Utilising Emotions in the Teaching of Water Management Structures III

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Abstract. Fortunately, the role of emotions in relation to motivation and the learning process has been increasingly taken into account lately, not only for younger pupils but for all generations of students, including university students. In the past already, the educational goals were divided into cognitive, affective and psychomotor but at universities, the emphasis has always been more on cognitive goals. University student’s motivation to learn is a complex psychic process, which is influenced, among other things, by the student's volitional (I must) qualities and their emotions (I am interested, I enjoy). An important part of studies is also the acquisition and strengthening of social personality competences (soft skills), which are closely related to emotions and which, together with expertise, are an important part of every profession. In the research, we first found out how the emotions and motivation of university students are utilised in the teaching of the course Water Management Structures III; and which teaching methods are preferred for this purpose. Then we investigated the level of stress, fear and anxiety that students experience when presenting a seminar assignment in the given subject in front of a study group by measuring the physiological quantity of emotion – the electrodermal activity of the skin. The measured values were collated with the self-awareness of students; to what extent they were aware of their emotions, how they experienced them and worked with them. Adequate self-presentation and coping with difficult situations are closely related with the ability to work with emotions and are considered by employers as very important social and personal competencies.

1. Introduction

Didactic competence, which includes the ability to motivate students to learn, plays an important role in the work of a university teacher. Within their courses, the teachers are also required to strengthen and develop students’ social and personal competencies (soft skills). The motivation of university students to learn significantly affects their academic success, it is, therefore, understandable that university teachers are looking for new ways to utilise it. This need is particularly acute at technical universities, which have long been facing shortages of applicants. One of the ways to make these studies and teaching more attractive is to use the interconnectedness of emotional and motivational processes. In our reasoning, we start from the assumption that there can be many causes of students’ “non-motivation” to learn. For example, inadequately chosen teaching methods, which negatively affect students emotionally and therefore motivationally as well; or insufficiently developed social personality skills of students, such as their low resistance to stressful situations brought by university studies.

Learning is understood as one of the most important and difficult mental processes and as a basic precondition for the existence and development of an individual. According to Hartl and Hartl, it is an active and creative process that expands the innate genetic program and capabilities of an individual [1]. The student’s learning efficiency is influenced by their ability to continuously motivate themselves, using...
their social personality skills – activity, autonomy, persistence, communication skills, assertiveness, self-presentation skills, ability to cope with stressful situations, etc. The concept of motivation is not defined uniformly. In the broadest sense, it is understood as the sum of the factors that induce, regulate and sustain human activity that leads to a certain goal. Maslow explained motivation through meeting needs. He created their hierarchy in which cognitive needs have their place among physiological and psychological needs. These include the need for education, the desire for knowledge, the need to deepen one’s intellectual abilities and to understand the world [2].

Teaching methods that arouse the interest of students, promise experience and arouse their curiosity, thus affecting their emotional experience in some way, are most motivationally effective. On the other hand, negative emotions can affect students’ attention, concentration and will negatively, which is manifested by laxity to anything related to teaching and learning. Experts disagree as to how exactly the learning process works, and disagree as to how it is affected by concentration, mood, or other mental processes that are or may be part of it.

Even when it comes to looking at emotional processes, there is no consensus among experts. They are usually characterised as complex phenomena whose characteristic qualities include sensitivity and variability. They are believed to have originated in order to effectively coordinate different systems at the physiological, experiential and expression levels of a human being, and to enable them to respond to challenges or opportunities in the environment. Over time, neurophysiological foundations of emotional processes, the function of emotions, possibilities of their regulation and connection with other mental processes, especially with cognitive processes and motivation, were investigated [3].

As mentioned above, the motivation of students to learn is also influenced by the teaching methods chosen by the teacher, which emotionally tune them and subsequently motivate them to learn or do not motivate them. The student's motivation may be negatively influenced also by his insufficiently developed social personality competences, whose level is expected from him on various occasions. The student's resistance to stress also plays a role in this, for example when he/she presents the seminar paper and the ability to present himself / herself (self-presentation) in front of the study group and the teacher in an optimal way.

The connection between motivation and emotions is evident.

1.1. Emotions and their Physiological Component

Emotions can be understood as fast, immediate, organised and economical information processing that helps make immediate decisions and act without long rational consideration [4]. Some authors (e.g. Nolen-Hoeksema Frederickson, Wagenaar, Loftus) state that emotions are a set of interconnected, interactive and synchronised processes that include the subjective individual experience, expressive motor behaviour, physiological changes, behavioural tendencies, cognitive evaluation and emotional regulation [5].

Emotions are closely linked to bodily reactions, as evidenced by psychological approaches aimed solely at examining peripheral physiological changes or brain processes during the experiencing of emotions. The quality of physiological changes in the body is significantly influenced by cognitive interpretations of what a person is experiencing because, in addition to the current situation, it also contains the previous experience and the resulting expectations. An individual who is aware of this fact can better regulate their emotions. According to Stuchlíková, one of the ways to regulate mental and physiological manifestations of emotions are techniques that are on the border of behavioural and physiological intervention [3].

In the search for specific physiological profiles of different emotions, it has been shown that skin conductivity is a remarkable and self-contained variable that exhibits stability, albeit with a rough distinction between emotional states (sadness, fear, anger, disgust). The problem of physiological measurements, however, is their high individuality – for example, a specific change in skin conductivity is extreme for one individual and much smaller for another; some have a narrow range of values, while others a much broader range of physiological reactions. This also applies to age – measuring becomes more difficult with age of the subjects. It is also a matter of measuring the pure emotion, not the stress of the measurement itself and the environment. Nevertheless, electrodermal activity is considered to be
an important indicator of physiological changes, especially the level of stimulation of the organism and its current activity [6]. We used the physiological indicator of emotional changes and stress in our research by measuring students who were supposed to present their seminar work in front of their study group and the teacher, using the Galvanic Skin Conductance (GSC) method to obtain data on the conductivity of their skin. Students thus received feedback on the physiological reaction of their body to the situation, which they could cognitively process and then use for the next adequate situation. In this way, students learned to regulate their emotions and, among other things, to strengthen their competence associated with self-presentation.

1.2. “Water Management Structures III” Course
The content of the subject includes basic concepts of the area, bases for designing, functional and structural design of hydro-technical buildings (reservoirs – dams, bilge structures – weirs, fairways, waterways and use of hydropower). The aim of the course is to familiarise students with the problems of construction and operation of hydro-technical works of various types and functions, to discuss this topic with them, teach them to apply their theoretical knowledge from the field of hydraulic calculations of hydro-technical constructions into practice and solve both hypothetical and practical issues from this field. The most common teaching methods include a heuristic lecture, demonstrative method, discussion, independent work, problem-solving, experiential learning. The growing knowledge of students during the semester is verified by each of them working out two seminar programmes and successfully passing two tests during the semester. The motivation of students is achieved through the method of questioning, method of cooperation among students, valuation of correctly and timely executed tasks, excursions to the real environments of water management structures, valuation of activities beyond the subject, and participation in solving real-life problems. The social personality competencies are strengthened and developed within the course, namely activity, independence, communication, cooperation, persuasion, self-presentation, self-evaluation, creativity and stress management. In the research, we focused on the level of competence of self-presentation and the associated competence in coping with a stressful situation, i.e. stress management during presenting a seminar assignment in front of a study group and a teacher.

2. Material and Methods
In the research, we used the Galvanic Skin Conductance (GSC) method. We measured the skin conductivity of university students when they presented a seminar assignment to their study group and the teacher in the subject Water Management Structures III. We used the Sensetio wireless measuring wristband, so students were not stressed by the measurement technology. When choosing the measuring method, we proceeded from the fact that when experiencing stress, fear and/or anxiety, typical physiological reactions occur, which are little dependent on the ability to handle them (skin conductivity and muscle tension increases, skin temperature decreases). After taking the measurements, we asked the students if and to what extent they were aware of their experience and its quality. For this purpose, we presented them with a short questionnaire to determine whether during the performance they felt nervousness, fear and/or anxiety and if so, when it was most intense, and whether they perceived their experiences as strong or weak. We were aware of the fact that the students’ experience and therefore their GSC physiological values may have been influenced to some extent by our presence and the fact that they were being measured. In any case and nevertheless, students received interesting information about how they perceive, experience and regulate this difficult situation.

2.1. Research Goal
The research aimed to find out how well students can use their social personality competences – in our case specifically the competence of self-presentation and the competence of coping with difficult situations.
The difficult situation for the students was to present their seminar work in front of their study group and the teacher without stress and fear and to optimally present themselves. We assumed that if the teacher prepared the students well for this activity, worked with their emotions (and used adequate teaching methods), motivated them and developed their social personality competencies, the level of stress, nervousness and fear of this activity would be low.

2.2. Respondents
The respondents included 10 students (6 women, 4 men) of the first year of the follow-up master’s study programme Technology and Water Management at VŠB-TUO, who in the winter semester of the academic year 2018/2019 completed the course Water Management Structures III.

2.3. Sensetio Method
Electrodermal activity (EDA) can be measured in many different ways electrically including skin potential, resistance, conductance, admittance, and impedance (Boucsein, 201). The Sensetio provides a way to capture electrical conductance across the skin (GSC). Sensetio is a psychodiagnostic method based on measuring the strength of physiological functions caused by emotional reactions. The method is based on the recognition that certain physiological values change under the influence of emotions, which gives the opportunity to obtain objective data on the mental state of the respondent. A wireless Bluetooth wristband is used to measure, send, display and process in SensetioPro software.

The wireless bracelet has the characteristic that the measured respondent gets used to it very quickly and does not perceive it as a disturbing element. In our measurements, this diagnostic method was used to measure the physiological component of emotion - GSC - in a situation where students presented a seminar assignment in front of a study group and a teacher. The physiological component of each student's emotion record is represented by a curve showing the relative GSC values in the "arbitrary unit" on the y-axis, and the ordinate number of the measurements over time at 3.3 x per second on the x-axis.

2.4. Questionnaire
For research purposes, we created a non-anonymous questionnaire with the following items: At what moment were you most nervous? Were you fully aware of your experiences? Did you try to regulate your experience in some way and your body reactions? Do you have problems with similar situations? Do you experience emotions intensely? We wanted to find out how the students felt during the presentation of the task – whether it was the worst at the beginning, during or at the end of the presentation; which emotion did they feel most prominently during the measurement; whether they were fully aware of their experiences or tried to intentionally regulate them in some way.

2.5. Research Procedure
Before conducting the research, we first instructed the students about the goal of the research and how they can use the information obtained by our measurements. After that, we gradually measured their GSC, as the individual presentations followed, for the entire duration of each presentation (5 minutes). Immediately after presenting the seminar assignment, each student filled out a questionnaire with the previously mentioned questions. The student needed to fill out the questionnaire immediately after the GSC was measured so that they had their feelings fresh in their mind and did not have to recall them extensively, thus avoiding unnecessary misrepresentation of the data.

3. Results and Discussion
Various shapes of curves can be traced on GSC charts. In all cases, it is possible to identify moments in which students experienced emotions to a greater extent – whether at the beginning of the presentation (self-presentation), during it or at the end. Naturally, the intensity of the experiences is individual, so some of the respondents reacted intensively, while others reacted mildly. We compared this data with the data provided by the students in the questionnaire.
A total of 10 university students, 6 women and 4 men aged 19 and 20, filled out the questionnaire immediately after the presentation. For the analysis of the results, we selected three students whose course of experience and therefore the shape of the curve differed significantly. We compared the degree to which the student's curve coincided with his / her cognitive perception and awareness of the situation. It can be seen from the chart in Figure 1 that the student was relatively calm at the beginning of his performance, but after about 20 seconds his curve started to rise and increased almost until the end of the performance. Changes in the course of the curve may have been caused by his increasing stress from his performance or the level of his excitement - the situation did not necessarily have to be unpleasant, on the contrary, he could feel pleasant and positive in it. In the questionnaire, the student stated that he is usually nervous and that he was aware of his emotional state. He felt most nervous about the middle of his performance, but at the same time he was pleased that he was doing well.

**Figure 1.** Sequence of the GSC values of Respondent 1, x-axis - number of samples.

Graph (Figure 2) shows that the student was rather calm throughout the performance, the curve does not show any significant emotional fluctuations. We can conclude that it was rather a phlegmatic individual, who remains calm even in socially demanding situations, or manages similar situations, is rehearsed, and therefore they do not represent any extraordinary burden for him. The student himself stated that he did not experience similar situations hard, although he enjoyed studying quite well.

**Figure 2.** Sequence of the GSC values of Respondent 2, x-axis - number of samples.

**Figure 3.** Sequence of the GSC values of Respondent 3, x-axis - number of samples.

Graph (Figure 3) shows that the student's nervousness first increases quite steeply, but then gradually decreases. We may assume that the situation was initially burdensome for the student, but he was gradually managing it - probably adapting to it or using some of the adaptive coping strategies. This course of the curve had most students - most nervousness was felt at the beginning of the presentation.
and then gradually calm down. This student also stated in the questionnaire that he is most nervous at the beginning of the “action” and gradually adapts to the situation and manages it.

4. Conclusion
The aim of our research was to measure the physiological component of emotions (GSC) that students experienced during the presentation of the seminar task in the subject Water Management Structures III in front of the study group and the teacher. We assume that those students who possess the competence of self-knowledge and competence in dealing with difficult situations will show less excitement and be able to better emotionally regulate yourself. From the questionnaires we found out that most students feel subjectively the most nervousness at the beginning of their presentation. However, the shape of the measured curve of their electrodermal skin activity did not always correspond to this. According to their cognitive evaluation of emotional experience, each of them experienced a different degree of nervousness and at a different time. The performance before the study group was different for everyone. Six of the interviewed students said they were most nervous just before or at the beginning of the seminar assignment, but then they could calm down. The discrepancy between the subjective perception of the intensity of emotion and the values of the measured quantities is caused by how well an individual can perceive his / her body, understand his / her emotions and regulate them. If the discrepancy between subjective perception of emotion and the values of the measured values of GSC is minimal, then the student is aware of his / her emotional experience, which is a prerequisite for being able to work effectively with them. The students evaluated the method positively because it helped them in self-knowledge and self-development.

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