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Attitudes of students majored in mechatronics towards electronic technology

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Summary. The article presents and justifies the need to do research on students' attitudes towards curriculum content. Theoretical considerations were supplemented by research on the attitudes of mechatronics students before and after the content of the electronics subject, which occurs in the 90-hour study program (45 hours of lectures and 45 hours of laboratory exercises). The conducted research using the semantic differential method showed that an implementation of program content plays a significant role in shaping attitudes – an increase of the synthetic rate from 1.51 to 2.30. Participation of students in program classes results in increasing the direction, strength and permanence of students' attitudes towards electronic technology.

Postawy studentów kierunku mechatronika wobec techniki elektronicznej

Słowa kluczowe: postawy, edukacja, studenci, mechatronika, technika elektroniczna

Streszczenie. W artykule ukazano i uzasadniono potrzebę badań postaw studentów wobec treści programowych. Teoretyczne rozważania uzupełniono badaniami postaw studentów kierunku studiów mechatronika przed i po realizacji treści przedmiotu elektronika, który występuje w programie studiów w wymiarze 90 godzin (45 godzin wykładów i 45 godzin ćwiczeń laboratoryjnych). Przeprowadzone badania metodą dyferencjału semantycznego wykazały, że realizacja treści programowych odgrywa znaczącą rolę w kształtowaniu postaw – odnotowano wzrost wskaźnika syntetycznego od 1,51 do 2,30. Uczestnictwo

studentów w zajęciach programowych skutkuje zwiększeniem kierunku, siły i trwałości postaw studentów wobec techniki elektronicznej.

Introduction

The current reform of higher education in Poland, which is subordinated to the recommendations of the Bologna process, directs the didactic activity of the academics on the students' achievement of the assumed learning outcomes in the form of knowledge, skills and social competences[1].

Attitudes play a leading role in social competences. They integrate all three competency components to a large extent, while conditioning the proper mastery of knowledge and skills[2].

Attitudes considered as a personality disposition express an approach of a man to the object of cognition and action, and manifest themselves in the individual's attributing values to certain events, norms, products, works, and themselves[3].

Premises of theoretical research

Attitudes – due to their complex structure – are one of the most difficult objects of knowledge. The examination of attitudes requires determining the level of many attributes and components that are usually interconnected by a network of complex relationships[4].

The literature on the subject lists several characteristics of attitudes, such as: content, direction, strength and durability[5]. The object of the attitude defines

[1] *A Framework for Qualifications of the European Higher Education Area*, Ministry of Science, Technology and Innovation, Copenhagen 2005, p. 92.

[2] Z. Wiatrowski *Podstawy pedagogiki pracy*, WSP, Bydgoszcz 2000; A. Marszałek, *Elektronika w edukacji technicznej dzieci i młodzieży*, WSP, Rzeszów 2001; Z. Wołk, *Kultura pracy: etyka i kariera zawodowa*, ITE, Radom 2009; D.P. Schultz, S.E. Schultz, *Psychology and Work Today*, Upper Saddle River, Prentice Hall, New York 2010.

[3] cf. G.W. Allport, *Attitudes.* In C. Murchison (ed.), *Handbook of social psychology,* Mass: Clark University Press, Worcester 1935; W. Soborski, *Postawy, ich badanie i kształtowanie*, WSP, Kraków 1987, s. 25; A. Marszałek, *Elektronika w edukacji technicznej dzieci i młodzieży,* WSP, Rzeszów 2001, s. 94; G.R. Maio, G. Haddock, *The psychology of attitudes and attitude change*, SAGE, Los Angeles, London 2009.

[4] cf. W. Soborski, *Postawy, ich badanie…*; G.R. Maio, G. Haddock, *The psychology…*; T. Vogel, M. Wanke, *Attitudes and Attitude Change*, Psychology Press, London 2016.

[5] D. Krech, R.S. Crutchfield, E.L. Ballachey, *Individual in Society: a Textbook of Social Psychology*, McGraw-Hill, New York 1963.

a feature called the attitude content. An approach to attitude may be different – positive or negative, possibly ambivalent (opposite). This is the direction of attitude. Differences in the intensity of positivity or negativity show the strength of attitude. The resistance to change of the human relation to a specific object is determined by the persistence of the attitude.

According to the cited definition, three components of attitudes can be distinguished: cognitive, emotional-motivational and behavioral[6]. The cognitive component of the attitude may include beliefs, assumptions, knowledge about it. An individual associates different feelings with various objects. They are joy, tenderness, delight, respect, and they all stimulate or discourage specific actions.

Taking into account the stimulus triggering specific reactions it is possible, after W. Soborski, to divide the methods and techniques of studying attitudes into two groups:

- methods and techniques that allow studying any ideas of the attitude, e.g. drawings, responses;
- methods and techniques allowing the examination of the attitude itself [7].

Due to the ease of testing – techniques from the first group are used more often. Then the research results are significantly affected by the interfering factor that is difficult to eliminate – the social desirability bias[8].

These premises identified the need to undertake research aimed at defining students' attitudes towards the content of education in electronics. An implementation of the research required answering two questions: What are the attitudes of students towards electronic technology? and How do students' attitudes towards electronic technology change before and after the content of the electronics subject? For the further analysis the direction of a multi-area mechatronics was chosen. From the main problem thus posed, specific problems were identified regarding the content, direction, strength and permanence of attitudes towards electronic technology of students of a given field of study.

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[6] T. Vogel, M. Wanke, *Attitudes…*, p. 68; T. Mądrzycki, *Psychologiczne prawidłowości kształtowania się postaw*, WSiP, Warszawa 1977.

[7] W. Soborski, *Postawy, ich badanie…*, s. 59.

[8] L.A. Edwards, *Social desirability variable in personality assessment and research*, Dryden, New York,1957; A. Furnham, *Response bias social desirability and dissimulation. Personality and Individual Differences* 1987, no. 7, p. 385–400.

Research on attitudes using semantic differential technique

The minimization of the phenomenon disturbing the measurement of attitudes – a social desirability bias can be obtained by using the semantic differential technique whose authorship is attributed to Charles E. Osgood[9]. This technique is based on examining the pragmatic meaning of a specific term (words, concepts) for the tested individual. According to Asahel Davis Woodruff the concept (fig.1) is attributed to a specific "emotional" color[10].

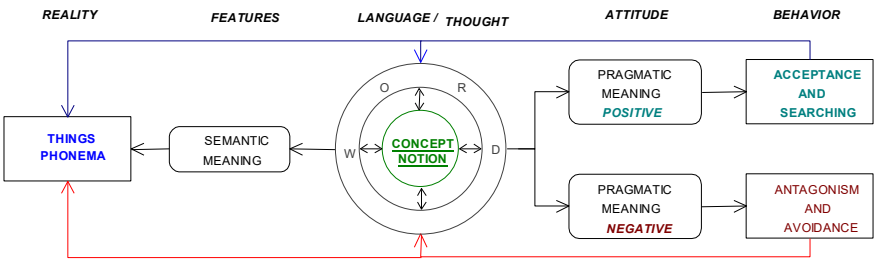

Figure 1. The complex character of the concept (word)

C.E. Osgood noted that each language sign can be characterized due to the content range it concerns (semantic significance) and due to its non-linguistic reactions (pragmatic meaning). The concept (name) together with its associations creates a semantic field. The meaning of a name is not the sum of the meanings of its associations, but it contains a component common to the meaning of this name and the meanings of its association. Osgood proposed a method of studying the relationship between the semantic (denotative) and pragmatic (connotative) meaning of the name. He accepted the assumption that key terms understood as stimuli trigger reactions in associations that differ not only in type, but also in features (e.g., great – bad). The technique of conjugational differentiation using similar bipolar scales was called by Osgood the technique of semantic differential. In the method he distinguished three basic groups of scales of equivalent factors: assessment, strength and activity.

By examining a specific name (concept) using this technique, one has an opportunity to draw a conclusion on the relation of the subject to the name, which is a representative of certain values. Lack of literal wording increases the

[9] T. Vogel, M. Wanke, *Attitudes…*, p. 41.

[10] E.B. Hurlock, *Child Development,* McGraw-Hill, New York 1978, p. 131.

reliability of the study. The meaning of pragmatic words reflects the attitude of the human being and is identical with the emotional and motivational component of the attitude. The characteristics of the factors refer to the characteristics of attitudes defined in the literature. An assessment to the direction of attitudes, strength to strength, activity to durability.

Research procedure and characteristics of the group

The research on attitudes by means of the semantic differential technique was carried out in 2016–2017 at the University of Rzeszów. The study involved 86 students of the first-cycle full-time studies majored in mechatronics. Measurements of students' attitudes towards electronic technology were made before and after an implementation of classes in electronics, 90 hours, of which 45 hours were allocated for lectures, 45 – for laboratory exercises.

The issues of lectures and exercises in electronics included the following contents[11]:

Characteristics of the subject, history and main directions of electronics development.

Discrete RLC elements, filters.

Semiconductor diodes.

Bipolar transistors.

Unipolar transistors.

Controlled semiconductors.

Thermoelectric devices and other semiconductor devices.

Optoelectronic devices.

Power systems.

Strengthening systems.

Generating systems.

Basics of electronic digital technology.

Logical function words (gates).

Arithmetic systems.

Commutation systems.

[11] A. Marszałek, *Elektronika,* UR, Rzeszów 2013; P. Horowitz, W. Hill, *Art of electronics,* Cambridge University Press, New York 2015; M. Plonus, *Electronics and Communications for Scientists and Engineers,* Harcourt/Academic Press, San Diego 2001.

Code converters.
Sequential systems.
Recording systems.
Counting systems.
Digital-to-analogue and analog-to-digital converters.
Memory and programmable logic structures.
Processor.

The subject matter of the lectures concerned the knowledge of construction, principle of operation, parameters, types and applications of these devices and systems. Laboratory exercises were focused on practical understanding of construction, measurement of parameters, characteristics, combining elements into systems and presenting the functioning of systems that were implemented in groups of 3 people.

The surveyed students were asked to indicate the values on the scale from "-3" to "+3" for 12 antonyms for the terms: "Me in the electronic technology environment" "electronics – subject of study" "a colleague as a person cooperating in the electronic technology environment" and "teacher of Electronics". Each of four antonyms described one of three features: an assessment, strength and an activity (table 1).

Table 1. Table to assess the meaning of the connotative concept of electronics

The scale of the semantic differential Electronics										
no.	code	denotation	-3	-2	-1	0	+1	+2	+3	denotation
1	O	bad								good
2	S	weak								strong
3	A	passive								active
4	O	unkind								kind
5	A	slow								fast
6	S	small								big
7	A	grim								cheerful
8	O	ugly								pretty
9	S	heavy								light
10	O	dirty								clean
11	A	stupid								clever
12	S	soft								hard

Research results

The conducted research before an implementation of classes indicated that the attitudes of students towards electronic technology were at the medium level (w = 1.51). The attitude assessment rate was 1.66, strength – 1.55 and activity 1.30 (fig. 2).

Figure 2. General results of research on students' attitudes towards electronic technology

After completing the course, the attitudes change. They are more shaped (the synthetic rate is 2.30). The direction (assessment) increased (from 1.66 to 2.51), a similar increase was observed for the strength rate (1.55 to 2.24) and activity (from 1.30 to 2.16).

When analyzing the results of research on the connotative meaning for the concept of "Me in the environment of electronic technology" before and after an implementation of classes, one can notice an increase in all rates (fig. 3).

Figure 3. The results of the study of the connotative meaning of the term "Me in the electronic technical environment" for students before and after the classes

The synthetic rate before participation in the subject classes was 1.29 and increases after completion of 90 hour-classes to the value of 2.19. The assessment

rate increased from 1.48 to 2.38. Significant increases are important for other rates: the strength rate from 1.31 to 2.08 and the activity rate from 1.07 to 2.12.

The connotative meaning of the term "electronics, as the subject of study" before and after the implementation of classes also increased significantly (fig. 4).

Figure 4. The results of the study of the connotative meaning of the term "electronics, as a subject of study" for students before and after the classes

The synthetic rate before the participation of students in subject classes was 1.65 and increased to 2.38 after the completion of classes. The assessment rate increased from 1.69 to 2.62. Slightly smaller increases were recorded for other rates: the strength rate from 1.71 to 2.39 and the activity rate from 1.55 to 2.15.

The value of the connotative meaning before and after the implementation of classes changes significantly for the term "a colleague as a person cooperating in the electronic technology environment" (fig. 5).

Figure 5. The results of the study of the connotative meaning of the term "a colleague as a person cooperating in the electronic technical environment" for students before and after the classes

The synthetic rate before the participation of students in subject activities was 1.38 and increased after the classes to the value of 2.17. Significant increases

were recorded for component rates: the assessment rate – from 1.50 to 2.38, the strength rate from 1.44 to 2.18 and the activity rate from 1.15 to 2.04.

The value of the connotative meaning before and after the classes changed significantly for the term "teacher of Electronics" (fig. 6).

Figure 6. Results of the study of the connotative meaning of the term "teacher of Electronics" for students before and after the classes

The synthetic rate before the participation of students in subject classes was 1.72 and increased to 2.44 after an implementation of the classes. Significant increases can be noticed for the remaining rates: the assessment rate – from 1.98 to 2.68, the strength rate from 1.75 to 2.32 and the activity rate from 1.44 to 2.35.

Discussion and conclusion

The conducted research showed that the implementation of program content in the subject of electronics plays a significant role in shaping the attitudes of mechatronics students towards electronic technology (an increase in the synthetic rate from 1.51 to 2.30). Attitudes of students became more positive, strong and lasting.

The higher value of the connotative meaning of the students' notions is characteristic not only for the concept of electronics, but also for concepts involving the student – teacher, student – own activity, student – student relations. This undoubtedly confirms the positive educational and didactic effect of classes in this subject of study.

The respondents in open statements drew attention to a number of important factors that create favourable conditions for shaping attitudes towards electronic technology. Among them there are: well-equipped workshop (67 people – 78% of respondents), interesting topics of classes (59 students – 67% of respondents), interesting lectures (51 – 59% of respondents), good academic textbook (47 – 55%

of respondents), clear instructions for exercises (41 – 48%). Inconveniences in the development of attitudes towards electronic technology are considered by mechatronics students: in too big laboratory groups (71 subjects – 83%), lack of classes in electronic construction (38 people – 44%) and small rooms for laboratory classes (24 people – 28 %).

The comprehensive assessment of students' attitudes towards electronic technology requires taking into account the emotional and motivational component, as well as the intellectual and operational components. This involves the use of other methods and research tools that will allow students assessing the knowledge and skills in this area.

Bibliography

A Framework for Qualifications of the European Higher Education Area, Ministry of Science, Technology and Innovation, Copenhagen 2005.

Allport G.W., *Attitudes.* In C. Murchison (ed.), *Handbook of social psychology*, Mass: Clark University Press, Worcester 1935.

Edwards L.A., *Social desirability variable in personality assessment and research*, Dryden, New York 1957.

Furnham A., *Response bias social desirability and dissimulation. Personality and Individual Differences* 1987, no. 7.

Horowitz P., Hill W., *Art of electronics*, Cambridge University Press, New York 2015.

Hurlock E.B., *Child Development*, McGraw-Hill, New York 1978.

Krech D., Crutchfield R.S., Ballachey E.L., *Individual in Society: a Textbook of Social Psychology*, McGraw-Hill, New York 1963.

Maio G.R., Haddock G., *The psychology of attitudes and attitude change*, SAGE, Los Angeles, London 2009.

Marszałek A., *Elektronika w edukacji technicznej dzieci i młodzieży*, WSP, Rzeszów 2001.

Marszałek A., *Elektronika,* UR, Rzeszów 2013.

Mądrzycki T., *Psychologiczne prawidłowości kształtowania się postaw*, WSiP, Warszawa 1977.

Plonus M., *Electronics and Communications for Scientists and Engineers*, Harcourt/Academic Press, San Diego 2001.

Schultz D.P., Schultz S.E., *Psychology and Work Today*, Upper Saddle River, Prentice Hall, New York 2010.

Soborski W., *Postawy, ich badanie i kształtowanie*, WSP, Kraków 1987.

Vogel T., Wanke M., *Attitudes and Attitude Change*, Psychology Press, London 2016.

Wiatrowski Z., *Podstawy pedagogiki pracy*, WSP, Bydgoszcz 2000.

Wołk Z., *Kultura pracy: etyka i kariera zawodowa*, ITE, Radom 2009.