THE IMPACT OF FELDER'S LEARNING STYLES INDEX ON MOTIVATION AND ADOPTION OF INFORMATION THROUGH E-LEARNING

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Abstract: In this paper, we examined the nature and distribution (direction and intensity) of motivation for using e-learning, focusing the connection between the independent variables on one side and the Felder's learning style on the other. The most relevant information that we wanted to examine and present is the individual ways of the respondents in adopting the same material. We were also interested in the ways to technically adjust the information delivery. The results confirm the statistical significance of the initial idea.

Keywords: e-Learning, motivation, learning style, placement of materials, adoption of information.

INTRODUCTION

In the forties of the twentieth century, the teams of engineers and psychologists were actively working on examining the relationship between the optimization in handling different types of machinery and efficient transmission and reception of information. It was found that the transmission and reception of information had limitations that were not of technological nature, but limitations of the cognitive system. Attention, selection and optimization of information transmission have become the focal problem of the research. In order to fully comprehend such problem, it is necessary to find a reasonable analogy between an abstract communication system and functioning of the nervous-sensory apparatus.

The mathematical formulation of information theory was given by Claude Shannon, but the basics of the approach were given by Andrei Kolmogorov [26]. They define the information as the probability of

events in a system, where the content of information is irrelevant. If the probability of event is lower than the quantity of information carried by this event is higher. This means that the amount of information carried by an event is inversely proportional to its probability.

Martin Dougiamas, working on his doctoral dissertation on the use of open source software to support education on the Internet, launched the idea of developing the Moodle platform. Dougiamas is the leading Moodle programmer of today [10].

LEARNING

It is important to emphasize that learning permeates almost every human activity. There is a large number of factors acting as indirect learning tasks. Firstly, it is the perception, as a general human mode of operation and a dose of idiosyncrasy. Stimulated by various stimuli, it presents its own value. Its latent importance

is in the perception of the previously seen, through experiences and connections with the new. Motivation also plays an important role in acquiring knowledge. Certainly, a man of certain age has defined certain motives, but additional motives can be excited by other people or specific relevant materials.

Today, in the 21st century we live in a computer world where production, processing and storage of knowledge are very important factor of a complete social progress. Education as one of the basic pedagogical category anticipates vocational training and life skills development through the acquisition of knowledge [20]. The basic elements of education are knowledge and competence, where knowledge is defined as a system of scientifically based facts that students gain and practically apply. The term information technology was first used by Jim Domsik in 1981 as a substitute for the term data processing, but the information technology anticipates the use, storage, production and exchange of information [19]. In the last decades, the development of information technology has recorded unprecedented growth and is further progressing. The essence of technological development comprises a complex range of information and communication technologies. The future development of information technology lies in the integration of the system, standardization of equipment, the Internet dispersal, higher speeds, but it also depends on new inventions, changing the world even more than expected [7].

Moodle Platform

Electronic learning (e-Learning) is a type of education based on the use of modern technologies for creating, presenting of educational content, as well as the adoption of material. Suppose we have a forum where a student has the opportunity to download some material, but also to ask questions to a professor[1]. Asking questions does not guarantee a response within a specified time period, the professor will answer questions when available and "online". The disadvantages of this approach have been avoided by the use of synchronous technologies such as web and video conferencing, IP telephony. Attending lectures and discussions in real time provide added value to distance education, so that group work leads to generating more ideas.

This form of communication has been experienced more responsibly by students than professors. They are 2-3 times more likely to send messages and much more responsive to those received [21].

Educational platforms are complex tools that enable controlled distribution of multimedia and text lessons to all or selected users enrolled in a course, either through conventional or distance education. That way we can track approaches to a text, note changes and add comments. To testing the student on computers, you can use many free and simple programs that can easily fit into classes, so it is very easy to test students who are not physically present in the classroom [28].

The market offers specific tools that enable easy content creation, setting presentations, forums, all with the aim to enable users to focus on the content itself, not on the techniques of presentation [6].

Moodle is a free, open source platform for e-Learning. This very popular platform has more than 57 million users. According to many surveys published on the Internet, moodle is one of the best accepted platforms in its segment [22].

Moodle is a Course Management System (CMS), also known as a Learning Management System (LMS), or a Virtual Learning Environment (VLE). It is a free web application that educators can use for creating efficient online learning sites. There are also many additional ways to use it [2].

The focus of the Moodle project is to provide teachers with the best tools to manage and promote learning. Built-in functionality allows exactly the same procedures in the work whether it has a couple of users, or dozens, hundreds of thousands of active users. Due to its scalability, it has been applied both to private users that provide courses for a small number of users, and to huge systems having over 50 thousand users [24].

Moodle characteristics are as follows [25]:
- Built-in support for the evaluation and monitoring of student activities,
- Roles system can be adjusted to the level of activity
- Supports collaboration through forums, chat, wiki's and other modules,
- Supports the development of tests with different types of tasks,

- Supports imports of standardized packages for learning objects,
- A number of free plug-ins are available on the Internet
- Moodle has been localized in 78 languages.

MOTIVATION

Motives are movers, tendency to achieve and adopt the goal and psychological processes supporting us in our efforts. The psychological motives comprise learning incentives (means of motivation) such as: grades, praise, critics, competition etc. [27].

It is important to understand the difference between traditional learning and modern active teaching. The emphasis is not on technology, but on a higher involvement of students, their encouraged motivation, resulting in knowledge. In the traditional teaching we had a simple system, the professor teaches, the students listen (regardless of the attention, motivation and desire). In more contemporary form of teaching, students do not feel such a drastic hierarchical distinction between themselves and lecturers. This way they are equally involved, important, and can provide innovative contributions to this kind of teaching. The important finding is that learning has stimulating effect on the involvement of two sensory modalities (hearing and vision), unlike traditional style, solely listening. But active teaching is just one step that binds innovation in teaching and online learning. It brings a series of new ways and knowledge sharing and acquiring.

In particular, strict requirements regarding attendance for lessons and exercises and limited number of examination terms are absolutely incompatible with the needs of active seafarers, who spend few months, half a year, or longer onboard ships, but who would like to, or need to improve their knowledge in order to keep their jobs and/or get a career advancement [4].

The material adopted by students through these classes needs to be related to earlier contents, preferably through experience, through a positive transfer [15]. Furthermore, the student should have a personal way of adopting materials, adjusted to the most suitable strategy of idiosyncratic personality and di-

versity of opinion. Interpretation is also a free alternative upon each individual. It is also an opportunity for expressing a personal touch of each participant.

There are two types of motivation [13]:

Extrinsic (external) motivation:
- focused on fulfillment of obligations in the subject
- is strongly influenced by incentives or pressures coming from outside;
- leads toward superficial approach to learning and the fear from failure;
- outcomes are not flexible and cannot be easily transferred to various application contexts (knowledge is "rigid").

Intrinsic (internal) motivation:
- reflects a personal goal;
- results from the interest in the field of study;
- depends on personal engagement in tasks that can be selected;
- depends on the feeling of their own competence and self-confidence;
- leads to a deep approach to learning and understanding of concepts;
- outcomes are flexible and can be easily transferred to various application contexts.

FELDER'S LEARNING STYLES

Learning styles can be defined as a method through which an individual focuses on new and complex information, process them, reform them into knowledge, persisting and using the acquired knowledge. "The style of learning is an established and dominant way of receiving, processing and use of stimulus / information in the learning process, and the most recognizable in the course of organized learning in the classroom; it's a way of dominating the mental representation and processing of the learning content" [5].

Learning can be defined as a complex process acknowledging the influence on students, teachers, motivation, interaction and cohesion of these factors [9]. The earlier learning process has changed. The basics have remain the same. The principle transfer - adopt knowledge - is still the main driver of the process. Everything that comes along is additional learn-

ing motivators, positively correlated by their intensity. The technical revolution has brought a number of innovations with their advantages and disadvantages.

Felder-Silverman model examines three issues [18]:

a) a distinctive learning style with an alternative way to process information and its significance for engineering education;

b) learning style most prefered by students and teaching style most favored by teachers and

c) strategies undertaken by students, which are not equivalent to standard methods of engineering education.

Learning in a structured educational system has two important steps:

a) reception of external information through senses;

b) the inside information, to be processed by a specific method or simply ignored.

A further process may include short-term or long-term memory, through repetition or detailed analysis. Felder-Silverman model classifies students into one of the four learning styles:

a) Sensory students (specifically, practically oriented towards facts and procedures) or intuitive students (conceptual, innovative, oriented theories and very important);

b) Visual learners (prefering visual presentations of the material - images, diagrams) and verbal learners (prefering written and spoken explanations);

c) Active students (through interaction and continuous work) or reflective students (working and thinking by themselves);

d) Sequential learners (neat, learn in small steps, upon a detailed scheme and work division) or global learners (holistic, systematic thinkers, learning in big steps forward) [11].

The model emphasizes the importance of adapting the teaching process to one of the styles or at least one of the two style dimesions, e.g. visual or intuitive style of teaching, and stimulating environment for such strategic type.

The first dimension - sensory / intuitive, is one of the four dimensions of the Jung's theory of psychological types, and the third dimension - active / reflective, is a component of the Kolb's learning style. The second dimension - visual / verbal, is analoguous to the visual-auditory-kinesthetic modality of the theory formulation and rooted by the cognitive study of information processing. The fourth dimension - sequential / global, has been developed eclectically.

For sensual students to remember and understand information, it is best to enable them sense the way it relates to the real world. If they are in a class where the most of material is of an abstract and teoretic type, they will be prone to have difficulties. Instructors for specific examples of suitable concept examples will know which model should be applied in practice. If the instructors do not provide sufficient specifics, stimuli and motivation, it will not produce a positive effect.

In the Felder's model, visual dimension refers to internal processing (such as visualization) rather than a sensory stimulus. There are evidences from studies on brain hemispheres and clinical observations showing that global learners are more likely to use visual processors, a sequential learners are more likely to use verbal processors [11]. Felder made two significant changes to his model in 1987. The first change was the deletion of inductive / deductive dimension due to the misunderstandings of the instructors in the distribution of materials for inductive or deductive methods of teaching. The second change was the renaming of category visual learners / spectators into visual / verbal. Felder made this change to allow both spoken and written word to be included in the verbal category [12].

Kolb says that learning involves the provision of abstract concepts that can be flexibly applied in various situations. In the Kolb's theory, a stimulus for the development of new concepts provides new experiences [17].

AIM AND OBJECTIVES OF THE RESEARCH

The initial aim of research is to assess the nature and distribution (direction and intensity) of motivation in e-learning, as an independent variables on one side and the Felder's learning styles, as a dependent one on the other.

Research Objectives
The research has a two-fold objective:

a) Scientific objective- aiming to determine the type and nature of relationship between e-Learning motivation and learning styles, also wishing to use the obtained results for further research on this and similar fields.

b) Practical objective – aiming to use the data obtained for contributing to more efficient and practical work of educational institutions in the country and encourage effective engagement of individuals (students and teachers) who would readily act towards enhancing the educational system of Montenegro.

Variables in the research:

a) Considering the dependent variable, we have been examining students' motivation for e-Learning at the Maritime Faculty of Kotor. The motivation scale has 5 items and has been designed by the author. The Krombah's alpha coefficient is 0,67;

b) As intervening variables, we examined the impact of the Felder's learning styles to knowledge acquisition. The testing scale for the Felder's learning styles, with 44 items and of the Likert's type, was designed by Richard M. Felder and Linda Silverman. It had been originally designed by Felder and Solomon, with subsequent modification.

c) The independent variables were student experiences with e-Learning.

Research Methodology

The Sample

The survey was conducted on a sample of 100 respondents. It consists exclusively of the students of the Maritime Faculty in Kotor. The sample has elements of intentional.

While processing of data, the following statistical procedures were applied:

a) the frequencies and percentages;

b) differentiation measures for the segments of crossed variables (Pearson Chi-square);

c) measures that indicate the rate of correlation among the variables (C - Contingency coefficient).

Research Results

Table 1. Results of the dependent variable (motivation for using e-Learning)

No.	Items	A.S.
1.	This kind of learning is an innovation leading the educational process into progress.	3.90
2.	Learning this way is efficient both for students and teachers.	3.74
3.	I gladly give suggestions for possible changes in the work of electronic forms of teaching process.	3.66
4.	Aquisition of knowledge by this method of learning is easy.	3.51
5.	E-Learning is a motivating method of teaching/learning.	3.04

The arithmetic mean - the average is the most commonly used measure of central tendency. Its definition is simple: sum of data values divided by the number of data.

Table 1 shows the order of items that are had the highest to the lowest value of the aritmetic mean. Item No. 1 is the claim with the mean value perceived by students as the most positive one. And so on for all five. They are very minor differences in the values of all items, which implies that students are generally strongly motivated for the use of this type of learning.

Table 2. Display items independent variables (general experience of e-Learning)

VARIABLE	FREQUENCY	PERCENTAGE
I like the e-Learning method		
YES	89	89%
NO	11	11%
This kind of learning I evaluate as		
BAD	9	9%
GOOD AND EXCELLENT	91%	91%

Table 2 shows the percentage of student motivation and satisfaction with e-Learning. In a large percentage (89%), students like this kind of work and evaluated it as good or excellent (91%). This means that this kind of teaching generally suits the respondents, with the modification of individual segments, i.e. while adapting the learning styles.

Table 3. Frequency percent of the Felder's learning styles

LEARNING STYLE	FREQUENCY	PERCENT
Active / reflective	19	19%
Visual / verbal	41	41%
Sensory / intuitive	22	22%
Sequential / global	18	18%

Table 3 shows the frequency percent of the Felder's learning styles. What is the most striking is that more than 40% of the respondents preferred the visual-verbal learning style, while other styles are quite balanced.

Table 4. Correlations between dependent and independent variables (motivation and learning styles)

1. Motivation for the use of e-learning and the active-reflective subjects			
$\chi^2 = 2.888$	df = 4	c = 0.179	p = 0.875
2. Motivation for the use of e-learning and visual-verbal			
$\chi^2 = 11.007$	df = 4	c = 0.157	p = 0.050
3. Motivation for the use of e-learning and sensory-intuitive			
$\chi^2 = 4,355$	df = 4	c = 0.156	p = 0.512
4. Motivation for the use of e-learning and sequential-global			
$\chi^2 = 5.677$	df = 4	c = 0.197	p = 0.617

Differentiation measures for the segments of crossed variables (Pearson Chi-square).

Pearson's correlation coefficient (r) is used in cases where the variables of observed model show a linear correlation and continuous normal distribution. The value of the Pearson correlation coefficient ranges from +1 (a perfect positive correlation) to -1 (perfect negative correlation). The "+" or "-"indicates the direction of correlation - whether positive or negative, but it does not refer to the strength of correlation.

The **p** value indicates the statistical significance that exists or does not exist. If there is one, then its value ranges from **0,000** to **0,050.**

Table 4 clearly shows the correlation between the motivation for the use of e-Learning and the Felder's learning styles. Out of the four learning styles, only the visual / verbal style is positively correlated with

motivation. This is indicated by the value **p = 0.050**, which is the statistical significance at the level 0.05 and Hi square value of 11. This means that students with greatest interest in this kind of learning belong to the visual-verbal learning style.

$$r = \sqrt{r^2} = \frac{SDxy}{SDxSDy} E\left[-1,+1\right]$$

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}, \ df = n - 2$$

The measures show the degree of correlation between the variables (**C - Contingency coefficient**), a measure of association between statistical variables which have quantitative categories of unequal magnitude or at least one of which can be classified only qualitatively.

$$C = \sqrt{\frac{\chi^2}{N + \chi^2}}$$

Df is the number of degrees of freedom, i.e. the number of values in the final statistical calculation, which is free to vary.

x² (Chi-squared)

$$x^2 = \sum \frac{(f_0 - f_t)}{f_t}$$

f_0 - required frequency
f_t - expected frequency
$\sum$ - sum

Closing Remarks

At the beginning of the paper we were engaged in theoretical part and hypotheses about impact on the adoption of information among the respondents. In particular, we focused on the dependent variable, i.e. the Index of the Felder's styles of learning that have proved to be a relevant variable in this study. Through operational defining of the variables we obtained the results that the visual-verbal learning style is the most dominantly present among the respondents and the only one having a positive correlation with the independent variable.

Visual learners are best in remembering the contents they can see, whether that is schemes, diagrams, graphs, demonstrations. The verbal respondents were

better in remembering by using sensory materials, meaning that they are prone to acquire information with sound but with no images. These are audio recordings, oral texts, verbal presentations, etc. [16].

It should be noted that many studies showed that the majority of the visual-verbal respondents belong to the visual type. This percentage reaches up to 70% [11].

CONCLUSION

The existing technologies enable and provide the basis for the existence of universal society i.e. information society. No one is to be excluded from the education society, as guaranteed by the Law. Knowledge is a public property accessible to everyone. The technological progress i.e. the emergence and development of technological innovation allow for the development of creativity and further innovation, or generation of new ideas.

Regardless of the student motivation and satisfaction with the teaching forms of today, it is necessary to introduce continuous innovation also at the level of individual. As this and other studies show, students and teachers are still not enough aware of the possibilities to make their jobs easier and practical with an appropriate form of providing information.

The research results show the following:
- 89% of the respondents are satisfied with e-Learning;
- 91% of the respondents who are satisfied with e-learning believe that this form of learning is good or excellent;
- As for the Felder's learning styles, more than 40% of the respondents preferred the visual-verbal learning style, while other styles are quite balanced and
- In examining the correlation between dependent and independent variables, the found statistical significance was at the level 0.05, with the satisfaction in e-Learning and visual-verbal type of acquiring knowledge.

As shown by the research results, it is necessary to note that the subjects/respondents mostly have an emphasized visual intelligence. Individuals who have a high coefficient in this kind of capabilities have a personal style of adopting information. When such an individual at-tempts to extract information from the long-term memory, (s)he uses the visualization mnemonics and creating of images in her/his mind. This ability is a good predictor of geometry jobs, jobs with the spatial orientation, but in the adaptation to a new environment.

They find it easier to interpret images, layouts, diagrams, charts, numbers, etc. They like to assemble three-dimensional objects. And as their future occupations they usually choose engineering, architecture, sculpture, mechanics and visual arts.

These data leave place for further research in the same and similar fields. They also confirm the fact that e-Learning is a specific and attractive form of education, and, as such, it modifies the human awareness, simplifying the process of teaching/learning and adapting it to the needs of its users.

BIOGRAPHY

Zeljko Pekic, Spec.Sci. Zeljko Pekic was born in Bar, Montenegro, in 1984. He received the Spec.Sci. degree in Computer Engineering at the University of Montenegro, Podgorica, in 2009. Currently a postgraduate student of computer science in Podgorica. Since 2011, he is employed at the University of Montenegro – Faculty of Maritime Studies, at the post of computer laboratory system engineer. His area of interest includes computer engineering, networks, advanced forms of e-Learning, learning styles, etc.

Srđan Jovanovski, D.Sc. Srđan Jovanovski was born on August 30 1982 in Bar, Montenegro, where he finished elementary and high school. For great results during education he was rewarded twice with the diploma "LUČA". He entered Faculty of Electrical Engineering of University of Montenegro in Podgorica in 2001/02.

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