competencies [9], which is reflected in better communication and more productive cooperation through teamwork. Project learning enables every individual, who wants it, to prepare more easily for the future working environment, because knowledge is acquired through traditional teaching in which project learning is integrated, i.e. learning based on work, i.e. practice.

The situation in the educational system is further complicated by the fact that clear visions of education have not been defined and harmonized by those who shape educational policies [10]. The current situation indicates a necessary need for changes in education curricula. But despite the very expressed need for changes, they are still lacking [11], since extracurricular forms of work require professional individuals who are capable of performing extracurricular work activities, and the problem is also the unwillingness of teachers to maintain extracurricular forms of work.

In today's curricula and programs, which must be harmonized with the modern age, situations from the real environment must be integrated into the teaching contents, which will prepare students for life challenges in the current reality and the coming future. Through education by attending extracurricular activities, students are given the opportunity to strengthen their current abilities and to build their future profession according to their wishes [12].

II. THE PROBLEM AND AIM OF THE RESEARCH

Achievements of students in the affective domain, involved in extracurricular activities, are very poorly researched and do not provide concrete results for activities in the STEM field of science. Although there are studies that analyse the affective achievements of students for the teaching of natural sciences, there is still a lack of concrete evidence of the influence of extracurricular activities in the field of electrical engineering and computing on the affective domain of student achievements in the STEM field of education, which represents the synergy of cognitive and affective achievements of students. This research deals with the problem of determining the affective achievements of students that have been improved through the participation of students in the extracurricular activity "Young Innovators". The aim of this research is to determine as clearly and precisely as possible the difference in the achievement of affective achievements of students who are involved only in a traditional concept of education and students who combine a traditional concept of education that is imbued with extracurricular forms of

work. The research question posed by this research is: *What is the link between the extracurricular activity "Young Innovators" and student achievement in the affective domain? Does it really improve student's affective achievements?* In this research, it is an extracurricular activity that represents the synergy of all components of the STEM field of education, from electrical engineering and computing (programming of works/manufactured devices, wiring of components) to mathematics and natural sciences that enable the application of electrotechnical laws and sustainable development).

III. METHODS, PROCEDURE AND SAMPLE

A. Methods

The research was conducted in the form of a quasi-experimental design, which was carried out after the process of monitoring students during their education from the second grade of high school to the fourth grade of high school. Two groups of students were included in the research, one group of students who were involved in an extracurricular activity and another group of students who were not involved in an extracurricular activity but were involved in the educational process only through the traditional form of teaching. The participants of the groups were monitored during three years of secondary education, and the students of both groups were equalized according to the criteria of general success and assessment of proficiency in previously completed secondary education classes and participation in competitions of technical disciplines in secondary education. The initial assumption that was made at the beginning of the research is that the affective achievements of the selected group of students who participate in the program of extracurricular activities do not differ statistically significantly compared to the achievements of students who do not participate in these activities, but attend classes according to the traditional teaching model.

B. Research procedure

The students of both groups are participants of the same high school qualification "Mechatronics technician" lasting four years. All are educated according to an equivalent curriculum that includes general education and vocational subjects. One group of students, in addition to the traditional form of teaching, was involved in the extracurricular activity "Young Innovators", through which students create technical and technological creations with which they participate in national, state and international competitions and work reviews. The curriculum and program of the extracurricular activity "Young Innovators" is imbued with vocational content in the fields of electrical engineering and computing, but it allows students to choose the vocational field in which they believe they can best prove themselves (automation, energy, renewable energy sources, etc.). Students independently develop their concept of the work/creation they will create, then make a specification of tools and materials and a conceptual sketch of the work. Then the teacher, who is the leader of the extracurricular activity, examines the students' conceptual versions of the works, and corrects and/or supplements them if necessary. The students then acquire the necessary material and tools (if there is a specific need, with the

support of the teacher) and then make the work/creation by applying different techniques of joining/connecting the elements and as a final step, perform tests and tests the correctness of the final product. In all stages of the creation of the finished work, the teacher - the leader of the extracurricular activity - is available to the students as support. The finished works are registered by the head of extracurricular activities for presentation at national and/or state and/or international exhibitions and reviews of works, and some of them are: "Inova - mladi", "Inova – Sajam inovacija i tehničkog stvaralaštva", "mladi@inovacije ", "Sabor mladih inovatora ", "SOELA". At these exhibitions, students present their works to visitors and other participants of the exhibition to an expert committee that evaluates the exhibits, and depending on the placement, students receive a medal and/or recognition for their work.

C. Sample

The research was conducted on a sample (N=36) of fourth-grade students of a secondary vocational school in Rijeka who were studying for the professional qualification Mechatronics Technician. The students of one group (N_A=18) were educated according to the officially prescribed curriculum, while the students of the second group (N_B=18) were educated according to the same curriculum with the difference that they were involved in the extracurricular activity "Young innovators", in addition to the traditional learning and teaching process. All students acquired prior knowledge in the field of general education subjects and vocational content in the sector of electrical engineering and computing. The members of both observed groups are equal in terms of general success, which is an exact indicator, but also in terms of interest and motivation in adopting new teaching content, communication with the environment and cooperation with peers, the degree of responsibility towards obligations and independence when completing tasks and the level of systematicity when documenting in teaching process.

D. Data collecting

Since the research paper focused on differences in the affective achievements of students involved in extracurricular activities and students who do not participate in extracurricular activities, data on achievements was collected during the fourth year of schooling, i.e. after two full years of monitoring students during secondary education. For this purpose, instruments were used to assess students' affective achievements. The elements of evaluation were: interest in adopting new teaching content, communication with other participants in the teaching process, cooperation with other participants in classes, timely and complete performance of obligations, keeping notes in a notebook related to the studied teaching content, and independence in solving problem tasks. For each evaluation element, points were assigned to each student, in accordance with the notes in the e-Diary student success administration system and the monitoring of work and progress during the final year of high school, on a scale from 1 to 5, where 1 is not satisfactory, 2 is mostly not satisfies, 3 – partly satisfies, 4 – satisfies to a greater extent and 5 – completely satisfies. The points collected in this

TABLE 1. RESULTS OF DESCRIPTIVE STATISTICS: MEAN VALUE (M), DOMINANT VALUE (MOD), STANDARD DEVIATION (SD), COEFFICIENT OF VARIATION (CV)

Group	Achievements	N	M	Mod	SD	CV
A + B	Interest	36	4,17	4	0,81	19,46
	Communication	36	4,23	4	0,80	18,87
	Cooperation	36	4,28	5	0,74	17,32
	Responsibility	36	4,00	4	0,93	23,14
	Documentation	36	4,23	5	0,87	20,50
	Independence	36	4,13	4	0,83	20,14

way were used for further statistical analysis and determination of differences in achievements between groups.

IV. RESULTS

The descriptive analysis of achievements (Table 1) for both groups (N = 36) indicates the results from which it is evident that the achievement of cooperation (M = 4.28) has the highest mean score, while responsibility is slightly less pronounced. Looking at the total sample, it is evident that the achievements of independence (M = 4.17) and interest (M = 4.13) in the vocational content of the STEM field of education should be improved.

The results of the descriptive analysis of the achievements of each group individually (Table 2) indicate that affective achievements are more developed among students of the group that participates in extracurricular activities. Among such students, the higher mean value of the assessment of cooperation stands out (M = 4.67) and communication (M = 4.67) is highlighted, which is very pronounced in their actions within extracurricular activities through cooperation and exchange of knowledge with other individuals of the group, although other achievements also show a high-level development. Students of the group not involved in extracurricular activities have the least developed achievement of responsibility (M = 3.50), since such students are not conditioned by deadlines and obligations that they must fulfil within a certain time frame, but only participate in the performance of regular obligations of the traditional way of schooling.

TABLE 2. RESULTS OF DESCRIPTIVE STATISTICS: MEAN VALUE (M), DOMINANT VALUE (MOD), STANDARD DEVIATION (SD), COEFFICIENT OF VARIATION (CV)

Group	Achievements	N	M	Mod	SD	CV
A	Interest	18	4,56	5	0,62	13,52
	Communication	18	4,67	5	0,49	10,39
	Cooperation	18	4,67	5	0,49	10,39
	Responsibility	18	4,50	5	0,62	13,74
	Documentation	18	4,50	5	0,71	15,72
	Independence	18	4,61	5	0,50	10,88
B	Interest	18	3,78	4	0,81	21,40
	Communication	18	3,78	4	0,81	21,40
	Cooperation	18	3,89	4	0,75	19,50
	Responsibility	18	3,50	4	0,92	26,39
	Documentation	18	3,94	5	0,94	23,78
	Independence	18	3,67	4	0,84	22,92

A statistical comparison of the results of both groups A and B was performed using the t-test for independent samples.

A comparison of the results of the assessment of achievements between the group of students who attend extracurricular activities and students who do not attend extracurricular activities (Table 3) shows that the differences in all achievements, except for the achievement of documentation, are statistically significant at the level of statistical significance $p < 0.05$. The above result clearly indicates that the achievements of interest, communication, cooperation, responsibility and independence are more successful for students involved in extracurricular activities.

TABLE 3. RESULTS OF T-TEST COMPARISON OF ACHIEVEMENTS BETWEEN GROUPS A AND B

Achievements	t	df	p
Interest	3,247	34	0,002622
Communication	4,000	34	0,000324
Cooperation	3,665	34	0,000835
Responsibility	3,817	34	0,000545
Documentation	2,007	34	0,052743
Independence	4,094	34	0,000247

V. DISCUSSION

The results of the research show that significantly more successful achievement of the observed affective achievements is achieved by students who, in addition to attending classes according to the traditional model, also participate in extracurricular activities with an emphasis on activities in the STEM field of education. Through participation in extracurricular activities, students strengthen their actions through cooperation with other activity participants, develop additional interest in professional knowledge, but also improve their independence and responsibility because they take responsibility for the execution of tasks and obligations. This fact is also confirmed by research related to project learning [10], which showed that students should be exposed to work situations and tasks in which their personal reflection on the problem of the task and innovation come to the fore. As proven by previous research, learning imbued with practical work results in more advanced knowledge than learning through traditional teaching principles [13, 14]. The development of the affective domain of achievement increases the quality of the education system, but also the mutual cooperation of all stakeholders in society [15]. One of the possible solutions for modernizing the educational system and enabling the selection of extracurricular activities is the transition from a linear model of learning to learning using puzzles [16], with the help of which the participants very successfully complete the assigned problem-solving tasks, but also spread enthusiasm

VI. RESEARCH LIMITATIONS

The limitations of this research are manifested in the fact that the groups are not completely uniform through appropriate testing, it is a quasi-experimental study because the participants of the groups are uniform according to the general success in the previously completed years of education, according to the grade of governance in the previously completed school years and the criterion of participation in associations that conduct workshops in the STEM field of education. In addition, different teachers approach the activities differently, so the limitation may be related to the teacher's personality and expertise.

The research produced results that indicate the fact that students involved in extracurricular activities achieve better results in the domain of affective achievements, but there is a possibility that the results of the research were influenced by factors that were not taken into account during the implementation of the research, such as the environment in which the members of the sample are surrounded, the influence parents, level of education of parents, interest groups in which members of the sample reside, as well as innate characteristics of the individual within the affective domain of achievement. From the above, it is concluded that the research should be expanded with included factors that can influence the research results, with the aim of obtaining more credible research findings.

VII. CONCLUSION

The conducted research clearly indicates a difference in the affective achievements of students involved in extracurricular activities from students who are not involved in extracurricular activities, with an emphasis on more developed affective achievements in students whose education combines a traditional approach to teaching and extracurricular activities. Significant differences are present in all analysed achievements: interest, communication, cooperation, independence and responsibility. This research indicates that the degree of development of affective achievements is much more emphasized in students who have the opportunity to participate in team work, who are more dedicated to work-based learning and have the opportunity to research depending on their interest, and all activities are accompanied by a time frame for fulfilling obligations and working tasks. The initial assumption that was made at the beginning of the research that the selected affective achievements of the group of students who participate in the extracurricular activities program do not differ statistically significantly compared to the achievements of students who do not participate in these activities, but attend classes according to the traditional teaching model, is also rejected. As previously stated, students who participate in extracurricular activities have a statistically significant development of affective achievements, which greatly helps them in further education, but also in participation in the labour market.

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