

The Impact of Providing Adaptive Courses for Students based on their Preferred Learning Styles

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ABSTRACT

Over the past 3 decades a large number and variety of learning styles have been identified and used to discover what is considered as a preferred learning style. The detection of learning style of the student is the first step to providing learners with courses that fit their preferred learning styles to let them learn better. In this paper, our goal was to determine students' learning styles based on the Felder-Silverman learning style model and then to provide them with a course that fits their first preferred learning style in order to know whether there is a relationship between providing a course that suits their learning style and their achievement. Forty students were involved in this study where the results showed that the most preferred learning style for students was the visual style, and they got better results than others.

KEYWORD: E-Learning, Learning Styles, Learning Managements System, Learning Style Modles, Index of Learning Styles Questionnaire.

1. INTRODUCTION

At present, educational institutes, for instance colleges or universities, offer e-learning options alongside or instead of their regular courses. This choice is presented to learners and achieved through the use of learning management system (LMS). A learning management system focuses on associate tutors in forming, managing, and supervising online courses by presenting a

variety of features to learners. Some LMS's do not reflect distinct differences among learners and give all learners what they need to learn clearly and correspondingly regardless of their requirements and characteristics. Instances of these are Moodle [10], Blackboard [1] or WebCT, but there are some other LMS's which provide courses that fit learners' style such as AHA [2] or IDEAL [7].

Every single learner as an individual has different requirements and characteristics such as different previous knowledge, rational skills, learning styles, enthusiasm, motivation, and so on. These individual variances have an impact on the learning process and that is some individuals find it easy to learn in a particular course where others find it difficult to cope with the same course. Moreover, the variation between learners' preferences for a specific learning style may lead them to face difficulties in learning if the teaching style is different from their learning style [5] [12].

In this paper, we will explore and identify different types of the learning style models and then identify the method that determines the appropriate learning style that fits each learner. Furthermore, we will present the results of an experiment conducted among the students of the computing department at Gulf College in Muscat, Oman. The aim of this experiment was to detect students' learning styles and accordingly design one of the subjects taught at

the college matching the style of the most present this adapted course for students within a learning management system (Moodle). Finally, we will present the results of our investigation as to whether there is a relationship between providing the adaptive course and the final grade that each student obtained.

2. LEARNING STYLE MODELS

As mentioned above, every single learner as an individual has a different learning style, so to make the learning process easier and to improve learner's acquired knowledge, institutional process (that fulfilled by LMS) must adapt to suit the learner's learning style. In the literature, there are several learning style models, for instance Memletic learning styles model [9], Kolb Learning Styles Model [8], The Dunn & Dunn Learning Style Model [6], Honey and Mumford [11] and Felder-Silverman Learning Styles Model [5]. This study relied entirely on the Felder-Silverman Learning Styles Model (FSLSM) that categorized learning styles initially into five dimensions, but later recategorized their model into four dimensions [4] by dropping the fifth dimension that is called the inductive-deductive. Whatever categories, this model is considered a well-known, used broadly in LMS because it describes learning styles in detail. Besides that, it combines major learning style models such as Kolb, Pask and the Myers-Briggs Type Indicator [6] and that is why we have selected a Felder-Silverman model in our study. In the next section, we will discuss this model in detail.

3. FELDER-SILVERMAN MODEL

As mentioned before, this study is based on the Felder and Silverman model. It should be mentioned here that there are several learning style models, each model consists of a number of learning styles such as Dunn &Dunn that was

favoured learning styles among students and developed by Rita Dunn and Kenneth Dunn. This model consists of 20 elements of learning style. Kolb model also consists of four styles. The 2nd version of the ModelFelder-Silverman Learning Styles, developed by Richard Felder and Linda Silverman (FSLMS), consists of four dimensions and each dimension has two styles. The first and second dimensions are common in more than one model (active/reflective and sensing/intuitive), as these dimensions also exist in Kolb and Myers-Briggs. The third and fourth dimensions are visual/verbal, and sequential/global each of these dimensions answers a question from the following [5]:

What type of information does the student preferentially perceive: sensory (external) sights; sounds; physical sensations or intuitive (internal) possibilities, insights, hunches, etc.

3.1. The first dimension tends to split the perception process into two styles. The first one is *sensing* when people observe and gather data, sensing learners prefer learning by facts, data, experimentation and solving problems in the standard way (concrete material). They deal with the details patiently and do not prefer complications so that you may find them as careful and slow learners. Also, they have a strong memory to remember facts. The second style is *intuitive* where people are perceived by their unconscious speculation, imagination and hunches. They prefer to learn by using abstract materials like principles and theories. Intuitive learners like innovations and like to grasp new challenging concepts. As they are broad-minded, they are characterized by creativity. They dislike repetition and get bored by details and welcome complications.

3.2. The second dimension in FSLSM model is *visual/verbal*, where visual learners remember information more easily if they see it in the form

of the pictures, charts, films, flow charts or presentations but they will forget easily if they only hear this information. In contrast, verbal learners prefer to learn by hearing and remember better what was presented to them. So they tend to discuss wherever they find a good opportunity to exchange ideas because they learn better and better if they hear and say what they need to learn.

3.3. The third dimension is *active / reflective*. Active learners are practical. They prefer to learn by doing experimentations, trying out what they want to learn or discuss that with others, so that they prefer working with groups. Reflective learners are theoretical and more introvert. They prefer to learn individually or with one colleague only. They tend to think deeply about what they want to learn and read the material very carefully.

3.4. The last dimension is *sequential/ global*, progressive learning. Systematic steps and gradual paces are the preferred method of sequential learners to learn. They follow a linear process to solve the problem or to understand the curriculum. While global learners tend to learn by large leaps, the main idea is what they are looking for in order to form a big picture about it. So they tend to have a general introduction about a specific subject and jump to the next point randomly.

4. EXPERIMENTAL STUDY

4.1. Data Collection

Forty undergraduate students were included in this experiment. First of all, it was necessary to detect the preferred learning style of the students with respect to the four dimensions that make up FSLSM. A well-known instrument for detecting learning styles is the Index of Learning Styles Questionnaire (ILSQ) [12], developed by Felder and Soloman. It is designed according to FSLSM. Each student had to fill in that questionnaire. To facilitate the research process

of, we have developed a site [3] that allows each student to register and begin filling in the questionnaire and then it analyses the data entered immediately in order to provide each student with their preferred learning styles and then it generates a report according to their preference.

4.2. Index of Learning Styles Questionnaire

The ILS questionnaire comprises forty-four questions grouped into four dimensions according to FSLSM and for each dimension there are 11 questions. Figure 1 shows 44 questions categorized by the four dimensions with a couple of options for each answer: a and b. To determine the preferred learning style of any student, he/she must answer all the questions, for example, to determine whether the student is an active or reflective learner. He must answer the 11 questions in the first dimension which are (1,5,9,13,17,21,25,29,33,37,41). This means the value of preferred style ranging from 1 to 11. If the answer of the first question was "a" that means one would add to the active style, at the same time 1 will be deducted from the reflective style and so on until all questions have been answered. Then total all ones in each style to get a final score. Add letter "a" if that score belongs to the first style and the letter "b" beside the second score and so on for all four dimensions.

Finally, after getting four pairs of scores where each pair belongs to one dimension, subtract the lower score from the higher score in each pair and keeps a letter (a or b) for which the total was larger. For example, if the first dimension (active / reflective) had 9 times "a" and 2 "b" the result would be 7 "a". All results must be equal to 1, 3,5,7,9 or 11. If the result ranges from one to three, then the learner is fairly well balanced on the two styles in that dimension. But if the result was between five to seven like our previous example (it was active = 7 "a") that means the learner has a moderate preference for this dimension of the scale and will learn more easily

in a teaching environment which favours that style. If the result was between 9 to 11 that means the learner has a very strong preference and learns easily in a teaching environment

which supports that style, but he may be facing difficulties in an environment that does not support that preference.

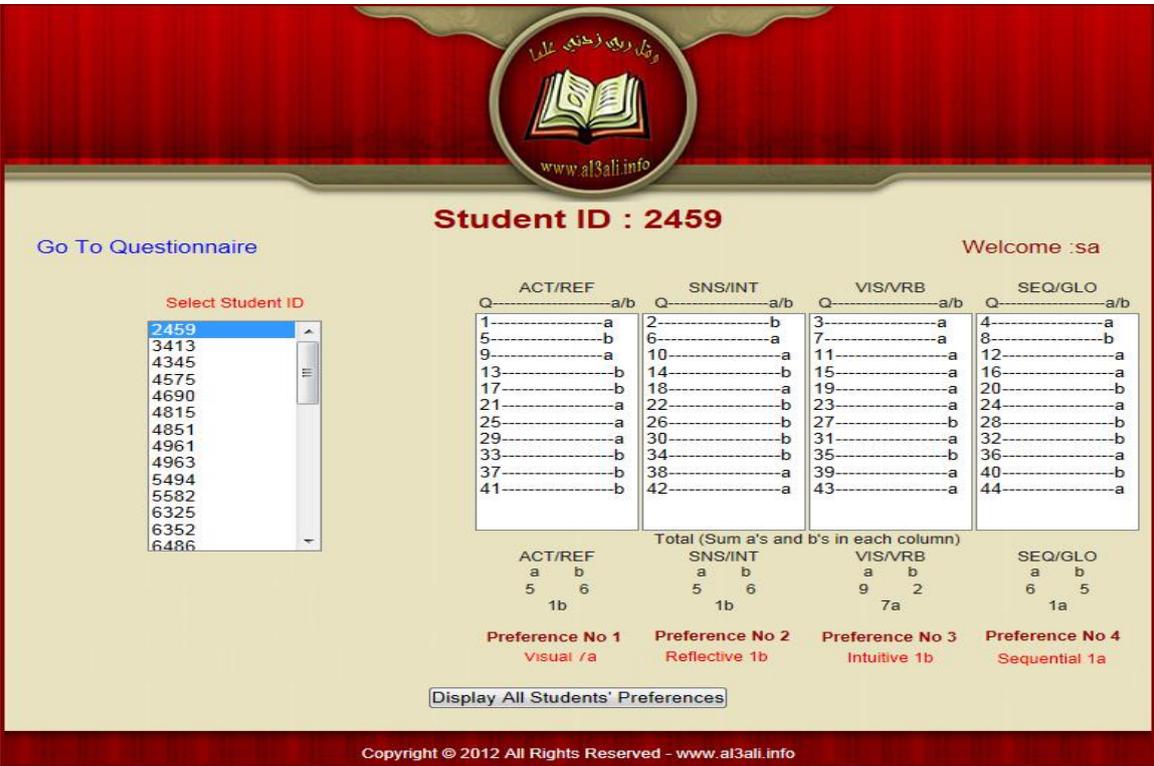


Figure 1: Results of Index Learning Styles Questionnaire

4.3. Detecting Learning Style

In the first semester of the academic year 2012-2013, we offered a course for undergraduate students in the computing department at Gulf College in programming language (VB.NET2010). Forty students from all levels were enrolled who had not studied that module before. During the first week we asked the students to register on our website that had been specially developed for this study and to fill in the ILSQ in order to detect their preferred learning styles. The website was developed in the form of a navigator to show only one question per screen, the second question will not appear until the previous one has been answered. Figure1 above shows the system administrator form and how he can select any student ID on the left list it directly displays forty-four answers

sorted according to the four dimensions and analyses the answers to detect the learning styles for that student in red colour.

When all students finished filling in ILSQ, data were gathered from the database and analyzed. Figure 2 below shows that the students at Gulf College have four preferred learning styles out of eight as a first preferred choice. Those are (visual, active, sequential and sensing). The most preferred learning styles were visual which formed 57.5% of the total, whereas an active learning style was less favoured by the students where the results showed that 25% of all students prefer this style. The third preferred learning style was sequential that formed only 10% of the total. And finally, the sensing,

learning style was the lowest preferred choice of the students and formed just 7.5% of the total.

Another important point shown in Figure 2 is that in the remaining four learning styles, none of the students chose as a first choice. Those are reflective, verbal, global and intuitive.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Visual	23	57.5	57.5	57.5
	Active	10	25.0	25.0	82.5
	Sequential	4	10.0	10.0	92.5
	Sensing	3	7.5	7.5	100.0
	Total	100	100.0	100.0	

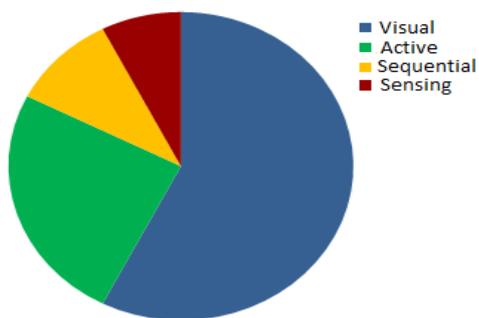


Figure2: Means for each learning style

4.4. Course Design

Figure 2 shows the vast majority of Gulf college students tend to have the visual style as their first preferred style to learn. In order to facilitate the learning process, we have developed a course that fitted their style with respect to the sequence of all the preferred learning styles as stated in Figure 2. Because our study entirely relied on FLSM, we took into account the design of the course with respect to that sequence. The course was VB.NET2010 programming language which was taught to undergraduate students in level 4 (the level which follows the foundation level). This course was managed entirely by Moodle. The course consisted of ten chapters where each chapter was turned into a set of short videos to facilitate the learning process for students who prefer visual learning style. Each set of videos presented the content of each chapter of the traditional curriculum. The reason behind that was to facilitate the learning process by explaining a specific idea just visually using real development environment. By the end of each

short videos the students were asked to apply what they watched directly before moving to the next video. That step was aimed also at facilitating active learner to learn more easily because those students tend to try something out to learn because those learners formed 25% out of the total students. We presented all videos in a sequential way, where each short video relied on the previous one. In other words, the whole course was just one example, which covers all learning topics to facilitate the learning process for sequential learners which formed 10% of the total as shown in Figure 2 with respect to the sequence of the same figure mentioned above. On the other hand, the course that we developed was a comprehensive example that covered many chained ideas. Beside that we provided our students with some notes as concrete material which included the presented topics as well as hands-on for each chapter to facilitate the learning process for sensing students who came in the last rank and formed only 7.5% of the total.

4.5. Data Analysis

Through the above, we have briefly identified what the learning style model is namely FLSM as an answer to the first research question. With regards to the second question, the method that determines the learning style that fitted each learner, the answer for this question was ILSQ. The next question was about the most preferred learning style among this group of college students. Figure 2 shows that most of the students preferred visual style to learn, which formed 57.5% of the total students, while the students from the other three learning styles together formed only 42.5%. Based on this result, a course was designed to suit the learning style of most of the students at the college. So we categorized our students into two groups as shown in Figure 3 in order to answer the last question which was whether there is a relationship between providing the adaptive course and the final grade obtained by each of these students .

	Frequency	Percent	Valid Percent	Cumulative Percent
Visual Group	23	57.5	57.5	57.5
Non-Visual Group	17	42.5	42.5	100.0
Total	40	100.0	100.0	

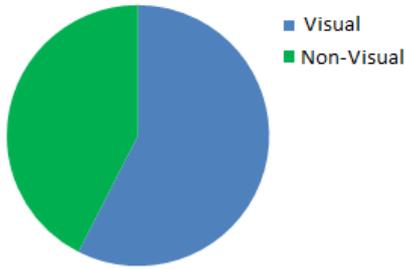


Figure 3: Group of Students

For the final grade, students have to sit for two exams (first and second), it was during the course as well as an assignment which they asked to submit it individually at the end of the course. The assignment requirements were basically simulation of the example, which we explained visually during the course period. So the final grade was calculated by summing the results of these three components to assess students' performance. The data will be used to

answer our last question in this study, namely, whether there is a relationship between providing the adaptive course and the final grade that each student obtained.

4.6. Experimental Results

After obtaining the final grades for those students, the SPSS was used in order to conduct a statistical analysis, taking into account that the students have been classified into two groups Visual and Non-Visual as shown in Table 1. This table also shows the basic statistics like mean and standard deviation. As indicated in Table 1, the average grades of students in the visual group was higher than the average grades of students in the non-visual group, where the average grade in the first group is 69.26%, while the average in the second group is 59.18%. This provides a clear indication to answer the last question in this paper whether there is a relationship between providing the adaptive course and the final grade that each student has obtained.

Table 1: Mean, Standard Deviation and Standard Error for Visual and Non-Visual Group

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Visual Group	23	69.2609	14.14926	2.95032	63.1423	75.3795	36.00	88.00
Non-Visual Group	17	59.1765	13.06826	3.16952	52.4574	65.8955	41.00	78.00
Total	40	64.9750	14.43906	2.28302	60.3572	69.5928	36.00	88.00

To confirm the answer to the last question of this study, we conducted a comparison between the two groups with the final grade of students using significance P value of one-way ANOVA. Table

2 shows there is a significant difference between learners from visual group and non-visual group, using significance level 0.05.

Table 2: Comparison between a group of c and non-Visual

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	994.070	1	994.070	5.293	.027
Within Groups	7136.905	38	187.813		
Total	8130.975	39			

5. CONCLUSION

In this paper, we presented an investigation into the impact of providing adaptive courses for students in LMS considering learning styles according to FSLSM. The study consisted of several phases. The first phase was identifying the preferred learning style of the students. The study showed that a visual learning style is the style preferred by most students. The second phase is to design a course to suit preferred

learning style of most students and present it through the LMS. The final phase was to find whether there is a relationship between providing the adaptive course and the final grade that each student obtained. Our results show that there is a significant relationship between the provision of an adaptive course that fits students' preferred learning style and their performance.

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