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The relations between students' perceptions of equipment and attitudes toward teaching technical culture and informatics

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Abstract: *The students' attitude towards teaching is important in order to arouse interest and motivation for the lessons. In addition to the teacher, who plays the most important role, the environment in which instruction takes place can also influence student interest and motivation. Considering the peculiarities of technology and computer science teaching, the equipment of the classroom where the teaching takes place could have an influence. Therefore, the relationship between students' perceptions of workshop/classroom facilities and their attitudes toward teaching technology and computer science was investigated here. The research was conducted in the form of a survey among a sample of 5th-8th grade students (N = 2155) from primary schools in Croatia. The results show a positive correlation between the students' perception of the equipment and the statements that technical culture is important for life, that there should be more teaching in technical culture, that they like hands-on activities, and that they like working with technology. A weak correlation was found between the equipment and the need for more informatics and attitudes towards a career in this area. Therefore, it can be concluded that equipment is important for making students aware of the importance of this teaching, but it is not a decisive predictor of student attitudes.*

Keywords: *informatics; technology teaching; equipment; students' attitudes; technical culture*

1. INTRODUCTION

The structure of any educational institution, including schools, consists of physical and organizational as well as social aspects [1], with classroom organization being an important part of the physical aspect. A rich and stimulating spatial and material environment is considered an indispensable condition for quality learning and full development of students [2]. In other words, the environment in which learning and teaching take place must not only provide opportunities for the implementation of student activities, but should also be stimulating for students. This means that it cannot be considered only as a passive space for carrying out activities, but must be an integral part of learning that helps to shape the personality of each child [3]. For this reason, the technical-technological area of education is particularly demanding and specific. This area goes hand in hand with a very dynamic epistemological (content) foundation, but also with a specific path to knowledge that is not possible without student activity in a meaningful instructional context. Part of this context, which gives meaning and significance to the content that students learn [4], is also a specially equipped space (workshop/lab/practicum) in which such activities are carried out, as well as the equipment for carrying out the activities. This space, with its aesthetic appearance, can influence students' attitude towards the subject [5], as they feel more comfortable in it and are therefore more motivated for the activities. Teachers also believe that a space suitable for teaching technology, equipped with the necessary classrooms, tools, and other technical resources, plays an important role in achieving the goals of teaching [6]. However, students' attitudes should not be ignored, i.e., their perceptions of classroom/workshop equipment and attitudes towards teaching in this area. Although students' attitudes are their personal perceptions, beliefs, values, judgments, opinions, personal theories, and similar constructs of a particular reality, there is no doubt that they are related to their interest in a particular field [7]. Thus, the main objective of this study was to determine the extent to which students' perceptions of classroom equipment are related to attitudes toward teaching technical culture and informatics. In this way, it was hoped to gain a deeper insight into the ways in which the space in which instruction takes place can indirectly influence attitudes toward that instruction, as well

as students' interest in and motivation for that instruction and field of activity.

2. METHODS

The research was conducted as an anonymous survey of student attitudes, on a stratified sample of students (N = 2155) in 5th through 8th grades. An extended version of the Pupils' Attitudes Toward Technology - Short Questionnaire (PATT-SQ) test was used to collect data, as described by Ardies et al. [8]. This expanded and adapted version of the questionnaire was named PUTTOR (Student preferences towards technique, technology and sustainable development), which was then validated and used to examine broader student preferences [9]. Items were selected for this study, i.e., statements made by students to which they expressed their agreement on a Likert scale ranging from 1 - I strongly disagree to 5 - I strongly agree. Students expressed their assessment of the classroom/workshop facilities (equipment) on a scale from 1 - very poor to 5 - excellent. The selected items of the questionnaire are shown in Table 1. The first variable (OPRE) is treated here as an independent variable, while the other variables are dependent. Data collection was done in cooperation with primary school teachers and in accordance with the Code of Ethics for Research with Children [10].

Table 1. *Selected items from the PUTTOR questionnaire*

No.	Variable – statement
1.	*How would you rate the workshop/classroom facilities in your school? (OPRA)*
2.	*Technical culture is important for life (TKZI)*
3.	*Informatics is important for life (INFZ)*
4.	*I would like to join the club of young technicians (RKMT)*
5.	*There should be more technical culture in school (VITK)*
6.	*There should be more informatics in school (VIIN)*
7.	*I like to repair things at home (UZKU)*
8.	*I like practical exercises in class (SVPV)*
9.	*I will probably choose a profession in technology (VJPO)*
10.	*I like to work with technology (UZTE)*
11.	*I would like to become a technician or engineer (ZETE)*
12.	*I would like to become a programmer or computer scientist (ZEIN)*

After collection, all data were processed using descriptive statistics procedures, and regression analysis was performed to determine the relationship between equipment ratings and student attitudes. In this way, a correlation was established between the students' ratings of the equipment and the distribution of the ratings in relation to the statements of the questionnaire. By determining the value of the correlations, it was also determined with which students' attitudes and in what way their perception of the equipment of the classroom could be related.

3. RESULTS

A total of 2155 primary school students in Croatia participated in the study, of which 1025 (47.56%) were boys and 1130 (52.44%) were girls. Among them, 497 were 5th grade students, 530 were 6th grade students, 559 were 7th grade students, and 569 were 8th grade students.

The descriptive statistics data (Table 2) show that the students rated the equipment of the workshops/classrooms as medium-high (M = 3.822), with the most frequent rating being four (Mod = 4) and the coefficient of variation CV = 25.06%. Although, according to teachers in most primary schools, the equipment of technical culture workshops is not up to the level it should be [11], the equipment of classrooms IT can be considered acceptable. This is because, although resources for computer science (informatics) teaching are weaker than the European Union average [12], [13], the state has repeatedly invested significant resources in this equipment. In contrast to computer science, the equipment of technical culture workshops is mostly left to the schools and the abilities of individual teachers. Therefore, we believe that this way of evaluating the equipment by students can reflect the reality from their point of view.

The mean scores of the ratings as well as the dominant scores are highest for the statements that informatics is important for life (M = 4.371; Mod = 5), that they like practical exercises (M = 4.021; Mod = 5), and that technical culture is important for life (M = 4.016; Mod = 4). This is followed by the mean scores for enjoying working with technology (M = 3.705; Mod = 5) and enjoying repairing things at home (M = 3.478; Mod = 5). For the variables related to the attitude that there should be more technical culture and informatics in school, the mean values of the assessments are relatively low (M = 2.943 and M = 3.297), and the dominant value (Mod = 3) indicates a large number of undecided students on this question. Similarly, the student is likely to choose a career in engineering and technology (M = 2.593; Mod = 3). The lowest mean scores of the ratings, but also worryingly dominant scores, are observed in the statements about their future career development and about the clubs' activities for young technicians. Thus, the mean values of the evaluation for the statement that the student wants to become a technician or engineer are convincingly the lowest (M = 2.423) with a high percentage (33.41%) of students disagreeing with this statement at all. Similarly, the statement that the

student wants to become a programmer or computer scientist (M = 2.695) has 30.02% of students disagreeing with it at all. Surprisingly low is the mean estimate for the statement that the student would like to join the Young Technicians Club (M = 2.661), with which 26.90% of the students disagree at all. This finding for the RKMT variable was not expected, as the students expressed mostly positive attitudes toward technical activities, as evident from the estimates for practical exercises (SVPV), enjoying working with technology (UZTE), and enjoying repairing things at home (UZKU). In addition, for the variable RKMT, a high inconsistency of student ratings (CV = 52.34%) was found, which may indicate either a high polarization of students or a lack of information about such a possibility.

Table 2. *Descriptive statistic data for the selected items.*

Var.	M	Mod	F of Mod	Var	SD	CV (%)
OPRA	3.822	4	907	0.917	0.958	25.06
TKZI	4.016	4	850	0.866	0.930	23.16
INFZ	4.371	5	1171	0.673	0.820	18.76
RKMT	2.661	1	638	1.940	1.393	52.34
VITK	2.943	3	677	1.698	1.303	44.28
VIIN	3.297	3	600	1.712	1.308	39.69
UZKU	3.478	5	650	1.794	1.339	38.50
SVPV	4.021	5	960	1.270	1.127	28.03
VJPO	2.593	3	646	1.721	1.312	50.60
UZTE	3.705	5	674	1.367	1.169	31.56
ZETE	2.423	1	720	1.716	1.310	53.93
ZEIN	2.695	1	647	2.060	1.435	53.24

The results of the regression analysis of the relationship between each dependent variable and the independent variable are shown in Table 3. From the results, it can be seen that the values of all variables correlate positively and statistically significantly with the equipment ratings. However, the correlation values show a mostly weak relationship, but also significant differences in the correlations. The values for the statement that students like practical exercises (SVPV) correlate most strongly with the equipment variable (OPRE), whose values tend to be moderately correlated (R = 0.246; F = 138.212; p = 0.000). The correlation can be considered indicative for the statement that technical culture is important for life (R = 0.215; F = 104.669; p = 0.000) and for the student's statement that he would like to join the club of young technicians (R = 210; F = 99.171; p = 0.000). High F-values for the above variables also indicate the possible predictive value of workshop/classroom equipment for the development of such attitudes among students. Slightly lower values, but still significantly higher than the lower ranged, were recorded for the statements that the student likes to work with technology (R = 0.199; F = 88.671; p = 0.000) and that there should be more technical culture in school (R = 0.176; F = 68.809; p = 0.000). The correlation of the student statement that they enjoy repairing things at home with the equipment ratings is weak (R = 0.133; F = 38.826; p = 0.000). The correlation values for students' statements that they are likely to choose a career in engineering and technology (R = 0.114; F = 28.196; p = 0.000), that they would like to become a technician or engineer (R = 105; F = 23.989; 0.000), and that computer science is important in life (R = 0.101; F = 22.364; p = 0.000) are strikingly low. Although these values are also statistically significant and above the reference value (R = 0.10), the relationship between these variables and workshop/classroom equipment is borderline and therefore highly questionable. For the variables related to the statements that there should be more informatics in school (VIIN) and that the student wants to become a programmer or computer scientist (ZEIN), the very low correlation with the workshop/classroom equipment assessments is striking. Namely, the correlation values for these variables are below the reference value, while the F-values indicate a weak predictive value of the equipment for the development of student attitudes from the variables VIIN and ZEIN mentioned above.

Table 3. *Regression analysis of the relationship between dependent variables and the independent variable OPRE.*

Var.	R	R^2	SS	F	p
TKZI	0.215	0.046	86.438	104.669	0.000
INFZ	0.101	0.010	14.897	22.364	0.000
RKMT	0.210	0.044	184.004	99.171	0.000
VITK	0.176	0.031	113.287	68.809	0.000
VIIN	0.056	0.003	11.521	6.748	0.009
UZKU	0.133	0.018	68.443	38.826	0.000
SVPV	0.246	0.060	165.046	138.212	0.000
VJPO	0.114	0.013	47.933	28.196	0.000
UZTE	0.199	0.040	116.465	88.671	0.000
ZETE	0.105	0.011	40.725	23.989	0.000
ZEIN	0.075	0.006	24.971	12.187	0.000

4. DISCUSSION

Although workshop/classroom equipment can be considered from different and highly professional points of view due to the specific equipment used for teaching technical culture and informatics, the

value of students' perceptions of the equipment is of particular importance in this research. Indeed, students' perceptions are often more important than the actual equipment in the classroom, because students should perceive it as such. The distribution of equipment ratings presented here, which at the same time meets the normality criteria (K-S d = 0.24851, $p < 0.01$), can be considered as an authoritative indicator of workshop/classroom equipment.

From the descriptive statistics data, it appears that students perceive technical culture and informatics classes as important for life, and that they like the hands-on (practical) activities that are conducted in these classes, as well as activities with engineering and technology in general. However, when it comes to the question of whether there should be more teaching in these subjects, it is obvious that students express significantly more doubts about these issues. This points to the problem of realization of teaching subjects in this area, which is not the subject of this research. As for the attitude towards joining young technicians' clubs as an extracurricular activity, the assessments on this (Table 2) somewhat clash with the observed correlation from Table 3, which could indicate that students in some elementary schools do not know about this possibility or that the teacher in their school has not organized such activities. Regarding the perception of future career choice and professional activity, it is obvious that the majority of students do not want to assert in technology. However, research points to the problem of insufficient knowledge about the possibilities of such affirmation and the insufficient number of lessons in which students could become aware of this area [14], so positions on these issues should be taken with caution.

Regression analysis shows a positive and statistically significant correlation between workshop/classroom equipment and all dependent variables. However, this correlation is generally weak, which is to be expected. Indeed, the classroom as such is not expected to directly influence student attitudes. Despite the weak correlation, the differences are still noticeable, so it can be said that the equipment of the classroom has some predictive power and is related to the students' attitudes. This relates to students' interest in hands-on (practical) activities, attitudes toward the importance of technical culture in life, and attitudes toward extracurricular activities. In other words, the better equipment of the classroom could produce a more positive attitude among students if the main conditions are also met. By the main conditions, we primarily mean the implementation of appropriate and meaningful activities and the essential quality of teachers as the most important factor for the quality of teaching. At the same time, it can be seen from the analysis that the equipment of the classroom does not have such a great predictive power when it comes to the attitude towards the importance of the informatics for life, nor for the attitude towards the future professional development of students in the engineering and technology. From the results, it appears that workshop/classroom equipment is much more important for teaching technology (technical culture) than for teaching computer science (informatics), and therefore is a more important predictor of the quality of this teaching. Finally, the equipment of the technical culture classroom differs significantly from that of the computer science (informatics) classroom, as indirectly evidenced by the results of this study. Similarly, the equipment of the technical culture workshop is much more complex than the equipment of the classroom IT. Given the high prevalence of computers in everyday life today, low correlations between student perceptions of equipment and attitudes toward computer science instruction are not surprising, as students often do not view computer use through the lens of specific equipment.

Although the analysis of the research results showed a correlation and a positive relationship between the equipment and the attitude of the students, the equipment cannot be the decisive factor in the development of the awareness and the positive attitude of the students. In fact, the equipment and space are still static elements of the environment, which are not able to influence the students directly. For this reason, even such a weak correlation should be considered an important finding that nevertheless indicates some influence of a rich environment on student attitudes toward instruction. This is particularly important in technical education and teaching informatics because such an environment is a necessary condition for instructional success.

5. CONCLUSION

In this research we tried to answer the question if there is a connection between the equipment of the workshop/classroom where technical culture and informatics is taught and the positive attitude of the students towards these subjects and the teaching area and what is this connection.

In the analysis of the research results, it was found that there is a positive and statistically significant correlation between the variable of workshop/classroom equipment and all the variables of expressed attitudes of the students. This correlation is weak, which also indicates a weak relationship. Despite the weak correlation, it was found that the correlation between the equipment of the classroom where the classes are held is significantly higher for students' attitudes towards the importance of technical culture classes for life, for attitudes towards practical exercises in class, for attitudes towards extracurricular

activities in technical culture, for attitudes towards the need for more technical culture classes, and for students' enjoyment of working with technology. The relationship with the teaching of informatics and students' desires for career development in technology and informatics is significantly lower or even negligible. Overall, it can be concluded that the equipment of the classroom can have a positive effect on students' attitudes towards the teaching of technical culture, including informatics. Although this is a weak correlation, it should be noted that the equipment is only one part of the learning environment, so the results presented are meaningful according to the role of the equipment in the teaching process. In other words, the equipment can influence students' attitudes toward teaching, but it cannot be a decisive predictor of the development of students' attitudes and interests.

The research findings have provided a clearer picture of the role of the technical culture and computer science classroom in forming positive student attitudes toward it. Nevertheless, and especially because of the impossibility of real equipment assessment during this research, the role of space for the delivery of technology instruction in the formation of students' attitudes and interests toward this instruction requires additional research. Such research should answer questions about key elements of the environment that may influence the formation of positive student attitudes toward this specific instructional area.

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