

Future Academy®'s Multidisciplinary Conference

Learning and personal attributes of university students in predicting and classifying the learning styles: Kolb's nine-region versus four-region learning styles

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Abstract

Developing effective study skills and learning habits is very important for university students, not only for getting a university degree but also for preparing themselves for their career. Students and their instructors should be aware of what attributes related to students' perceptions and habits influence their learning styles. Studies in literature have mainly used Kolb's four-region styles, and this study is one of the few that investigate Kolb's nine-region styles and the only study that compares the two with data from the field. This is the first study in literature that investigates the research question of how important the various learning and personal attributes of university students are in predicting and classifying the learning styles. The main contribution of this study is showing that the Kolb's four-region and the nine-region learning style can be explained through different attributes. This study is also valuable for discovering the relations of the students' personal attributes, the students' learning styles and perceptions about studying and learning. Study planning, active participation, and group studies are listed as the most desired learning activities. Making learners aware of their learning styles and how to accommodate this in the learning environment obtains significant benefits to learning outcomes.

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Peer-review under responsibility of Future Academy® Cognitive Trading

Keywords: Kolb' learning style inventory; effective learning habits; study skills; perceptions on learning.

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1. Introduction

Developing effective study skills and learning habits is very important for university students, not only for getting the university degree but also for preparing themselves for their career after university. Lack of study skills, self-management and academic skills are commonly given as reason for dropouts from university, even though the decisions for withdrawal usually result from a combination of problems such as motivation, qualifications, personal situations, academic difficulties, and financial problems (Goldfinch & Hughes, 2007; Hall, 2001; Yorke, 2004). The most fundamental problem of higher education is that most of the students do not learn very well. This does not mean students do not learn anything, but students learn in a certain way and with certain constraints (Tagg, 2007). Students who do well in the exams may be good at in short-term recall but can quickly forget the information even they may study hard to improve their grades (Tagg, 2007). “How to study” can make difference for both short-term benefit and long-term benefit of education. Making learners aware of their learning styles and how to accommodate this in the learning environment obtains significant benefits to learning outcomes (Sadler-Smith, 1996; Schellens & Valcke, 2000; Vincent & Ross, 2001). The research presented here examines the learning styles of university students studying in an international institute of Higher Education. The adopted theoretical framework is the experiential learning model by David A. Kolb (1984), which has attracted much interest and application as a well-established model. This paper focuses on how learning styles may impact upon perceptions on learning and study habits, and the use of resources in the learning environment.

Various theories including Gardner’s (1993) multiple intelligences, Vermunt’s (1992) theory of learning styles, Kolb’s (1984) theory of experiential learning, and Sternberg’s (1997) theory of mental self-government, Gregorc’s (1982) cognitive style differences, and various extensions of Jung’s (1921/1970) psychological types (Lawrence 1993) describe the observed differences among students’ approaches towards learning and relate to the learning styles of students in higher education and how these depend on gender, age, university major, and personality (for example, Nielsen 2008). Most frequent used inventories include the Survey of Study Habits and Attitudes (Brown & Holtzman, 1967), Learning and Study Skills Inventory (Weinstein & Palmer, 2002), Inventory of Learning Processes (Schmeck et al. 1991), the Study Process Questionnaire (Biggs, 1987), the Learning Style Inventory (Kolb 1985), and other learning style inventories (Dunn & Dunn, 1978; Felder & Silverman, 1988; Jung, 1970; Kolb, 1985; McCarthy, 1987). This research study tests the key assumption of learning styles and study skills by using Kolb’s Learning Style Inventory (LSI). LSI has been used in student affairs practice and classroom applications, assisting individuals with both self-exploration and gathering information about the world of work (Salter et al., 2006). Study skills are defined as competence in acquiring, recording, organizing, synthesizing, remembering, and using information (Harvey, 1995), and encompass a variety of activities. These activities include time management, selecting an appropriate study environment, employing appropriate learning strategies, concentrating, self-testing, organization, and managing anxiety (Proctor et al., 2006). Studies have shown that students’ performance in higher education correlates with their confidence in study skills, communication and team-work skills, and also with their learning styles (Goldfinch & Hughes, 2007; Marriott & Marriott, 2003; Sangster, 1996).

David A. Kolb and Ron Fry (1975) developed the Experiential Learning Model (ELM) by drawing on the foundational theories of Jean Piaget, John Dewey, and Kurt Lewin. ELM defends that learning is a combination of experience, cognition, perception, and behavior (Kolb, 1984). ELM reflects a learning cycle model with two independent dimensions based on (a) perceiving, how one makes information meaningful, which involves concrete experience (feeling) and abstract conceptualization (thinking), and (b) processing, how one takes in information, which involves active experimentation (acting) and reflective observation (watching) (Kolb, 1999). These two dimensions form the following four sequential elements that repeat each other: (1) concrete experience (CE), (2) reflective observation (RO) on that experience, (3) abstract conceptualization (AC) based upon the reflection, and (4) active experimentation (AE) (Kolb, 1999). Based on ELM, Kolb developed the Learning Style Inventory (LSI) to investigate an individual’s learning preference. Four quadrants of the learning cycle reflect Kolb’s four learning styles (Kolb, 1999): Converger (acting and thinking); Accommodator (acting and feeling); Assimilator (watching and thinking), and Diverger (watching and feeling). Besides Kolb’s four learning styles, David Hunt and his associates (Abby et al., 1987) identified four additional learning styles as Northerner, Easterner, Southerner, and Westerner. Also, a “Balancing” learning style was identified by Mainemelis, Boyatzis, and Kolb (2002). Thus, Kolb’s four learning styles were expanded to nine distinct styles (Kolb & Kolb, 2005). These additional learning

styles are: Northerner (feeling, acting, and reflecting); Easterner (reflecting, feeling, and thinking); Southerner (thinking, acting, and reflecting); Westerner (acting, feeling, and thinking), and Balancing (thinking, feeling, watching, and acting). The Figure 1 illustrates the nine-region learning style and experiential learning model cycle. In the Figure 1, C is for center; N is for north; S is for south; W is for west; E is for east.

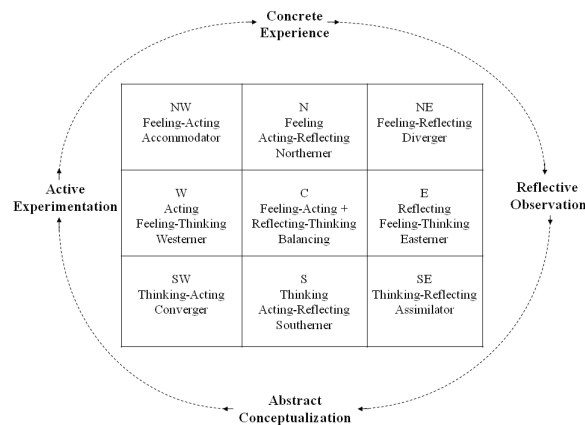


Fig. 1. The nine-region learning style grid

ELM has found pedagogical implications in adult education, and is used to enhance learning in higher education. Kolb (1999) describes ELM where development is accomplished by higher level integration and expression of non-dominant styles of dealing with the world (Kolb, 1984; Loo, 1999). Kolb's learning style model still remains a very popular learning style model (Demirbaş & Demirkan, 2007). Many investigators (Holley & Jenkins, 1993; Kolb, 1984; Kolb & Kolb, 2005) have used learning styles instruments to describe students, and to correlate learning styles with a wide variety of attributes related to academic and vocational interests, performance, and professional mentality. According to Kolb and Kolb (2005), in an idealized learning cycle, the learner touches all the bases - experiencing, reflecting, thinking, and acting- in a recursive process. The effective learner can use each of the styles in different learning situations, rather than only rely on one preferred style (Kolb et al., 2000). The following paragraphs explain the characteristics of the nine types of learning styles, converger, assimilator, accommodator, diverger, northerner, easterner, southerner, westerner, and balancing.

The contribution of this study is showing that the Kolb's four-region learning style and the nine-region learning style can be explained through different attributes (variables). Hence, the selection of four or nine regions makes a difference in which attributes are significant in explaining the learning styles, and one should not simply or randomly select from among four or nine regions. This research study is also valuable for discovering the relations of the students' personal attributes, the students' learning styles and perceptions about studying and learning.

2. Methods

2.1. Research questions

The question "how do you learn?" brings up subjects like learning styles and learning strategies. The question "how do you study?" brings up subjects like study skills and study habits. The questions "how effective do you study?" and "how often do you take responsibility for your own learning?" brings up subjects like students' perceptions about their effectiveness as learners. Through investigating the answers of these three questions, the current study focuses on the relations of the students' personal attributes, the students' learning styles and perceptions about studying and learning. The main research question is the following: "How important are the various learning and personal attributes of university students in predicting and classifying the learning styles?". To answer this question, the study investigates how different values of certain attributes influence the distribution of

learning styles in the nine-region learning style framework and compares the Kolb's four-region learning style and the nine-region learning style. The attributes that influence students learning have been developed into the Learning Styles and Perceptions on Learning Model, shown as Figure 2. This model identifies personal attributes of the learner and perceptions on learning to affect students' learning styles.

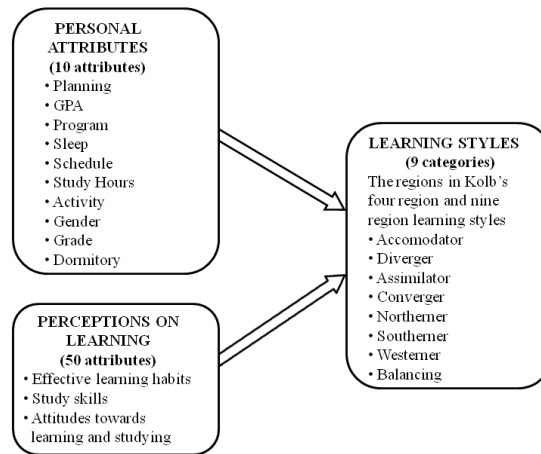


Fig. 2. Learning styles and perceptions on learning model

2.2. Sample

Participants were the undergraduate students of an international university in Istanbul, Turkey. The survey instrument has three sections; 14 questions as background information, 12 questions as learning style inventory (Askar & Akkoyunlu, 1991; Kolb, 1985), and 50 questions as learning and study habits. Each survey application lasted approximately half an hour, and the sample size was 3500 students. The survey was sent by e-mail to all undergraduate students. From 512 voluntary participants, 418 students' responses were analyzed, as 94 students did not respond to all items in the survey.

2.3. Research Instruments

Demographic data. Demographic characteristics and academic performance information were obtained through the individual items reflecting gender, living arrangement, grade level, faculty and cumulative grade point averages. Cumulative GPA was assumed as a measure of academic performance.

Weekly time management, study planning, and social activity planning. Three items designed to assess students' weekly time management (time spent for study and time spent for social activities) and their preferences about study planning. For the weekly time management, students were instructed to indicate how much time they spent in a week for studying and for social activities ranging from 1-5 hours, 6-10 hours to 11 hours and plus. With regards to study planning, students were asked to determine whether they study regularly, during exam weeks, or just a day before the exam.

Learning styles. The Learning Styles Inventory (LSI-2) (Kolb, 1985) was used to examine students' individual learning preferences. The LSI is composed of 12 short statements followed by four possible sentence endings. Each individual is required to rank each of four sentence endings based on his/her preference for using the four distinct learning modes. Every individual utilizes each of the four learning modes to some extent, but she/he has also a preferred learning style for perceiving and transforming the information. Turkish version of The LSI-2, was adapted by Askar and Akkoyunlu (1991), was a reliable and valid instrument; internal reliability of four main learning

modes and two bi-polar dimensions were found to be high with a Cronbach alpha between 0.73 and 0.88 (see Askar & Akkoyunlu, 1991). For the current study, it was observed that the four basic learning modes' internal consistencies were between .73 and .84.

Study skills and perceptions about students' own effectiveness as learners. 50 items were generated that referred to study skills, and students' perceptions about study and learning. The lead author created these items in 2008-2009 academic year based on non-structured interviews conducted by undergraduate students and literature on study habits and study skills. Some of the statements reflected overt behaviors such as generating questions about reading materials, asking for help from peers and instructors, doing library research; and some of them referred cognitive styles like trying to build an interconnection between different courses, using information to solve practical problems and taking responsibility for learning. As result, 50 items were developed and participants were instructed to indicate how frequently they used each study habits on a scale ranging from 1 (never) to 5 (always). All items are shown in Appendix A.

Students' characteristics, weekly time management and study planning. 43% of the participants were (n = 181) female and 57% were male (n = 237). 82.5 % of the students were living in dorms (n = 345). The survey was administrated to students from two different faculty categories: (1) Engineering (2) Social Sciences. 62% of the students (n = 260) were participated from Engineering and 37.8% (n = 158) were participated from Social Sciences. With regard to academic performance, 17.4% (n=73) students had a cumulative GPA between 1-2, 45% (n=188) had a cumulative GPA within the range of 2-3, and 37.6% (n=157) had a cumulative GPA between 3-4. The percentages for time spent for studying and engaging in social activities were relatively similarly distributed among the students. Most students prefer to study for exams, while only a small percentage (12%) is prone to studying regularly.

Kolb's four-region learning styles. The four basic learning style types—Accommodator, Diverger, Assimilator, and Converger are created by dividing the AC-CE and AE-RO scores at the fiftieth percentile of the total norm group and plotting them on the Four-Region Learning Style Type Grid (Kolb 2005). For the current study, the cut point for the AC-CE scale is 0, and the cut point for the AE-RO scale is -1. The Accommodator type is defined by an AC-CE raw score ≤ 0 and an AE-RO score > -1 , the Diverger type by AC-CE ≤ 0 and AE-RO ≤ -1 , the Converger type by AC-CE > 0 and AE-RO > -1 , and the Assimilator type by AC-CE > 0 and AE-RO ≤ -1 .

Kolb's nine-region learning styles. The nine region of the Kolb's learning styles—Accommodator, Diverger, Assimilator, Converger, Northerner, Easterner, Southerner, Westerner, and Balancing are created by dividing the AC-CE and AE-RO scores at the thirtieth percentile and sixtieth percentile of the total norm group and plotting them on the Nine-Region Learning Style Type Grid (Kolb & Kolb, 2005).

Information gain. In this study, the information gain (Kullback–Leibler divergence) measure is employed to rank the importance of the attributes, with respect to determining the learning styles in Kolb's four-region and nine-region models. Information gain of an attribute A is the information gained about a response random attribute X based on observation of values that A takes (Kullback & Leibler, 1951). The information gain concept is used in information sciences to obtain a ranking among attributes, based on how much they help in the prediction of values of the response random attribute. The higher the information gain value, the more information the attribute provides for predicting the response. In this study, the attributes with the highest information gain values can be thought as those attributes that help us most in understanding which learning style each respondent adopts.

Spearman's rank correlation test. To measure whether the ranks of the attributes, with respect to their information gain values, are the same or not in Kolb's four-region and nine-region models, Spearman's rank correlation test (Sperman, 1904) is applied for the null hypothesis "the Pearson correlation coefficient is equal to zero". Rejection of the null hypothesis will state that the ranks are different (Fieller, 1957), and thus the learning styles in Kolb's two models are affected in different ways from the selected set of attributes. Correlation represents the strength of relationship between two attributes, and the two methods applied to measure correlation are Pearson correlation and Spearman rank correlation. While Pearson correlation coefficient measures linear relationship between the values of the data, Spearman rank correlation coefficient (also named Spearman's rho) measures the linear relationship between the ranks of the data. In the case of Pearson correlation, testing of whether the correlation is zero is applicable only if the two attributes follow normal distribution, whereas such an assumption is

not needed in the case of Spearman correlation. Thus, Spearman correlation is more general, and has a wider validity (Altman, 1991), which is the reason it was selected for testing ranks in this study.

3. Results

The distributions of the participants on the four-region learning style type grid are shown in Figure 3 and Table 1. Also, the distributions of the participants on the nine-region learning style type grid are shown in Figure 4 and Table 2. In Figure 3 and Figure 4, AC: abstract conceptualization, CE: concrete experience, AE: active experimentation, and RO: reflective observation.

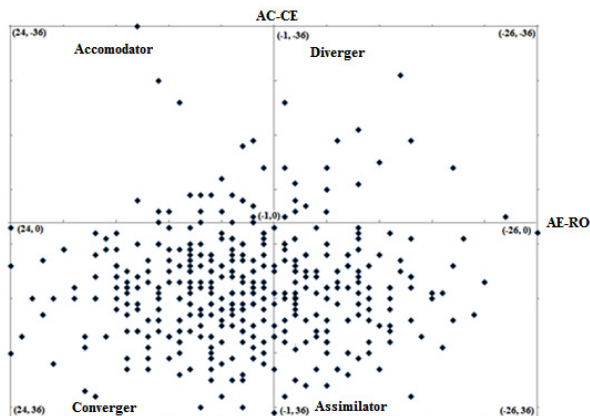


Fig. 3. The Kolb's four-region learning styles

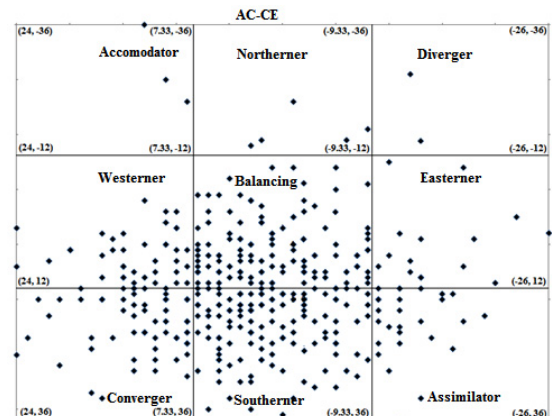


Fig 4. The Kolb's nine-region learning styles

Table 1 Count of participants in each region in the Kolb's four-region learning styles (N=418)

Rank	Four-region learning styles	Count	Percentages
1.	Converger	236	56%
2.	Assimilator	138	33%
3.	Accomodator	25	6%
4.	Diverger	19	5%

Table 2 Count of participants in each region in the Kolb's nine-region learning styles (N=418)

Rank	Nine-region learning styles	Count	Percentages
1.	C – Balancing	136	33%
2.	S – Southerner	130	31%
3.	SW – Converger	57	14%
4.	W – Westerner	43	10%
5.	SE – Assimilator	23	6%
6.	E – Easterner	19	5%
7.	N – Northerner	5	1%
8.	NW – Accommodator	3	-
9.	NE – Diverger	2	-

Once Kobl's four-region and nine-region learning styles have been constructed, the next step was to determine which attributes have the greatest effect on the learning styles and whether the ranks of the attributes (regarding their importance) change in the four-region and nine-region learning styles. To this end, six models (Models 1a, 1b, 2a, 2b, 3a, 3b) have been constructed to obtain information gain values, and hence the importance of the attributes. Attributes can be grouped into two: Personal attributes and perception attributes. The information gain values can be computed based on personal attributes only (Model 1), perception attributes only (Model 2), or both groups of attributes combined (Model 3). For each of the models defined, the information gain can be computed based on Kolb's four-region learning styles (Models 1a, 2a, 3a) or nine-region learning styles (Models 1b, 2b, 3b). For each pair of models 1a-1b, 2a-2b, and 3a-3b, scatter plots were constructed, and formal hypothesis testing was carried out. Table 3 shows the information gain values and attribute ranks for Models 1a & 1b as an example. Planning and GPA are among the top three attributes in both models, but Activity is the top attribute in Model 1b.

Table 3 Impact of attributes on which region the respondent falls into, in Model 1a and Model 1b, where only personal attributes are used

Model 1a Four-region			Model 1b Nine-region	
Rank	Attribute	Information gain	Attribute	Information gain
1	Planning	0.036	Activity	0.062
2	GPA	0.028	Planning	0.033
3	Program (Faculty)	0.018	GPA	0.030
4	Sleep	0.017	Study Hours	0.028
5	Course Schedule	0.016	Gender	0.026
6	Study Hours	0.014	Course Schedule	0.026
7	Social Activity Hour	0.011	Sleep	0.024
8	Gender	0.006	Grade	0.020
9	Grade	0.005	Living in Dormitory	0.016
10	Living in Dormitory	0.004	Age	0.015
11	Age	0.003	Program (Faculty)	0.013

Given the stated differences in the ranks of certain attributes, are the ranks of attributes the same in Models 1a & 1b, where only personal attributes are included? Hypothesis 1 is the null hypothesis that suggests the attribute ranks in Models 1a & 1b are the same. When this hypothesis is tested through the Spearman rank correlation test, p -value=0.2031 is obtained. Hence one cannot reject the null hypothesis that the ranks in Models 1a & 1b are the same at $p=0.10$, the typical threshold value used in this test. Yet, the scatter plot in Figure 5, where the ranks of attributes in Model 1b are plotted against those in Model 1a, gives additional insights. The ranks roughly lie on a line, as confirmed by the statistical test. However, there are two outlier points: The attribute Program has a very high importance (lower rank value of 3) in Model 1a, whereas it has less importance (higher rank value of 11) in Model 1b. The attribute Activity has a low importance (higher rank value of 7) in Model 1a, whereas it is the most important attribute (highest rank value of 1) in Model 1b. Next, the results for Models 2a & 2b are analyzed. When the null hypothesis of Hypothesis 2, "the attribute ranks in Models 2a & 2b are the same" is tested through the Spearman rank correlation test, p -value=0.0038 is obtained. Hence one can reject the null hypothesis, and suggest that the ranks in Models 2a & 2b are indeed different. Hence Hypothesis 2 is proven. The scatter plot in Figure 6 further confirms the statistical test results, since the points seem to be distributed almost randomly. Finally, the results for Models 3a & 3b are analyzed. When the null hypothesis of Hypothesis 3, that is, "the attribute ranks in Models 3a & 3b are the same" is tested through the Spearman rank correlation test, p -value=0.0003 is obtained. Hence one can reject the null hypothesis, and suggest that the ranks in Models 3a & 3b are indeed different.

As a conclusion, the differences in attribute ranks are statistically significant when only perception attributes are included, or when both personal and perception attributes are included. The program that the student attends is an important classifier attribute for the four-region styles, but not for the nine-region style. On the other hand, the time that the students spend for social activities is an important classifier attribute for nine-region styles, but not for four-region styles. Planned weekly studying, studying at least one week before the tests, and working only the night before the test are attributes that are important in both four-region and nine-region styles (Hunt, 1987; Kolb, 1999; Mainemelis et al., 2002; McCarthy, 1987; Smith & Kolb, 1986).

4. Conclusions and Discussions

Firstly, Kolb's four-region and nine-region learning styles have been constructed. Secondly, it has been determined which different attributes have the greatest effect on the learning styles. Lastly, it has been shown that the ranks of the attributes change in the four-region and nine-region learning styles. According to four-region learning styles, the first dominant learning style was Convergers, who generally likes to learn through practical application like solving problems and preferring to deal with technical works or problems to social relations (Gogus & Gunes, 2011). Using nine-region learning style gives detailed analysis of the learning styles of the students. According to counts and percentages of the students in each learning style, the ranks of the nine learning styles are: (1) Balancing (33% of the students) learning style harmonize thinking, acting, reflecting, and feeling; (2) Southerners (31% of the students) emphasize thinking while harmonizing acting and reflecting and reflect on the routes of their actions without benefit of emotional feedback; (3) Convergers (14% of the students) learn by thinking and acting to reach a conclusion or find a single, correct answer and prefer dealing with technical works or problems to social relations; (4) Westerners (10% of the students) emphasize acting and go directly from feelings to conceptual analysis and intuitive experience without reflecting on the concrete experience; (5) Assimilators (6% of the students) learn by watching and thinking and prefer to work alone, as in traditional lecture-oriented classrooms, and generally emphasizes on logical validity of theories than their practical value; (6) Easterners (5% of the students) are good at a deep reflection but they have trouble putting plans into action since they spend much time in thinking and reflection; (7) Northerners (1% of the students) emphasize feeling and have difficulty in conceptualizing or making meaning of experience; (8) Accommodators (less than 1% of the students) prefer acting on the basis of their feelings rather than mental and technical analyses; (9) Divergers (less than 1% of the students) learn by concrete information given them by their feeling and have concerns on taking actions (Hunt, 1987; Kolb, 1999; Mainemelis et al., 2002; McCarthy, 1987; Smith & Kolb, 1986).

Students' faculty/program type is an important classifier attribute for the four-region styles, but not for the nine-region style. On the other hand, the time that the students spend for social activities is an important classifier attribute for nine-region styles, but not for four-region styles. Planned weekly studying, studying at least one week before the tests, and working only the night before the test are attributes that are important in both four-region and nine-region styles. Studies in literature have mainly used Kolb's four-region styles, and this study is one of the few that investigate Kolb's nine-region styles, and the only study that compares the two with data from the field. To the best of our knowledge, this is the first study in literature that investigates the research question of how important the various learning and personal attributes of university students are in predicting and classifying the learning styles.

In Kolb's nine-region styles, the attributes are most important in determining the learning style are as follows:

S32. I cannot perform during the test, even though I have studied beforehand.

S10. I study to the course by teaching to others.

S41. I attend the courses regularly.

S11. I learn in the lectures through group exercises.

S6. I study the topics by taking notes while reading the resources.

S28. I volunteer to present and participate during the lectures.

S31. I believe that group studies help me in learning by active questioning.

According to these results, participating actively in the lectures (S41, S28) and working in groups in (S11) and out (S10, S31) of lectures are listed as desired learning styles. An important research question for the future is to understand why students who cannot perform during the test even though they have studied beforehand (S32) cannot develop effective learning habits.

This is the first study in literature that investigates the research question of how important the various learning and personal attributes of university students are in predicting and classifying the learning styles. Another contribution of this study is showing that the Kolb's four-region learning style and the nine-region learning style can be explained through different attributes. Making learners aware of their learning styles and how to accommodate this in the learning environment obtains significant benefits to learning outcomes (Sadler-Smith, 1996; Schellens & Valcke, 2000; Vincent & Ross, 2001). Similarly, it is considered important that educators and learners should

understand not only the concept of learning style but also the potential impact on the design of the instruction and learning environment.

Appendix A. Perception attributes

	Perception attributes
1.	I learn by listening during the class
2.	I learn by preparing by myself before the class
3.	I learn by asking questions during the class
4.	I study by reviewing class notes
5.	I study by making a fair copy of class notes
6.	I study the topics by taking notes while reading the resources.
7.	I study by solving the questions that unsolved before
8.	I study by memorizing solved examples
9.	I learn by studying by myself
10.	I learn by teaching to others.
11.	I learn in the lectures through group exercises.
12.	I learn by making group studies after the class
13.	I study by summarizing before the exam
14.	I study by memorizing class notes before the exam
15.	I study by solving questions only before the exam
16.	I benefit from peer study and discussion sessions of ASP
17.	I benefit from workshops of ASP
18.	I benefit from one to one tutorial sessions of ASP
19.	I receive private tutorial
20.	I underline useful information while reading and take notes from readings.
21.	I generate questions about reading materials.
22.	I come to class having reviewed the notes from the previous class.
23.	I take notes down what teacher say and write on the board during the class
24.	I seek help from teachers outside of class time regarding the course material that I did not understand.
25.	I seek help from friends regarding the course material that I did not understand.
26.	I ask questions during the class and try to actively participate into the class.
27.	I try to answer the questions that teachers ask in class.
28.	I volunteer to present and participate during the lectures.
29.	I attend actively off-class group studies, related to the lecture.
30.	I share my thoughts directly during group studies.
31.	I believe that group studies help me in learning by active questioning.
32.	I cannot perform during the test, even though I have studied beforehand.
33.	After the exam, I forget what I learnt.
34.	By focusing on my study I study efficiently.
35.	I have a regular and satisfactory sleep.
36.	I take care of my nutrition.
37.	I can find places to study on campus.
38.	I use ADP's study rooms.
39.	I use the study room in the library.
40.	I prefer studying at home or dormitory.
41.	I attend the courses regularly.
42.	I regularly attend labs and discussion/problem solving sessions of the course.
43.	I use the materials I learn in class to understand events in the world outside of the classroom.
44.	I use materials I learn in one class to better understand the material in a different class.
45.	As a college student I believe that I am the only person responsible for my education.
46.	Using computer affects my learning positively
47.	Computer games prevent me to obey my schedule.
48.	I make a study plan and I try to abide by it.
49.	I do not let my friends distribute my study plans.
50.	I try to find a balance between studying and social activities.

References

- Abbey, D. S., Hunt, D. E., & Weiser, J. C. (1985). Variations on a theme by Kolb: A new perspective for understanding counseling and supervision. *The Counseling Psychologist*, 13(3), 477-501.
- Altman, D. G. (1991). *Practical Statistics for Medical Research*, Chapman & Hall, London, pp.285-288.
- Askar, P. & Akkoyunlu, B. (1993). Kolb learning style inventory. *Education and Science*, 15(81), 37-47.
- Biggs, J. (1987). *Student approaches to learning and studying*. Hawthorn, Vic: Australian Council for Educational Research.
- Brown, W. & Holtzman, W. (1967). *Manual: Survey of study habits and attitudes*. New York: Psychological Corp.
- Demirbas, O. O. & Demirkan, H. (2007). Learning styles of design students and the relationship of academic performance and gender in design education. *Learning & Instruction*, 17(3), 345-359.
- Dunn, R., & Dunn, K. (1978). *Teaching students through their individual learning styles: A practical approach*. Reston, VA: Reston Publishing.
- Felder, R. M. & Silverman, L. K. (1988). Learning and teaching styles in engineering education. *Engineering Education*, 78: 674-681.
- Fieller, E. C., Hartley, H. O., & Pearson, E. S. (1957). Tests for rank correlation coefficients: I. *Biometrika*, 44(3-4), 470-481.
- Gardner, H. (1993). *Frames of mind: The theory of multiple intelligences*. New York: Basic Books.
- Goldfinch, J. & Hughes, M. (2007). Skills, learning styles and success of first-year undergraduates. *Active Learning in Higher Education* 8; 259-273.
- Gogus, A. & Gunes, H. (2011). Learning Styles and Effective Learning Habits of University Students: A Case from Turkey. *College Student Journal*, 45(3), 586-600.
- Gregorc, A. F. (1984). *Gregorc style delineator: Development, technical, and administration manual*. Gregorc Associates, Inc.
- Hall, J. C. (2001). Retention and Wastage in FE and HE, Scottish Council for Research in Education. Retrieved on May 27, 2006 from: <http://www.scrc.ac.uk/scot-research/wastage/wastage.pdf>
- Harvey, C. (1995). Increasing course completion rates. *Adults Learning*, 6(6), 178-179.
- Holley, J. H., & Jenkins, E. K. (1993). The relationship between student learning style and performance on various test question formats. *Journal of Education for Business*, 68, 301-308.
- Hunt, D. E. (1987). Beginning with ourselves in interpersonal relations. In D. E. Hunt (Ed.), *Beginning with ourselves*. Cambridge, MA: Brookline Press.
- Jung, C. G. (1970). *Analytical psychology, theory and practice, the Tavistock lectures*. New York: Vintage Books.
- Kolb, D. (1984). *Experiential Learning: Experience as the Source of Learning and Development*. Englewood Cliffs, New Jersey: Prentice Hall.
- Kolb, D. A. (1985). *Learning style inventory* (3th edition). Boston: McBer.
- Kolb, D. (1999). *The Kolb Learning Style Inventory*, Version 3. Boston: Hay Group.
- Kolb, D. A., Boyatzis, R. E., & Mainemelis, C. (2001). Experiential learning theory: Previous research and new directions. In R. Sternberg and L. Zhang (Eds.) *Perspectives on cognitive learning, and thinking styles*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Kolb, D. A. & Fry, R. (1975). Toward an applied theory of experiential learning. In C. Cooper (Ed.), *Theories of Group Process*, London: John Wiley.
- Kolb, A. Y. & Kolb, D. A. (2005). Learning styles and learning spaces: enhancing experiential learning in higher education. *Academy of Management Learning & Education*, 4(2), 193-212.
- Kullback, S. & Leibler, R. A. (1951). On information and sufficiency. *Annals of Mathematical Statistics*, 22(1), 79-86.
- Lawrence, G. (1993). *People Types and Tiger Stripes: A Practical Guide to Learning Styles*, 3rd edition. Gainesville, FL: Center for Applications of Psychological Type.
- Loo, R. (2004). Kolb's learning styles and learning preferences: Is there a linkage? *Educational Psychology*, 24(1), 99-108.
- Lowe, H. & Cook, A. (2003). Mind the gap: Are Students prepared for higher education? *Journal of Further and Higher Education* 27(1): 53-76.
- Mainemelis, C., Boyatzis, R., & Kolb, D. A. (2002). Learning styles and adaptive flexibility: Testing experiential learning theory. *Management Learning*, 33(1), 5-33.
- Marriott, N. & Marriott, P. (2003). Student learning style preferences and undergraduate academic performance at two UK universities. *International Journal of Management Education*, 3(1): 4-13.
- McCarthy, B. (1987). *The 4MAT system: Teaching to learning styles with right/left mode techniques*. Barrington, IL: EXCEL, Inc.
- Nielson, T. (2008). Implementation of learning styles at the teacher level. *Education & Training*, 50(2), 155-166.
- Proctor, B. E., Prevatt, F., Adams, K., Reaser, A., & Petscher, Y. (2006). Study skills profiles of normal-achieving and academically struggling college students. *The Journal of College Student Development*, 47, 37-51.
- Sadler-Smith, E. (1996). Learning styles: a holistic approach. *Journal of European Industrial Training*, 20, 29-36.
- Salter, D. W., Evans, N. J. & Forney, D. S. (2006). A longitudinal study of learning style preferences on the Myers-Briggs Type Indicator and Learning Style Inventory. *Journal of College Student Development*, 47(2), 173-184.
- Sangster, A. (1996). Objective tests, learning to learn and learning styles. *Accounting Education* 5(1): 131-46.
- Schellens, T. & Valcke, M. (2000). Re-engineering conventional university education: Implications for students' learning styles. *Distance Education*, 21(2), 361-384.
- Schmeck, R. R., Geisler-Brenstein, E., & Cercy, S. P. (1991). Self-concept and learning: The revised inventory of learning processes. *Educational Psychology*, 11: 343-362.
- Smith, D. & Kolb, D. A. (1986). *User's Guide for the Learning Style Inventory*. Boston: McBer and Co.
- Spearman, C. (1904). The proof and measurement of association between two things. *The American Journal of Psychology*, 15, 72-101.
- Sternberg, R. J. (1997). *Thinking styles*. New York: Cambridge University Press.
- Tagg, J. (2007). Double-loop learning in higher education. *Change Magazine* (39)4, 36-41.

- Vermunt, J. D. H. M. (1992). Learning styles and regulation of learning in higher education – toward process-oriented instruction in autonomous thinking, Amsterdam/Lisse, Swets & Zeitlinger.
- Vincent, A. & Ross, D. (2001). Learning style awareness. *Journal of Research on Computing in Education*, 33, 1-10.
- Weinstein, C. E., & Palmer, D. R. (2002). *Learning and study strategies inventory*. User's Manual (2nd ed.).
- Yorke, M. (2004). Employability in Higher Education: What It Is – What It's Not. *Learning and Employability*. York, Learning and Teaching Support Network Generic Centre and ESECT.
- Zull, J. E. (2002). *The art of changing the brain: Enriching teaching by exploring the biology of learning*. Sterling, VA: Stylus.