

Online learning style and e-learning approaches

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Abstract

Although there are many learning style models, theories, and methodology that been used for a long time in education, none of them have adequately covered all learning aspects such as personality, emotional issues, scale differences, and preferences. Many researchers have derived and used some elements from these models in an e-learning system but these seem insufficient to overcome some e-learning difficulties. In e-learning when the learning style of the student is not compatible with the teaching style of the teacher; difficulties in academic achievement can result. Therefore, knowing what is the preferred learning style and favorite study environment supporting emotional intelligence and guaranteeing the success of learning and teaching process, is critical. This paper attempts to outline learning styles suitable for e-learning. It also presents a model developed for e-learning and the results of a survey conducted to verify the model.

1. Introduction

Learning in general is any increase in knowledge, memorizing information, acquiring knowledge for practical use, abstracting meaning from what we do, and a process that allows us to understand [1]. Learners perceive and process information in very different ways and we can group common ways of how people learn. This is represented in learning style. Learning style theory has been developed and applied in various curricula for all levels of education. By recognizing and understanding the individuals to their learning styles, the techniques can be used better and improve the speed and quality of learning [2].

Research work indicates that the key to getting and keeping students actively involved in learning lies in understanding learning style preferences, which can positively or negatively influence a student's performance. It has also been shown that adjusting teaching materials to meet the needs of a variety of learning styles benefits all students [3].

Nowadays, the main concern in e-learning is improving the learning process and many research papers indicate that this is possibly done through an adaptive system. The purpose of this system is to encourage the student to enroll into e-learning, gain through the latest educational techniques, and assist him/her by providing for each student a convenient environment. There are many attempts to improve the

adaptive system by using different methods and artificial intelligence techniques for extracting user modeling and overcoming the difficulties. However, such system lacks the ability in building student personality by motivation, increasing self-confidence, or reducing shyness. Therefore, most of the researches focus on the student modeling and how the system can automatically deal with different students.

In traditional classroom system, a teacher can monitor and react accordingly based on what he/she sees of his/her students' reaction. However, an e-learning environment requires student to be more independent. As such the system should be able to adapt to the preferred learning style of each student.

1.2 Background

There are many e-learning projects implemented. the available learning style models to extract the user model such as: iWeaver project, which used Dunn & Dunn learning styles model. There are a number of learning strategies that have been derived from this model and transferred into an e-learning environment by using multimedia representations and specifically developed learning tools [4]. Research proposed a support environment for learning by describing "problem map". The "problem map" is a kind of semantic network where a node is a problem and a link describes relations between two problems [5].

1.2.1 Learning style models

Everyone has his own way of absorbing and processing information. Learning styles have been defined as characteristic tendencies for the understanding and processing of information and experiences, which are, unique for individuals and which develop during various phases of life. They consist of complex interactions of physiological, psychological, environment and situational variables [7]. In this section we will look into various learning style classifications.

1.2.1.1 Kolb's theory of learning styles

David Kolb (1984) found that the four combinations of perceiving and processing determine the four learning styles. According to Kolb, the learning cycle involves four processes that must be present for learning to occur. Kolb's has developed a test (Learning Style Inventory) which describes the way in which people are used to learning and how they deal with ideas and day-to-day situations in their life [7]. Kolb's model therefore works on two levels - a four-stage cycle:

1. Concrete Experience (CE): being involved in a new experience
2. Reflective Observation (RO): watching others or developing observations about own experience
3. Abstract Conceptualization (AC): creating theories to explain observations
4. Active Experimentation (AE): using theories to solve problems, make decisions

In addition, four-type definition of learning styles, (each representing the combination of two preferred styles, rather like a two-by-two matrix of the four-stage cycle styles, as illustrated below), for which Kolb used the terms:

1. Diverging (CE/RO)
2. Assimilating (AC/RO)
3. Converging (AC/AE)
4. Accommodating (CE/AE)

1.2.1.2 Gardner's multiple intelligences

Multiple Intelligence (MI) theory states that there are at least seven different ways of learning anything, and therefore there are "seven intelligences": body/kinesthetic, interpersonal, intra-personal, logical/mathematical, musical/rhythmic, verbal/linguistic and visual/spatial. In addition most all people have the ability to

develop skills in each of the intelligences, and to learn through them. However, in education we have tended to emphasize two of "the ways of learning": logical/mathematical and verbal/linguistic.

- Plays with words (Verbal/Linguistic)
- Plays with questions (Logical/Mathematical)
- Plays with pictures (Visual/Spatial)
- Plays with music (Music/Rhythmic)
- Plays with moving (Body/Kinesthetic)
- Plays with socializing (interpersonal)
- Plays alone (Intrapersonal) [3]

1.2.1.3 McCarthy's 4MAT model

Bernice McCarthy developed the 4MAT system based on her study of a number of other models of teaching, and David Kolb's Learning Style theory. Kolb noticed that learners have different preferred learning styles. To simplify, learners are asking four different questions in relation to the learning process:

- Why? These learners want to know the reason for learning. Kolb calls them "Divergers".
- What? These learners want to get the facts and concepts. Kolb calls them "Assimilators".
- How? These learners want to practice and do something. Kolb calls them "Convergers".
- What if? These learners want to try out variations. Kolb calls them "Accommodators".[3]

1.2.1.4 Felder- Silverman Learning Style Model

This model developed by Richard Felder and Linda Silverman incorporates five dimensions, two of which replicate aspects of the Myers-Briggs and Kolb models.

- Sensing/intuitive: sensing (concrete information such descriptions of physical phenomena, practical, oriented toward facts and procedures) and intuitive (conceptual, innovative, oriented toward theories and meanings)
- **Visual/verbal:** visual learner (prefers visual representations, pictures, diagrams, and

flowchart) and verbal learners (prefer written and spoken explanations).

- **Inductive/deductive:** inductive learner (prefers presentations that proceed from the specific to the general) and deductive learners (prefers presentations that go from the general to the specific).
- **Active/reflective:** active learner (learns by trying things out, working with others) and the reflective learner (learn by thinking things through, working alone). Active and reflective learners have difficulty taking notes hard for both learning type. Active learner will retain information better if s/he find ways to do something with it. Writing short summaries for reflective learner will be very helpful to compensate the shortage of class time thinking about new information.
- **Sequential/global:** sequential learners tend to gain understanding in linear steps and the global learners tend to learn in large jumps, absorbing material almost randomly without seeing connections [9].

1.2.1.5 Dunn and Dunn learning style Model

Dunn & Dunn learning style model is complex and encompasses 5 strands of 21 elements that affect each individual's learning. Some of these elements are biological and others are developmental. A summary of these elements is provided below [10]:

1) Environment

- Sound (for student who prefers background sound while learning)
- Light (refers to the level of illumination that preferred while studying)
- Temperature (what level of temperature the learner prefers during the study time)
- Design (related to the room design and furniture)

2) Emotional

- Motivation (the level of motivation the student has for academic learning. Are you self-motivated, motivated through interest in topic, or are you motivated by adult feedback)
- Persistence (relates to the learner's attention span and ability to stay on task)
- Responsibility (prefers to work independently on assignments with little supervision, guidance or feedback. Or without any one telling you how to proceed)

- Structure (do you prefer being told exactly what the learning task is, how you should proceed, and what is expected of you? Or do you prefer to be given an objective and then be left alone to decide which procedures or options you use to reach the objective)

3) Sociological

- Self (this depends on the person's character. When working on assignment, do you prefer to work alone or with group?)
- Pair (do you prefer working with one other person as opposed to working as member of a group? Some learner may prefer working with others but not in a small group or alone)
- Peers and team (this element helps determine a student's preference for working with a small group with interaction, discussion and completion of the task as a team member rather than independently)
- Adult (this element relates to preference for interaction and guidance from an adult)
- Variety versus concentrating in routines or patterns (this refers to a preference for involvement in a variety of tasks while learning)

4) Physiological

- Perceptual (element focuses on learning by listening, viewing, experiencing or touching)
- Intake (it is related to the need to eat, drink or chew while engaged in learning activities)
- Time (this related to the energy levels at different times during the day)
- Mobility (this is focus on the extent to which you prefer to be moving, while involved in concentration)

5) Psychological

- Global- Analytic (this determines whether a student learns better when considering the total topic of study or when approaching the task sequentially one aspect at a time)
- Hemisphericity (this regarding the type of learner whether is left or right brain. Left-brain student tend to be more analytic, whereas right brain student tend to be associated with simultaneous or global learners)

- Impulsive-Reflective (do you make a decision quickly or do you think about the alternatives before making decision?)

1.2.1.6 Myers-Briggs Type Indicator (MBTI)

This model is derived from psychologist Carl Jung's theory, which classifies students according to their preferences on scales derived from this theory [11].

- **Extraverts/Introverts:** extraverts try things out and the introverts think things
- **Sensors/intuitors:** sensors focus on facts and procedures and intuitors focus on meanings and possibilities
- **Thinkers/feelers:** thinkers make decision based on logic and feelers make decision based on personal and humanistic considerations
- **Judgers/ perceivers:** judgers set and follow agenda, seek closure even with incomplete data and perceivers adapt to changing circumstances, resist closure to obtain more data

1.2.2 Learning approaches

The learning approaches to be discussed in this paper focus on e-learning environment, which presents information in different ways and constructs the course content in different structures. The following available methods that can be implemented in e-learning system:

- **Holistic:** People will learn by presenting the whole picture of information prior to the details.
- **Sequential:** Describes the logical presentation of information and follows a very strict sequence of instructions to achieve an outcome.
- **Mind Maps:** (flowchart) Concept maps offer a method to represent information visually.
- **Multimedia:** the learning environment is integration of text, graphics, animation, sound and video.
- **Problem Based Learning:** PBL is any learning environment in which the problem drives the learning. The students are given a problem before learning any knowledge. Then the students will discover that they need to learn some new knowledge before they can solve the problem.
- **Inquiry Based Learning:** is an active learning approach focusing on questioning, critical thinking, and

problem solving. It's associated with the idea "involve me and I understand."

- **Gaming:** for adventure learner, taking risk, like to try things out, and for visual and global learners the information will be presented as a game.

2. E-learning model

Most, if not all instructional design strategies accommodate different learning styles these include multimedia, course syllabus, copies of the lecture slides. However, none of the available learning style models adequately cover all e-learning aspects such as learning approaches and learning preferences. It has been stated that learning includes purposes, goals, intentions, choice and decision-making. It is not clear where these elements fit into the Kolb's learning cycle [12]. Many researches in this field customize or combine some elements from those learning style models and implemented them in their projects.

The most critical element for a student's success in school is an understanding of how to learn. The key ingredients for this understanding are confidence, curiosity, intentionality, self-control, relatedness, capacity to communicate, and ability to cooperate. These traits are all aspects of emotional intelligence [1]. Furthermore, in the classroom it would not be feasible for the teacher to attempt to teach exclusively to match each student's unique learning style. However, with an understanding of the different styles of learning, the teacher can plan the environment, lessons/activities and materials to better create a balanced setting to enhance the success of each student. This is all in traditional learning system while e-learning with the absence of all tangible elements when the learning style of the student is not compatible with the teaching style of the teacher difficulties in learning can arise. Therefore, knowing the learning style and study in favorite study environment supported by emotional intelligence increase the success of learning and teaching process in e-learning.

2.1 Analysis

This research paper attempts to outline the elements of the learning style which are more suitable for e-learning and to combine them with the e-learning approaches. The following analysis describe the model which is based on a combination of several model such as Kolb, Gardner's multiple intelligences, 4MAT model, MBTI, and Felder- Silverman.

2.1.1 Kolb's analysis

The analysis is made by combining and comparing the characteristic of the above learning style model elements with the mentioned learning approaches elements which is suitable for e-learning system. Five approaches have been chosen such as *sequential*, *mind map*, *problem based*, *inquiry based*, and *gaming*. For example: In Kolb's model, the person who is a Converger falls between AC (thinking) and AE (doing) which means this person is practical using logical idea and learns by doing. Therefore, gaming and problem based is the most convenient way of learning and the Inquiry based is another alternative based on their characteristics. Another example an assimilator is categorize between thinking and watching and because of the ability to create theoretical models we believe the sequential method is the best. Table1 shows the comparison between Kolb's model and the five chosen approaches.

Kolb	Learning style Approaches						
	Sequential	Mind map /flowchart	Problem based	Inquiry based	Gaming	Holistic	Multimedia
Diverger (CE, RO)			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	
Assimilator (AC, RO)			<input checked="" type="checkbox"/>				
Converger (AC, AE)	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
Accommodator (CE, AE)		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		

Table 1: Kolb's Learning Style Model

☉ Very suitable Suitable

2.1.2 McCarthy's 4MAT analysis

McCarthy's 4MAT system analyzed and resulted in table 2. For example, if the learner is type2 that means he/she prefers working alone, form theories and procedures, and prefers the instructor/leader to be an authority and enjoy traditional lecturers. All this shows that the most suitable leaning way is the sequential. Furthermore, the person learning style of Type2 learns also by reading, observing, collecting data, and analyzing therefore inquiry based is also suitable for them.

4MAT	Learning style Approaches					
	Sequential	Mind map /flowchart	Problem based	Inquiry based	Gaming	Holistic
Type 1 Diverger			<input checked="" type="checkbox"/>			
Type 2 Assimilators	☉			<input checked="" type="checkbox"/>		
Type 3 Convergents			☉	<input checked="" type="checkbox"/>		☉
Type4 Accommodator			☉	<input checked="" type="checkbox"/>		☉

Table 2: McCarthy's 4MAT system

2.1.3 Myers-Birggs's MBTI analysis

The result in table 3 is based on the characteristics of Myers-Birggs type indicator (MBTI) model. For example, we believe the best way for extraverts type (try things out) is gaming and problem based. Sequential way is the best for those sensors learning style because they are practical, detail oriented, and focus on facts and procedure. Intuitors focus on meaning and possibilities will learns better with

problem based. Thinkers tend to make decision based on logic and rules thus it is sequential.

MBTI	Learning style Approaches						
	Sequential	Mind map /flowchart	Problem based	Inquiry based	Gaming	Holistic	Multimedia
Extraverts			<input checked="" type="checkbox"/>			☉	
Introverts			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
Sensors	☉			<input checked="" type="checkbox"/>			
Intuitors			☉		<input checked="" type="checkbox"/>		
Thinkers	☉						
Feelers				<input checked="" type="checkbox"/>			
Judgers	☉	<input checked="" type="checkbox"/>					
Perceivers				☉			

Table 3: The Myers-Briggs Type Indicator (MBTI)

2.1.4 Felder Silverman's analysis

Table 4 shows the analysis results based on the characteristics of Felder Silverman is stated above.

Felder Silverman	Learning style Approaches						
	Sequential	Mind map /flowchart	Problem based	Inquiry based	Gaming	Holistic	Multimedia
Sensing	☉					<input checked="" type="checkbox"/>	
Intuitive			☉				
Visual		☉		<input checked="" type="checkbox"/>	☉		☉
Verbal	☉						
Inductive			☉		<input checked="" type="checkbox"/>		
Deductive	<input checked="" type="checkbox"/>					☉	
Active			<input checked="" type="checkbox"/>	☉	☉		
Reflective	☉		<input checked="" type="checkbox"/>				
Sequential	☉			<input checked="" type="checkbox"/>			
Global			<input checked="" type="checkbox"/>		☉		

Table 4: Felder- Silverman Learning Style Model

2.1.5 Multiple intelligence analysis

Table 5 represented the analysis results based on the characteristics of seven style of multiple intelligence model.

Multiple intelligence	Learning style Approaches						
	Sequential	Mind map /flowchart	Problem based	Inquiry based	Gaming	Holistic	Multimedia
Visual/Spatial		☉					☉
Verbal/Linguistic	☉			<input checked="" type="checkbox"/>	☉		
Logical/Mathematical	<input checked="" type="checkbox"/>		☉				
Body/Kinesthetic			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
Musical/Rhythmic					☉		☉
Interpersonal			<input checked="" type="checkbox"/>	☉			
Intrapersonal			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			

Table 5: Multiple Intelligence model

2.2 E-learning style Matrix

This paper presents the e-learning style model through a matrix (16*5). The 16 elements are the rows as in table 6 which represent what is/are the types of the person's e-learning style. The 5 elements are the chosen five learning approaches. Table 7 represents the extracted model. If a person wants to know what is the most suitable learning approach based on this model s/he must know what type of learner s/he is from table 6 and then from table 7 search for the column which has similar types.

Learning type	Description
Type1	I learn by trying things out, focus on the outer world of people.
Type2	I considered risk taker, learn by trial and error, rely on hunches rather than logic to solve problems. I dislike strict procedures, like variety and unstructured settings and open-ended problems.
Type3	I Learn by thinking things through, working alone.
Type4	I Tend to gain understanding in linear steps, following logical stepwise paths.
Type5	I tend to learn in large jumps, absorbing materials almost randomly without seeing connections.
Type6	I focus on facts and procedures, and often like solving problems.
Type7	I make decisions Based on logic and rules.
Type8	I am interested in detailed and facts, value logic and order, require facts, focus on concepts and the ideas, and excel at integrating knowledge and creating theories.
Type9	I am imaginative oriented toward theories and meanings, and prefer discovering possibilities and relationships.
Type10	I make decisions Based on personal and humanistic considerations.
Type11	I set and follow agendas, seek closure even with incomplete data.
Type12	I adapt to changing circumstances, resist closure to obtain more data.
Type13	I prefer visual representations with pictures, diagrams, flowcharts, etc.
Type14	I prefer presentations that proceed from the specific to the general.
Type15	I prefer presentations that go from the general to the specific.
Type16	I prefer learning by hearing other's explanations, explaining and analyzing language usage.

Table 6: E-learning Model

	Sequential	Mind map	Problem based	Inquiry based	Gaming
1.			Type1	Type1	Type1
2.			Type2	Type2	Type2
3.	Type3		Type3	Type3	
4.	Type4			Type4	
5.				Type5	Type5
6.	Type6		Type6		
7.	Type7				Type7
8.	Type8	Type8			
9.		Type9	Type9	Type9	Type9
10.		Type10		Type10	
11.	Type11	Type11			
12.		Type12		Type12	
13.	Type13	Type13		Type13	Type13
14.			Type14		Type14
15.		Type15			Type15
16.	Type16				

Table 7: E-learning Model

2.3 Survey result

Survey was conducted in university Tun Abdul Razak (Unitar) to verify the effectiveness of the matrix. Total hard copy survey respondents were 153 out of the total 600 respondents and the total responses from the net were 80. In addition, 20 face-to-face interviews were conducted to ensure that the students understand and clearly answer the questions. The analysis resulted in 80% of the respondents refers the e-learning model for the type of learner and suitable e-learning approaches.

3. Conclusion

In e-learning an adaptive system allows for adaptation of the content to the user accessing it to improve the learning process. This research paper proposes an e-learning model and presented survey result that validate the use of this model.

References

- [1] Marcia L. Conner, "How adults learn", <http://agelesslearner.com/intros/adultlearning.html>, copyright 2005, Ageless learner. Last updated: April 9, 2005.
- [2] Dave Alick, "Integrating Multimedia and Multiple Intelligences to Ensure Quality Learning in a High School Biology Classroom", December 7, 1999. <http://www.angelfire.com/de2/dalick/researchMI.htm>
- [3] Jessica Blackmore, "Pedagogy: Learning Styles", Aug. 11, 1996 <http://granite.cyg.net/~jblackmo/diglib/styl-a.htm>
- [4] Christian Wolf, "iWeaver: Towards 'Learning Style'-based e-learning in Computer Science Education", ACE2003, 2003.
- [5] Akira Nakano, Tsukasa Hirashima and Akira Takeuchi, "A Support Environment for learning by describing Problem Map", (ICCE'02), IEEE 2002.
- [6] Milos Kravcik, Marcus Specht, "Authoring Adaptive Course ALE Approach", Bureau42 GmbH as author42TM.
- [7] Ronald I.Sutliff and Virginia Baldwin, "Learning Styles: Teaching Technology Subjects Can Be More Effective", The Journal of Technology Studies
- [8] "Learning Styles and the 4MAT System: A Cycle of Learning", Learning Styles and 4MAT, <http://volcano.und.nodak.edu/vwdocs/msh/l/c/is/amat.html>
- [9] Richard M. Felder, "Matters of Style", ASEE Prism, 6(4), 18-23, (December 1996), <http://www.ncsu.edu/felder-public/Papers/LS-Prism.htm>
- [Dunn2003] "Dunn and Dunn learning style model", learning style network, 2003, <http://www.learningstyles.net/>
- [10] "Dunn and Dunn learning style model", learning style network, 2003, <http://www.learningstyles.net/>
- [11] Richard M. Felder, "Matters of Style", ASEE Prism, 6(4), 18-23, (December 1996), <http://www.ncsu.edu/felder-public/Papers/LS-Prism.htm>
- [12] Curtis Kelly, "David Kolb, the theory of experiential learning and ESL", (I-TESL-J) <http://iteslj.org/Articles/Kelly-Experiential/>