

Learning Styles Hypothesis, Knowledge Co-construction, and Epistemic Games in Education

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Abstract

This paper is a descriptive exploration of the prescriptive aspect of the learning style hypothesis which posits the need to understand the learning styles of students in order to match these with the appropriate approaches to learning. Accordingly, this paper investigated the learning styles of senior high school students using the Honey-Mumford Learning Style Questionnaire (LSQ). The findings showed that all of the different learning styles measured by the LSQ were preferred by students with greater preferences leaning towards the activist and pragmatist styles. This trend did not significantly differ according to the school, sex, or age of the respondent. Just knowing the preferred learning styles of the students would be of no value in itself unless seen in terms of its implication to teaching or instruction. In which case, this paper took the stance that learning is a process of knowledge co-construction. Knowledge co-construction can have the potential to impact student learning in real terms by way of epistemic games that offer the opportunity for students to leverage the advantage of their learning styles and experiences.

Key words: Learning styles, learning styles hypothesis, knowledge co-construction, epistemic tasks

1. Introduction

The past two decades have witnessed the growing attention given to learning styles which have gained influence and wide acceptance among educators, scholars, parents, and the general public (Cuevas, 2015). The concept of learning styles posits the different ways in which people process information and hence can learn more effectively when the instruction received conforms to their preferences (Pashler et al., 2009).

It is believed that the first IQ test developed in 1904 by French psychologist Alfred Binet spurred an interest in learning styles. Following this development was the development of the hands-on approach to learning pioneered in 1907 by Dr. Maria Montessori. A milestone came about in 1956 with the development of Bloom's taxonomy of learning which did not only find its relevance in formal education but in other modalities of learning outside the classroom setting as well. In 1962 the mother and daughter team of Isabel Myers-Briggs and Katherine Briggs came up with the Myers-Briggs Type Indicator (MBTI) which sought to determine preferences for types of learning that are psychologically based. This was later followed in 1976 by the Dunn and Dunn Learning Style Model which highlighted the significance of diagnostic testing for evaluation purposes. Another milestone came in 1983 when Howard Gardner introduced the theory of multiple intelligences which broke down human learning into distinct areas such as logical-mathematical, linguistic, spatial, musical, kinesthetic, interpersonal, and intrapersonal intelligences. In 1984, the experience-based learning model was introduced by Dr. Kolb's which among others highlighted the significance of learning styles as a determinant of teaching styles. In 1995, the ASK (attitude, skills, and knowledge) types of learning were introduced by Mark Tennant which gained popularity among for-profit organizations. In 2003, L. Dee Fink expanded and extended Bloom's taxonomy to accommodate new learning types. In the same year 2003, a study by the Institute of Education at the University of London concluded that students learn through their preferred learning styles in conjunction with other learning styles (Workman, 2012).

Based on these developments, Cassidy (2004) cited that learning styles research has been active for the past four decades. Between the years 1906 to 2000, Farid and Abbasi (2014) cited that the interest in measuring learning styles had resulted in the development of different instruments. Coffield et al.,(2004) identified thirteen (13) of the widely used instruments in the literature and Cassidy (2004) further identified 27 different typologies of learning styles based on the same number of models that portray or account for learning styles. As a result of these studies, multiple definitions of learning styles have been generated that overlap with other related concepts such as cognitive learning and individual learning strategies (Farid & Abbasi, 2014). It has been noted though that the underlying theme in these definitions is that learning styles encompass the way by which individuals acquire, process, internalize, recall, and retain information to generate knowledge (Kiblasen, et al.,2016).

Pashler et al. (2009, p. 106) argued that the existence of preferences says nothing about what these preferences might mean or imply for anything else, much less whether it is sensible for educators to take account of these preferences. Because of this limitation, studies later focused on situating learning styles in the context of instruction. This is based on the learning style hypothesis that "learning will be ineffective, or at least less efficient than it could be if learners receive instruction that does not take account of their learning style, or conversely, it is the claim that individualizing instruction to the learner's style can allow people to achieve a better learning outcome" (Pashler et al., 2006,p.108). Building on this hypothesis were studied relating learning styles with mental abilities (Jensen, 1998; Massa and Mayer, 2006) but evidence on such relations is open to challenge. Studies on style by treatment interaction were also done (Bostrom, et al., 1990; Sternberg, et al., 1999) but presented little evidence to that effect. Other studies using more appropriate methods yielded both negative (Massa & Mayers, 2006; (Cook, et al., 2009; Constantinidou & Baker, 2002) as well as positive results (Cronbach & Snow, 1977; Callendar & McDaniel, 2007). Pashler et al.(2009) attempted to lay the learning styles debate to rest by citing that the key test of the learning style hypothesis lies in interaction and the abilities and attributes of individuals that can relate to learning styles (Pashler et al., 2009).

Interaction situates the process of learning within a social setting and calls to the fore the significance of social constructionism in learning. In the spectrum of knowledge, one end positions knowledge as static and distributed among experts by discipline. These are later revealed and then organized within conversations among the different disciplines to produce shared knowledge. On the other end of the spectrum, knowledge is positioned as dynamic and emergent within the conversation allowing knowledge to be repackaged and transformed producing co-constructed knowledge (Stahl, 2010). Furthermore, it is through social interactions that individuals align their existing knowledge to create new meaning and understanding. This implies that knowledge co-construction is an active learning process (Damsa, 2013)

Early underpinnings of knowledge co-construction as learning can be seen in Stahl's (2003) conceptualization of social knowledge building. He saw knowledge co-construction as a learning process and that knowledge is actively constructed and re-constructed by the learner. He used the concept of internalization to explain how the message is received personally and then reconstructed by the learner to form culturally developed artifacts. This happens as a result of successive transformation due to collaborations and interactions within a group (Stahl, 2010). This implies that individuals come in contact with meaning as a result of participation in joint activities. These formed cognitive intellectual artifacts and ideas are externalized as individual meanings into the observable world by means of language and represent a form of co-constructed knowledge (Stahl, 2003).

Building on Stahl's (2010) conceptualization, Damsa (2013) agreed that knowledge is a social construct that centers on the processes of learning. Towards this end, Damsa (2013:10) assumed that learning is a process of co-construction of knowledge at the microgenic level which is constructed actively through social interactions mediated by language, objects, or artifacts. This process is accordingly situated historically, culturally and physically. The works of Zenios (2009) bears parallelism to the foregoing concepts. Accordingly, her assumption is that knowledge construction is the product of collaboration among people who work together, participate in the discussion, and agree on solutions to shared issues or problems (Zenios, 2011). Zenios (2009) invoked the concepts of epistemic fluency (Collins & Ferguson,(1993); epistemic games or activities (Ohlsson 1995); and conceptual artifacts (Bereiter 2002). Accordingly, epistemic fluency is the ability to engage in epistemic games or activities that is developed through interaction with others. This moves individuals from the realm of normative knowledge to constructing and co-constructing knowledge with others by engaging in epistemic games and activities. Epistemic games and activities are moves and strategies that guide knowledge construction. Participation in epistemic games is comparable to collaborative engagements within a given setting.

Based on the foregoing premises, this paper explored the learning styles of senior high school students to lay the backdrop for proposing an approach to knowledge co-construction in tertiary education. The choice of senior high school students as the participants of the study was based on the fact that they would be the in-coming entrants to tertiary education. Hence a knowledge of their learning styles would be essential in designing instructional programs that would suit their learning preferences.

2. Method

This study used the quantitative method to explore the learning styles of the participants and employed the survey to generate the research data. The quantitative findings served as the background for looking at the learning styles hypothesis using the lens of social constructionism.

3.1. Participants

The participants involved 551 senior students who were recruited using convenience sampling from two public schools and two private schools in Abu Dhabi. Of the total participants, 67% were from the public schools and 23% from the private schools. Seventy-nine percent (79%) of the participants are females and 21% are males. In terms of age, 54% were 18 years old and below and 46% were 19 years old and above.

3.2. Procedures

Due to the limitations of time and availability of the students, the 40-points Honey-Mumford Learning Style Questionnaire was used. The Honey-Mumford LSQ was particularly chosen as the main instrument because it is a reliable instrument used in measuring preferred learning styles (Lujan & DiCarlo, 2006; Zeynep & Nacar, 2007). The Honey-Mumford Learning Styles Questionnaire identifies four distinct learning styles or preferences: Activist, Theorist; Pragmatist and Reflector These styles are believed to be naturally preferred by individuals which will help them seek out opportunities to learn using that style. The answered questionnaires were processed using the scoring protocols of the instrument after which the results were descriptively and inferentially analyzed.

3. Results and Discussion

An essential assumption of the learning style hypothesis is the essential understanding of the preferred learning styles of students so that these can be matched with the appropriate teaching strategies and instructional approaches. This was the rationale of the survey done in this study.

3.1. Learning style preferences according to school

The research instrument used measured the learning style preferences of the students and classified them either as Activists, Reflectors, Theorists, or Pragmatists. Table 1 shows that 35% of the students from the public schools preferred the activist style and 33% preferred the pragmatist style. The reflector style was preferred by 16% of the respondents and another 16% preferred the theorist style. In the private schools, 33% of the students preferred the pragmatist style and 27% preferred the activist style. The theorist style was preferred by 21% of the respondents while 18% preferred the reflector style.

Table 1. Learning Style Preferences of the Students

	Public		Private		Total
	f	%	F	%	
Activists	130	35.2	49	26.9	179
Reflectors	58	15.7	33	18.1	91
Theorist	60	16.3	39	21.4	99
Pragmatist	121	32.8	61	33.5	182
Total	369		182		551

The trend in the learning style preferences of the students from the public and private schools is visualized in Figure 1.

Figure 1 . Preferred Learning Styles of Students from the Public and Private Schools

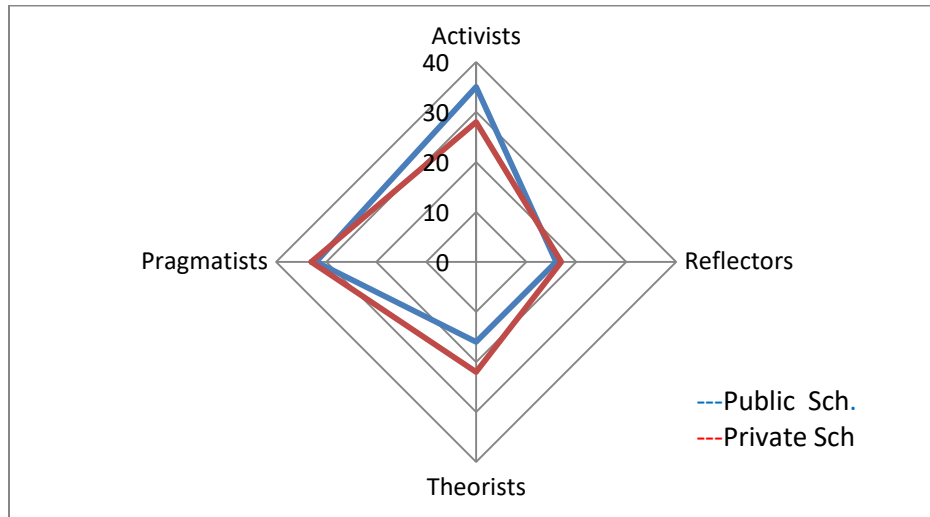


Figure 1 shows that there is a trend in the data showing a greater preference for the activist and the pragmatist styles among the students. This indicates that students in both the public and private schools preferred action over reflection and doing over thinking while others show the reverse preferences.

Table 2. Difference in the Preferred Learning Styles of the Students According to School

Learning Styles	Mean Difference	t-test		
		df	t	Sig. (2-tailed)
Activist	.13363	549	.226	.822
Reflectors	.20270	549	.346	.731
Theorists	.28378	549	.471	.639
Pragmatists	.41141	549	.631	.531

The results of the t-test shown in Table 2 revealed that the respondents from both public and private schools did not significantly differ relative to their preference for the activist, $t=.226, p=.822 > p=.05$; reflector, $t=.346, p=.731 > p=.05$; theorist, $t=.471, p=.639 > p=.05$; and pragmatists, $t=.631, p=.531 > p=.05$ styles of learning. This indicates that the learning style preferences of the students were significantly similar regardless of the school which they attended.

3.2. Learning style preferences according to sex

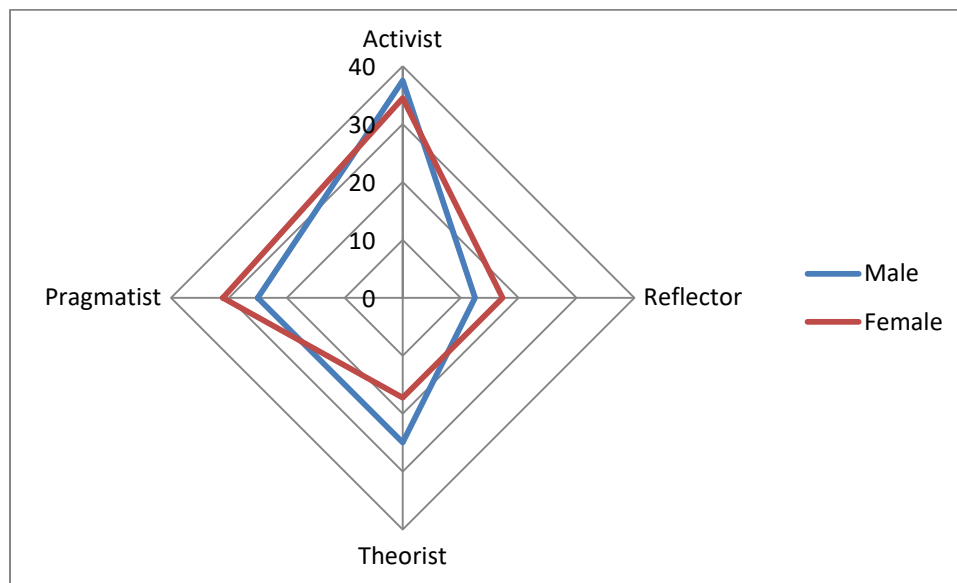
Table 3 shows the preferred learning styles of male and female students from both the public and private high schools. The data shows that 36% of the male respondents preferred the activist style compared to those who preferred the pragmatist (26%), theorist (28%) and reflector (10%) styles. Among the females, there were more who preferred the activist (32%) and pragmatist (31) styles compared to those who preferred the theorist (21) and reflector (16%) styles. It is evident from the data that the activist and pragmatist learning styles were the predominant preferences among the respondents.

Table 3. Preferred Learning Styles of Male and Female Students

	Males		Females		Total
	f	%	f	%	
Activists	41	36.3	140	32	181
Reflectors	11	9.73	91	20.8	102
Theorist	32	28.3	69	15.8	101
Pragmatist	29	25.7	138	31.5	167
Total	113		438		551

The data was segregated to show the trend in the learning styles of male and female students from the different high schools. Figure 2 shows the preferred learning styles of male and female students from the public high schools.

Figure 2. Preferred Learning Styles of Males and Female Students in the Public Schools



Accordingly, 37.5% of the males from the public high schools preferred the activist style. The theorist and the pragmatist styles were each preferred by 25% of the males, respectively and 12.5% preferred the reflector style. Among the female students, more of them preferred the activist style (34.48%) than those who preferred the pragmatist (30%), reflector (17.24) and the theorist (17.24%) styles. This indicates a greater preference for doing things among males and females in the public high schools.

Table 4. Difference in the Preferred Learning Styles of Male and Female Students in the Public High Schools

Learning Styles	Mean Difference	t-test		
		df	t	Sig. (2-tailed)
Activists	.39655	371	.485	.631
Reflectors	.37931	371	.495	.624
Theorists	.8405	371	1.061	.296
Pragmatists	1.03448	371	1.247	.221

The results of the t-test based on the data in Figure 2 revealed that male and female students from the public high schools did not significantly differ relative to their preference for the activist, $t=.485, p=.631 >p=.05$; reflector, $t=.495, p=.624 >p=.05$; theorist, $t=1.061, p=.296 >p=.05$; and pragmatists, $t=1.247, p=.221 >p=.05$ styles of learning.

Figure 3. Preferred Learning Styles of Males and Females Students in the Private Schools

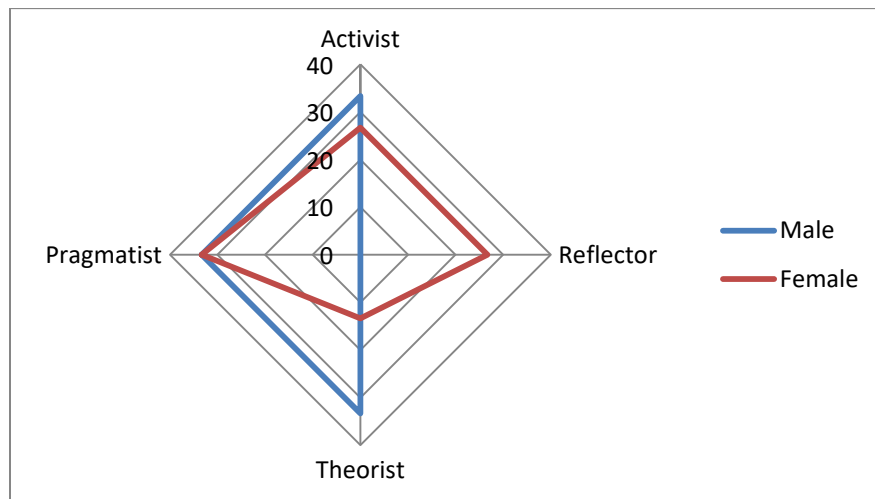


Figure 3 shows the general trend in the learning style preferences of male and female students from the private high schools. Accordingly, 33.33% of the males each had the same preference for the activist, theorist, and pragmatists styles, respectively. None of the males from the private high schools preferred the theorist style. Among the females, 33.33% preferred the pragmatist style compared to those who preferred the activist (26.67%), reflector (26.67%), and theorist (13.33%) styles. The trend indicates that more of the males in the private schools are thinkers while more of the females are doers.

Table 5. Preferred Learning Styles of Male and Female Respondents in the Private Schools

Learning Styles	Mean Difference	df	t-test	
			t	Sig. (2-tailed)
Activist	1.13333	176	.835	.416
Reflectors	1.40000	176	.957	.353
Theorists	1.4000	176	.957	.353
Pragmatists	.66667	176	.395	.698

The corresponding t-test done revealed that the male and female students in the private schools did not significantly differ relative to their preference for the activist, $t=.835, p=.416 >p=.05$; reflector, $t=.957, p=.353 >p=.05$; theorist, $t=.957, p=.353 >p=.05$; and pragmatists, $t=.395, p=.698 >p=.05$ styles of learning. This indicates that regardless of sex, the trend in the learning style preferences of the students in the private schools did not vary significantly hence the learning style preferences of the student were independent of their sex.

3.3. Learning style preferences according to age

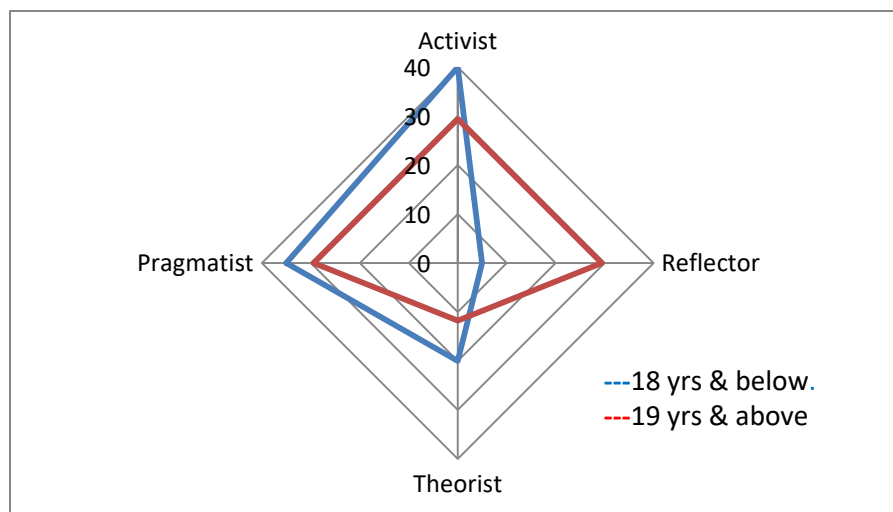
Table 6 shows the preferred learning styles of the respondents in the study sample according to age group. Generally, all of the learning styles were preferred by the students. Among the 18 years old and below students, 26% preferred the activist and pragmatist (34%) learning styles compared to those who preferred the theorist (16%) and reflector (23%) styles. Among the students who were 19 years old and above, there were more who preferred the activist (43%) and pragmatist (30%) styles compared to those who preferred the theorist (18%) and the reflector (9) learning style. The findings indicated that the activist and pragmatist learning styles were the predominant preferences of the respondents.

Table 6. Preferred Learning Styles According to Age

	18 & below		19 & above		Total
	f	%	f	%	
Activists	78	26.4	109	42.6	187
Reflectors	68	23.1	22	8.59	90
Theorist	48	16.3	47	18.4	95
Pragmatist	101	34.2	78	30.5	179
Total	295		256		551

The data was segregated to show the trend in the learning styles of students of both age groups according to school. Figure 4 shows the trend in the preferred learning styles of students of both age groups from the public schools.

Figure 4. Learning Styles of Students in the Public Schools According to Age Group



It can be gleaned that 40% of those who were 18 years old and below preferred the activist (40%) style compare to those who preferred the pragmatist (35%), theorist (35%), and reflector (5%) styles. Among the respondents aged 19 years old and above, 29.41% preferred the activist, pragmatist, and reflector learning styles, respectively. Only 5% of those in this age group preferred the reflector learning style.

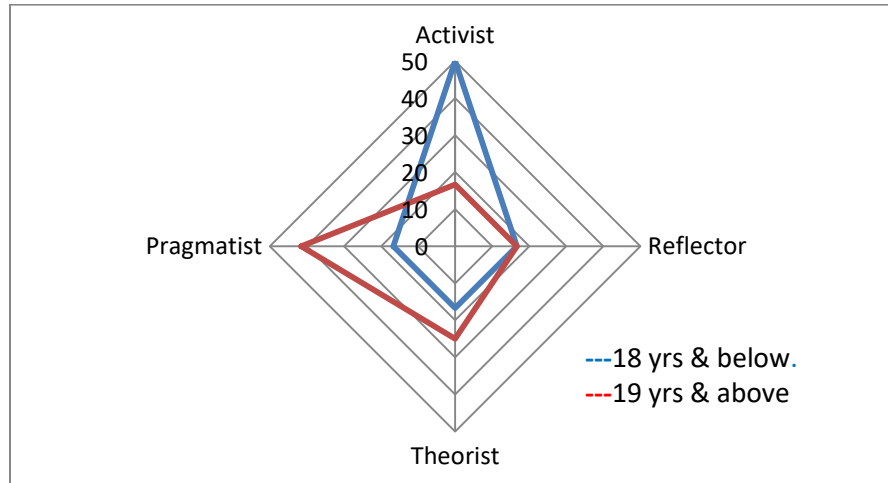
Table 7. Difference in the Preferred Learning Styles of in the Public High Schools According to Age

Learning Styles	Mean Difference	df	t-test	
			t	Sig(2-tailed)
Activist	.41176	293	.611	.545
Reflectors	.97353	293	1.587	.121
Theorists	.6176	293	.940	.354
Pragmatists	.30294	293	.434	.667

The corresponding t-test done revealed that the learning style preferences of the respondents from AMMS did not significantly differ according to age relative to their preference for the activist, $t=.611, p=.545 > p=.05$; reflector, $t=1.587, p=.121 > p=.05$; theorist, $t=.940, p=.354 > p=.05$; and pragmatists, $t=.434, p=.667 > p=.05$ styles of learning.

Figure 7 shows the trend in the preferred learning styles of students of both age groups from the private schools. Accordingly, 50% of the respondents who were 18 years old and below preferred the activist (40%) learning styles and the rest had each equal preference (16.67%) for the pragmatist, theorist, and reflector learning styles. More of respondents 19 years old and above preferred the pragmatist style (41.6%) compared to those who preferred the theorist (25%), reflector (16.67%) and activist (16.67%) learning styles, respectively.

Figure 1. Learning Styles of Students from Private Schools According to Age Group



The data shows that more of the students from the private schools who were 18 years old and below preferred the activist style compared to those who were 19 years old and above were more of them preferred the pragmatist style. The data further shows that there was a lesser number of respondents from both age groups who preferred the reflector and theorist styles. The finding generally indicates the tendency of both age groups to prefer doing over thinking.

Table 8. Difference in the Preferred Learning Styles of Students in the Private High Schools According to Age

Learning Styles	Mean Difference	df	t-test	
			t	Sig(2-tailed)
Activist	1.08333	256	1.020	.323
Reflectors	.25000	256	.211	.836
Theorists	.75000	256	.639	.532
Pragmatists	.83333	256	.629	.538

Accordingly, the t-test revealed that that the learning style preferences of the respondents from the private schools did not significantly differ according to age relative to their preference for the activist, $t=1.020, p=.323 >p=.05$; reflector, $t=.211, p=.836 >p=.05$; theorist, $t=.639, p=.532 >p=.05$; and pragmatists, $t=.929, p=.538 >p=.05$ styles of learning.

Discussion

The findings of this study indicated that the students investigated generally had different learning style preferences. Whereas other studies on learning styles showed mixed results (Pahler, 2009; Mohammadi, et al., 2015; Amini, et al., 2010; Urval, et al., 2014; Lujan & DiCarlo, 2006; Zeynep & Nacar, 2007; Javadinia et al.,2011), the variations observed according to school, sex, and age of the participants in the descriptive data in this investigation were found not to be statistically significant. According to the learning style hypothesis, learning can be further enhanced if the learning styles of the respondents are matched with the appropriate instructional strategies. The participants in the investigation were senior students and the findings on their learning styles can serve as a staging point in designing appropriate learning experiences that would appeal to the learning styles of incoming college students. This situation warrants looking into knowledge co-construction as an attractive alternative in instructional delivery in higher education.

In building on the conceptualization of Stahl (2010), Damsa (2013) posited that knowledge is a social construct that centers on the processes of learning and advanced the assumptions that “individual development originates in social sources, whether cultural or historical; human action, on both social and individual planes, is mediated by tools or signs; and the process spans over time and space (Damsa, 2013:9). Based on these assumptions, learning was re-conceptualized as a process of knowledge co-construction.

According to Damsa (2013), knowledge as co-construction can occur at three levels: sociogenetic, ontogenetic, and microgenetic. Accordingly, the sociogenetic level refers to organizational knowledge and the norms and values that govern social interaction. The ontogenetic level focuses on how the individual uses knowledge for lifelong development. Lastly, the microgenetic level focuses on the day to day interactions among individuals. It is at the microgenetic level that knowledge co-construction becomes observable through the interactions happening within the organization. Towards this end, Damsa (2013:10) assumed that learning is a process of co-construction of knowledge at the microgenetic level which is constructed actively through social interactions mediated by language, objects, or artifacts.

The works of Zenios (2009) bears parallelism to the foregoing concepts. Accordingly, her assumption is that knowledge construction is the product of collaboration among people who work together, participate in the discussion, and agree on solutions to shared issues or problems (Zenios, 2011). Zenios (2009) invoked the concepts of epistemic fluency (Collins & Ferguson,(1993); epistemic games or activities (Ohlsson 1995); and conceptual artifacts (Bereiter 2002). Accordingly, epistemic fluency is the ability to engage in epistemic games or activities that are developed through interaction with others. This moves individuals from the realm of normative knowledge to constructing and co-constructing knowledge with others by engaging in epistemic games and activities. Epistemic games and activities are moves and strategies that guide knowledge construction. Participation in epistemic games is comparable to collaborative engagements within a given setting. This leads to the production of conceptual artifacts.

Bereiter (in press) explained conceptual artifacts are those that assert something to be the case but are not limited to the subject matter because these can include interpretations, elaborations, criticisms, and proposals. Conceptual artifacts, therefore, can be seen as products of engagement in epistemic games or activities which are comparable to the externalization of knowledge. As such conceptual artifacts come parallel to knowledge objects as these can be generators of new conceptions (Damsa, 2013). More importantly, these are part of the core of things that makes possible further knowledge building (Bereiter, 2002). The work of Zenios (2010) suggested that individuals shared experiences, explored concepts and developed new forms of knowledge around key questions and problems when supported by different kinds of networked technologies that enable multiple and complementary ways of interaction.

Zenios (2009) synthesized central concepts such as epistemic fluency (Collins & Ferguson,(1993); epistemic games or activities (Ohlsson 1995); and conceptual artifacts (Bereiter 2002) and integrates these into a framework for knowledge co-construction. The epistemic tasks identified by Zenios (2010) include:

- Describing or fashioning a discourse referring to an object or event such that a person who partakes of that discourse acquires an accurate conception of that object or event.
- Explaining or fashioning a discourse referring to an event or pattern of events such that a person who partakes of that discourse understands why that event or pattern of events happened
- Predicting or fashioning a discourse such that a person who partakes of that discourse becomes convinced that such and such an event will happen
- Arguing or stating reasons for (or against) a particular position on some issue, thereby increasing (or decreasing) the recipient's confidence that the position is right
- Critiquing or fashioning a discourse such that a person who partakes of that discourse becomes aware of the good and bad points of that product
- Explicating or fashioning a discourse such that a person who partakes of that discourse acquires a clearer understanding of its meaning
- Defining or proposing a usage for a term.

Based on the quantitative findings of the study and the conceptual formulations on knowledge construction, learning can be more enhanced by engaging students in epistemic tasks. Different students have different learning styles hence the need for blended instruction. Instructional approaches that cater to the various learning styles should immerse students in epistemic games by engaging them to perform the epistemic tasks appropriate to their learning styles.

This paper demonstrated that different students had different learning preferences with the preference for doing predominating over thinking. Also, this paper presented that learning is a process of knowledge co-construction in a social setting. To cater to the various learning styles are different epistemic tasks that can lead to knowledge co-construction.

These can be leveraged by teachers in college to come up with blended approaches that integrate these epistemic tasks into the mainstream of daily instruction. On the whole, this paper demonstrated the assumption behind the learning style hypothesis that “learning will be ineffective, or at least less efficient than it could be if learners receive instruction that does not take account of their learning style, or conversely, it is the claim that individualizing instruction to the learner’s style can allow people to achieve a better learning outcome” (Pashler et al., 2006,p.108).

Conclusion

The learning style hypothesis can only be tested by experimental research that matches the hypothesis for interactional effects. This was not however, the intention of this investigation as this paper looked at the prescriptive value of the hypothesis as a means to look into workable instructional alternatives that would optimize learning. In which case, this paper looked at learning as a process of knowledge co-construction in a social setting. Knowledge co-construction, on the other hand, can be a suitable approach in the education of young adults who have their own unique preferred styles of learning supported by a variety of experiences. Engaging young adult learners in epistemic tasks can yet be another stepping stone in enhancing the learning of young adults as this would blend experience with the content of learning, therefore, giving a more interactive, realistic and meaningful outlook to knowledge. Knowledge co-construction can have the potential to impact student learning in real terms by way of epistemic games that offer the opportunity for students to leverage their learning styles.

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