DETERMINING THE MANAGEMENT INFORMATION SYSTEMS STUDENTS' LEARNER CHARACTERISTICS: SOCIAL SHY OR IDEA ORIGINATOR

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ABSTRACT

The rapid growth in the use of information and communication technologies and their smart applications in the field of education have offered new ways to educators to create more flexible and suitable learning environments. Nowadays, e-learning systems are expected to support better learner-centric instruction and enable more self-directed learning. Today's Learning Management Systems (LMS) use several methods for selecting suitable learning objects. The main difficulty with this process is the content and size of learning objects. Based on several criteria rules can be derived. One main rule composing an integrated and smart learning environment is to decide on learners' characteristics. In this study, different learning styles are discussed, and selected learning styles inventories (LSI) analyzed. LSI assesses a person's learning style, helping them identify the strategies they most and least prefer to adopt when learning new material. The most popular learning style inventories - Kolb's Learning Style Inventory and Felder-Silverman's Index of Learning Survey is then applied for evaluating the learning approaches of Management Information Systems (MIS) students at the Bachelor's Degree Level, who have mainly both business and technical skills. It is one aim of the study to find out if students who have nearly same scores from a University entrance exam have same learning styles; and which learning styles most successful students have. Depending on the results of the field study there should be developed strategies for developing more effective learning environments to be able to consider students' learning approaches when developing or improving learning environments.
Keywords: E-learning, learning styles, learning styles inventories

INTRODUCTION

In the information age, it has been recognized that teaching has shifted from an instructor-centric approach to a learner-centric approach in which knowledge is constructed by learners who are actively involved in the learning process (Vrasidas, 2000). Because, traditional methods and face to face education could not guarantee to provide the engagement of all students in the class, an alternative platform called e-learning has gained its popularity. The term of web-based education, online learning, distance education, distributed learning, virtual learning, Internet learning, and e-learning can be used interchangeably. However, this paper will use the term e-learning throughout, since it is more commonly used and its focus area is wider.

According to Carliner simple definition (1999) "e-learning is just an educational material that is presented on a computer." Ally (2004) has defined e-learning with much more detailed as "the use of Internet to access learning materials; to interact with the content, instructor, and other learners; and to obtain support during the learning process , in order to acquire knowledge, to construct personal meaning, and to grow from the learning experience." Although it is hard to determine about a generic definition of e-learning, the basic concept implies that the learner and instructors are far away from each other and the learning process continues via the information and communication technologies especially on the Internet, and all the material can be accessed from

the same database. E-learning serves several advantages to its users like low cost, business responsiveness, customization, time and location independence, universality, building a community and a social network, and scalability (Cansun, 2008). Nevertheless, there may also occur potential disadvantages which include training the instructors, providing the sufficient infrastructure and technical support, struggling with the transformation process (traditional to online), and some ethical issues. One of the most challenging disadvantages seems to transfer the course material into e-learning platform which is required time and cost effort. Also, the instructors must also be trained so the adaptation process can be carried out quickly and satisfactorily. Since the traditional e-learning systems often provide the same learning materials with the identical sequences for all learners; once the system is built and the adaptation process has gone, there is no need to editing any component or innovate until the users complain about. Nowadays, with the advent of the technological development, e-learning systems have also evolved.

In the early stages of computer learning systems were designed based on a behaviorists approach which claims that observable behavior indicates whether or not the learner has learned something, and not what is going on in the learners' head (Skinner, 1974; Bechtel & Graham, 1998). In response, some educators defend the learning processes do not become only relevant for learners' behaviors. This new revolution has led the cognitivist theory (Craik, 1972; Ertmer & Newby, 1993) which have been de-emphasized the foregoing factors and have been focused on the acquisition of knowledge and the learners'' mental processes. According to this theory, information is received, structured, stored and retrieved. While behaviorists deal with *what* learners do; cognitivism focus on what knowledge is and *how* it occurs (Jonassen, 1991). The last theory about learning is called constructivism which may be appropriate in dealing with ill-defined domains and may better support metacognitive and reflection skills (Alshammari, 2016). It is better to say that constructivism is considered as a part of cognitivism with its specific focus on conceptualizing the learners' mind as a processor responsible for reasoning, information retrieval, and reflection (Schunk, 1991). Constructivism theory has admitted that learner must have an active role in their learning process and they all responsible for themselves throughout their learning activities. Instructors are expected to become a guide for students, and they want to feel responsible about serving different learning materials and an effective learning environment for their students (Çelikten, 2009).

Ally (2004) has stated that the design of e-learning materials and courses can include principles from all three schools of thought. However, today's e-learning systems are expected to be more adaptive and customized. Brusilovsky (2012) has emphasized the typical structure of traditional e-learning systems and their undeserved learning environment. Traditional e-learning systems serve with the same content in the identical sequences, although it is no longer getting enough for the students' who differ in personalities, abilities, experiences, preferences, and characteristics in our technology-equipped world. Disenchantment with a one-size-fits-all approach, it is time to utilize more customized platforms which are known as "adaptive systems" in the literature. Jameson describes an adaptive system as "an interactive system that adapts its behavior to individual users by processes of user model acquisition and application that involve some form of learning, inference, or decision making." (Jameson 2009). Thanks to adaptive systems, student model can include the learning environment with their choices and selections to provide their requirements more efficiently. These systems aim to integrate learner characteristics such as learner style, skills, abilities, affective state and knowledge level to recommend more relevant instructional material and provide personalized services (Shi et al., 2013). According to Brusilovsky (1996) adaptivity is of particular importance in the field of e-learning for two main reasons. An adaptive system can guide the learner to navigate through a course by providing user-specific paths (Reason 1), and any system have this aim also must take care about different personality and different characteristics of learners (Reason 2). Many researchers have claimed (Aroyo, et al., 2006; Hauger & Köck, 2007; Essalmi et al., 2015) learning style and knowledge level are the most dominant two factors that must be integrated to e-learning systems.

While the learning style is recognized as a critical factor for an adaptive e-learning system, determining which learning style inventory should be used when designing our system is also essential. There exist several Learning Style Inventories (LSIs) in the literature, and they are all different from each other by comparison of their methods, classifications, and suggestions. For this purposes, the first aim of this study is offering a general

framework about LSIs which are the most known and popular. Then, we have tried to identify Sakarya University Management Information Systems Bachelor's Degree Level students learning styles via Kolb LSI's and Felder-Silverman ILS's separately. Our first goal in doing so is present a general framework about the learning styles of MIS students, the second goal is comparing the results attained from two different LSIs, and finally, the third goal is to give some future strategies to students, instructors and university management.

In the following section, we will briefly touch the most popular and the most used LSIs and will try to explain the differences between them. In our method part, the detailed information about the selected two LSIs and the assessment methodology of them will be presented. Findings part of our study contain the evaluations of the LSIs through the conducted surveys, and finally, in conclusions, some strategies will be offered.

LEARNING STYLE INVENTORIES (LSIs)

Learning styles are regarded as cognitive, affective and psychological behaviors. Thus there are no one-suits-all measurement methods that serve us to identify the characteristics of learners. There have been several models for defining the learning styles and also some inventories to measure the learners' characteristics, which are discussed in the below. Coffield et al. (2004) reported that it matters fundamentally which inventories will be chosen, especially when considering the learning styles for relatively mature learners. In the ongoing section, we have briefly given information about some of the inventories that are commonly used in the learning style research area and in Table 1 we have tried to summarize their similar and dissimilar features from each other.

Witkin's Group Embedded Test (GET-1971)

This approach has had its origins in Witkin's research (Witkin et al., 1962) and was based on cognitive learning style. It has had implications for e-learning is the distinction between field dependent and field independent personalities. According to the test results, while field-independent personalities approach the environment in an analytical manner and treat more global and analytical; field dependent ones create greater social orientation, and they tend to learn under conditions of intrinsic motivation such as self-study (Ally, 2004). This figure test contains 25 items and is a reliable tool (Witkin, 1971). However, some researchers argue that this LSI assesses learning ability rather than learning style (Messick, 1984); the validation of this test cannot be proven.

Dunn and Dunn's Learning Style Inventory (LSI-1974)

This inventory was based on the Dunn and Dunn Model (1974) and has claimed that 'people learn in different ways the reason why their various environmental conditions. Instead of psychological and cognitive processes the model focus on environmental factors which comprises five major categories, each of which contains several elements. The environmental category includes sound, temperature, and light and seating/furniture design. The emotional category is concerned with motivation, task persistence, and responsibility. The sociological category deals with preferences for learning alone, in a pair, in a small group or as part of a team. The psychological category refers to right/left, global/analytic and impulsive/reflective preferences. The physical category contains factors related to perception/modality preferences (visual, verbal), food and drink intake, time of day and mobility (Alshammari, 2016).

According to this model, the learning styles that ones have can be thought as a regular feature and maintains its continuity (Kılıç, 2002). This LSI contains more than 100 items and has problems arising from reliability and validity confirmation.

Kolb's Learning Style Inventory (LSI-1984)

According to Kolb two main components makeup learners' learning experience: perceiving and processing. Perceiving refers to absorbing the information in an environment where the processing deals with how the human mind can process the absorbed information in their perceiving phase. While these two processes are happening, four abilities of learners support them for their effective learning: concrete experience, reflective observation, abstract conceptualization and active participation. In addition to his theoretical assumption, Kolb (1984) has also suggested a 'learning cycle' and has tried to explain the learning process itself (Figure 1). Ally (2004) has stated that the concrete stages experience of reflective observation refers to perceiving; processing

ranges from abstract conceptualization to active experimentation.

Kolb has suggested while grouping the successive learning abilities in Figure 1, so the four type of learners exist converger (abstract/active), accommodator (concrete/active), diverger (concrete/reflective), and assimilator (abstract/reflective). Because Kolb has classified learners in linear and ordered steps, some researchers (Konak et al., 2014) criticized that this structure neglects the cultural and social perspectives of learning.
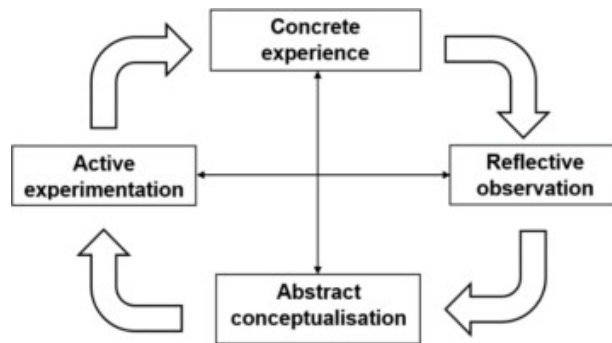

Figure 1. Kolb's Experiential Learning Cycle (Kolb, 1984)

Based on this theory, Kolb's Learning Style Inventory has been developed for identifying individuals' learning style. Kolb's LSI now in its version 3.1 (Kolb & Kolb, 2005) and proved its both reliability and validity. Kolb's LSI differs from other ones based on a comprehensive theory, Experiential Learning Theory, Figure 1, of learning and development. Although the LSI firstly conducted in the management field, it is also widely used in computer and information science, psychology, medicine, nursing, accounting, law and so other areas. It contains 12 survey questions which are infilling items instead of being multiple choice. The LSI has been translated into many languages, including, Japanese, Arabic, Spanish, etc. In this study, we have used its Turkish version which was translated and also was analyzed reliability-validity issues by Gencel (2007).

Myers-Briggs Type Indicator (MBTI-1985)

This inventory is based on Carl Jung's descriptions of individuals' preferred ways –Psychodynamic Theory- when describing the personality types. The basic assumption of this theory is that people's experiences and anticipations of the future have an impact on their personality and that personality traits are quickly influenced by the outside world (Myers and McCaulley, 1985). MBTI has dichotomized the peoples under four main group: extroversion versus introversion (the way of focusing), sensing versus intuition (the way of perceived information), thinking versus feeling (the way of making decisions) and judging versus perception (the way of dealing with outside). While combining them, 16 possible characteristics can be obtained that Kolb & Kolb (2005) indicated that they are very similar to the corresponding their Kolb's LSI. According to them MBTI's extroversion/introversion dialectical dimension refers to their active/reflective part while MBTI's feeling/thinking group has the same meaning with particular experience/abstract conceptualization. The MBTI has lengthy questionnaire with 93 items, and it suffers from some reliability and validity issues (Coffield et al., 2004), despite its usefulness in the learning area.

Felder-Silverman Index of Learning Survey (ILS-1988)

This survey based on the Felder and Silverman learning style model (Felder & Silverman, 1988) which is a hybrid one. Their model has utilized from both Dunn and Dunn (1974), Kolb (1984), and the Myers-Briggs (1985). The survey associated with the model is known as Index of Learning Survey (ILS) and contains 44 short items questionnaire with a choice between two responses to each sentence. According to the result of the survey, learners categorize in 4 main areas, and each area has two perspectives: information processing (active-reflective), input modality (visual-verbal), information understanding (sequential-global) and information perception (sensory-intuitive). Its proven reliability and validity has increased its frequency of use (Felder & Spurlin, 2005). Some researchers have also claimed that ILS has several advantages over other ones including conciseness and ease of administration (Graf, Viola, Leo, & Kinshuk, 2007). In this study, we have used the

Turkish version of the survey which is translated by Keskin Samancı & Özer Keskin (2007).

In Table 1, a brief comparison of mentioned LSIs is presented.

Table 1. Comparison of LSIs

Name of the LSI	More focuses on.	Reliability	Validity	Measurement
Dunn and Dunn's LSI	Environmental factors	No	No	104 item questionnaire
Witkin's GET	Visual memory and cognitive factors	Yes	No	25 item figure test
MBTI	Cognitive factors	No	No	93 item questionnaire
Kolb's LSI	Cognitive and sociological factors	Yes	Yes	12 infilling item
Felder-Silverman's ILS	Psychological, cognitive, and sociological factors	Yes	Yes	44 item questionnaire

However an instrument validity and reliability confirmation have critical importance for academic research, it can be seen that only two of them (Kolb's LSI and Felder Silverman's ILS) have provided this assurance. All five inventories benefit from survey technique during their methodological part. Truong (2016) has indicated that although there is no way to reveal the learners' characteristics without applying any LSI, this development has some drawbacks as for every qualitative study. The survey results completely depend on the participants' judgment, and it is done only at a point in time while the learning styles can change over time and different theories.

METHOD

In this study, we have preferred to use Kolb's LSI (version 3.1) and Felder-Silverman's ILS separately. The main reason why we have chosen these two is that they ensure their both reliability and validity. Another reason is they are some similarities between these models. For example, the sensory-intuitive dimension in the Felder-Silverman model may be related to the concrete-abstract dimension in the Kolb model (Alshammari, 2016). We have conducted these two surveys with the participation of 44 second year Bachelor's Degree MIS students, consecutively. The reason why we have chosen them is about Sakarya MIS curriculum content. In their first year, MIS students have intensely learned some general courses although when it comes after year their basic courses such as Management Information Systems, Algorithms and Introduction to Programming, System Analysis and Design, have just started. Deciding the second year undergraduate students' learning styles may guide both instructors and department management to be conscious and help them to educate more equipped students for the next years.

Kolb's LSI has twelve-point questionnaire had four choices, and every choice represents one of the abilities of the model; concrete experience, reflective observation, abstract conceptualization and active participation. Each participant had a total score for each ability range from 12-48. Next step is getting the aggregated score. It is calculated by abstract conceptualization (AC) score – concrete experience (CE) score and active experience (AE) score – reflective observation (RO) score. Finally, each person has two different aggregated score (AC-CE and AE-RO) range from -36 from +36.

If a participant gets a negative point in his/her AC-CE score, it means learning experience is a particular process. If a participant receives a positive point in his/her AE-RO score, it says the learning activity is an active process. Once the aggregated scores are evaluated, plotting them on the Learning Style Type Grid (Kolb, 1999) will be next step. For customizing the grid, in Table 2 we have presented the total norm group scores and have decided our cut point for the AC-CE scale is +0,5, and the cut point for AE-RO scale is +1,37.

Table 2. LSI Scores for Normative Groups

Total Norm Group				Cut Points	
CE	RO	AC	AE	AC-CE	AE-RO
29,0227	30,0682	29,5227	31,4318	0,5	1,37

According to these guide, the accommodator type would be defined by an AC-CE raw score <=0,5 and an AE-RO score >= 1,37, the diverging type by AC-CE <=0,5 and AE-RO <= 1,37, The converging type by AC-CE >= 0,5 and AE-RO >=1,37 and the assimilator by AC-CE >= 0,5 and AE-RO <=1,37.

The Felder-Silverman's ILS technique is more straightforward than the Kolb's. ILS contains 44 item questionnaire and categorizes the learners' into four main groups (active/reflective, sensing/intuitive, visual/verbal, sequential, global). Each dimension represents with 11 questions in which can be seen in Table 3. Each learner has his/her preferences for each dimension. These preferences are expressed with values between 0 to 11 per dimension. This range comes from the 11 questions that are posed for each dimension.

**Table 3.** ILS's four main groups and their belonging questions

Dimension	Questions
Active (answer a) / reflective (answer b)	1,5,9,13,17,21,25,29,33,37,41
Sensory (answer a) / intuitive (answer b)	2,6,10,14,18,22,26,30,34,38,42
Visual (answer a) / verbal (answer b)	3,7,11,15,19,23,27,31,35,39,43
Sequential (answer a) / global (answer b)	4,8,12,16,20,24,28,32,36,40,44

When answering a question, for instance, with an active preference, +1 is added to the all the questions answering with the answer 'a' and 0 points for the answer 'b.' Regarding the active/reflective dimension again, if someone gets the points between 0 to 5 'a' responses for the active/passive dimension, it would represent reflective dimension, while getting 6 to 11 'a' score represents the active dimension. These two category can also be enhanced: 0 to 1 'a' score comes from the strong reflective preference while 2 or 3 'a' score means the participant shows a moderate preference for reflective and finally 4 or 5 'a' represents mild preference for reflective. On the other side, however 6 or 7 'a' mild preference, 8 or 9 'a' moderate preference and finally 10 or 11 'a' strong preference for active learning. This evaluation methodology is generally used in all of the statistical analyses for grouping participants according to Felder-Silverman's ILS (Felder & Spurlin, 2005).

FINDINGS

According to the results of the survey conducted with 44 MIS Bachelor's Degree Student, Figure 2 shows the plots the aggregated scores on AC-CE and AE-RO for respondents.

Figure 2. LSI Scores on AC-CE and AE-RO
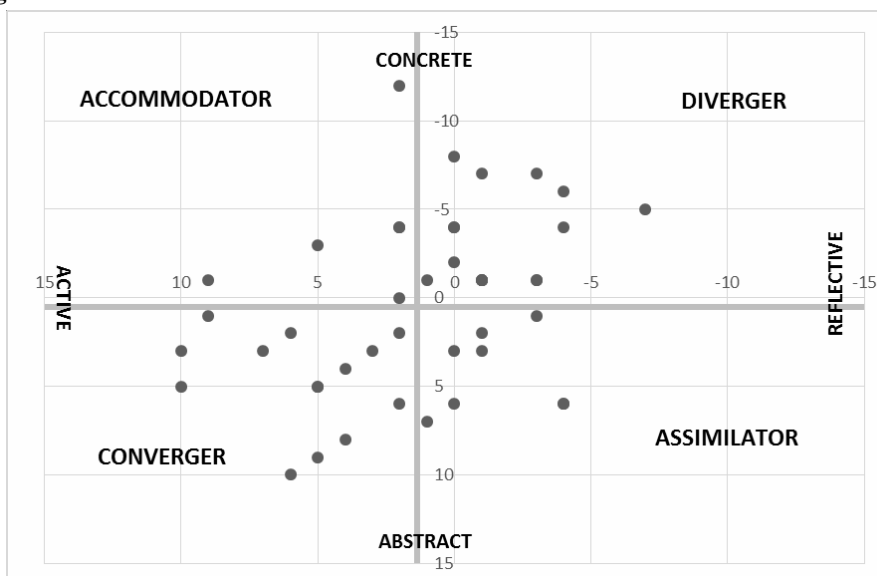
From the participants, the dominant learning styles seem to converger and diverger among the MIS students. While the %34,1 of students have converger learning style which represents the abstract/active, the %31,8 of them have diverger learning style the combination of reflective/concrete. Both accommodator and assimilator learning styles represent a reasonable distribution of nearly %16. This percentage means the students in MIS department place in two opposite poles; converger and diverger.

In literature, some researchers have suggested the most suitable professions for each dimension of LSI. For instance, however banking, marketing, educational management areas are matched with the accommodator dimension, social working areas and psychology are suits with the divergers. While economic, engineering and computer sciences are regarded as the convergers can do their best in these areas, law, teaching, biology would be an exciting area for assimilators (Aşkar & Akkoyunlu, 1993). Since the MIS discipline is an interdisciplinary - technical, sociological and psychological- in itself, the students educated in this department are also expected to be versatile. With the help of Figure 2, we can state that the students have converger learning style represents the technical side, while divergers belong to psychological and sociological part of the department.

Kolb (1985) has found strong relationships between learning styles and preference for learning methods- assimilators preferred lectures, reading, writing, and individual work, while accommodators and especially divergers and convergers preferred partner and group work. Students with the diverger style should be evaluated as patient, careful and creative ones in the learning process and they willing to concentrating to produce new ideas and making brainstorming activities (Ekici, 2003). Convergers are called "best practices of the ideas" which means that they want to solve the problems with technical ways via deductive approach instead of communicating with the people. Feedbacks of the instructors are critically important during their learning process and working with a group increase their efficiency in their learning environment. In Table 4 more detailed information about the learning styles and their features is presented.

Table 4. Learning styles and their unique features (Aşkar & Akkoyunlu, 1993; Kolb D., 1999; Kolb & Kolb, 2005; Evin Gencel, 2007).

Learning Style	Learning Activity	Educational specialty	Best Team
Accommodator	Individual study, verbal study material	Banking, marketing, educational management	Assimilators
Diverger	Group discussion, brainstorming, problem-solving	Psychology, social sciences	Convergers
Assimilator	Individual study, theoretical information, lab cases	Law, biology, education	Accommodators
Converger	Small group working, active participation	Economy, engineering, computer sciences	Divergers

From the perspective of Felder-Silverman ILS, the learners' characteristics of MIS students are shown in the below. Since one of the surveys contains insufficient information, it is excluded from our dataset, and the rest of 43 surveys is investigated.

Table 5. Results of the Felder-Silverman's ILS by each dimension

Active/Reflective		Sensory/Intuitive		Visual/Verbal		Global/Sequential	
Strong reflective	2	Strong intuitive	0	Strong verbal	0	Strong global	0
Moderate reflective	5	Moderate intuitive	2	Moderate verbal	0	Moderate global	0
Mild reflective	16	Mild intuitive	6	Mild verbal	7	Mild global	17
Mild active	11	Mild sensory	19	Mild visual	10	Mild sequential	13
Moderate active	7	Moderate sensory	13	Moderate visual	14	Moderate sequential	8
Strong active	2	Strong sensory	3	Strong visual	12	Strong sequential	3

The most striking result of the ILS is there is none strong nor moderate verbal and global learner among the MIS students which means that they prefer to learn with visual materials and step by step in a well-structured way. In general words, MIS students differ from each other mostly in information processing step (active/reflective) and for other ones such as input modality (visual-verbal), information understanding (sequential-global) and information perception (sensory-intuitive), they seem to locate in mild or moderate levels.

Table 6 shows the number of the students categorized by both Kolb's and Felder-Silverman's questionnaire. Although most of the students are located in the diverger and converger side of the Kolb's, it was unexpectedly found that most of them tend to learn reflectively. What it means is that, while the MIS students are willing to study with groups and a project team, they are not willing to leading their friends, and they want to participate the learning process passively. It may also mean that MIS students are creative but their social perspectives are not enough for showing their innovative sides and they are called as 'creative, shy students.' According to their information processing dimension, there are more students preferred to learn with their sense and the most of them are also diverger/converger category. It means the MIS students tend to observe and interact with examples before studying theoretical concepts or procedures.

Table 6. Combining the dimensions of Kolb's LSI and Felder-Silverman's ILS

Felder-Silverman's ILS's dimension		Accommodator	Diverger	Assimilator	Converger
		Kolb's LSI's dimension			
Information processing	Active	5	6	3	6
	Reflective	2	8	4	9
Information perception	Sensory	7	10	5	13
	Intuitive	0	4	2	2
Input modality	Visual	7	12	5	12
	Verbal	0	2	2	3
Information understanding	Sequential	4	9	4	7
	Global	3	5	3	8

Input modality preferences is another dimension, and visual learners are well ahead of verbal ones. Verbal learners are mostly categorized in diverger/converger class like sensing learners which shows us the MIS students can obtain more benefit from visual learning materials like graphs, pictures, diagrams. This finding also well matches the technical side of the department. For example, in algorithm and programming course it is first thought to students how to draw a flow-chart diagram and how would it be interpreted. The information understanding dimension represents with sequential and global learners which nearly has the same number of our participants. One point about is that our diverger learners mostly want to learn with sequentially. However, convergers have more tendency to become a global learner. This is because the divergers have more detailed perspective view and they believe they can achieve their goals by learning the subject step by step so that nothing

can escape from their attention.

CONCLUSIONS

Today's Learning Management Systems (LMS) use several methods for selecting suitable learning objects. The main difficulty with this process is the content and size of learning objects. Based on several criteria, rules can be derived. One main rule composing an integrated and smart learning environment is to decide on learners' characteristics. This study is a kind of pilot one that tries to reveal the learning style of Sakarya University Bachelor's Degree MIS students. For doing that, two different Learning Style Inventory which is called Kolb's LSI and Felder-Silverman's ILS relatively was used.

When applying these two different inventories into the same group, two significant and dominant learner characteristics have emerged. The first group represents the social side of MIS department, and it consists diverger style from the Kolb and reflective/sensory/visual/sequential style from the Felder-Silverman. We call this group "Shy Socials" as their unique characteristics of their creativeness but passive learners during their learning process. To create an effective learning environment for them, instructors should encourage them to participate in the learning activity and offer them a working group materials. For instance, case studies and collaborative project task can be useful to reveal shy socials innovative side and foster them being more active during their courses. Especially for verbal lessons, the courses should be supported by some additional interesting visual images like graphs, diagrams, etc. Our second group is called "Idea Originators" and consists converger style from the Kolb and reflective/sensory/visual/global dimensions from Felder-Silverman, respectively. They are considered as more technical people than the shy socials. Idea Originators represent the technical side of the MIS. There should be offered some practical learning activity for including the Idea Originators during the learning process. Small group activities may also increase their social relations and can make possible for creating new ideas for them. Some prototyping projects or any other project techniques such as agile, SCRUM can be helpful for providing their integration to the course. Even, executive education can also enhance their information understanding perspective because they tend to get knowledge globally and any expert can gain new aspects to them.

As every research has, this study also has some limitations. Firstly, a number of the participants is inadequate. Further studies with more students can be conducted to increase our test reliability and validity. Secondly, the integration of learning styles and adaptive learning system still requires further research and experiments. Since the learning styles are stable indicators but may change over the lifetime, identifying the potential learning styles predictors is also a critical issue.

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