A Match or Mismatch between Learning and Teaching Styles in Science Education

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Abstract

Mixed research method was used in this study to investigate and compare the learning styles of science students and the lecturer's teaching styles in Yemen. Quantitative data were collected from 179 students using a survey questionnaire while qualitative data were collected from 50 lecturers using observation checklist and videotaped classroom sessions. The quantitative data were coded and analyzed using descriptive statistics via SPSS software while observation and videotaped classroom sessions were used to triangulate the results. Research findings showed that the auditory and visual styles were more prevalent among the lecturers who adopted mainly lecturer-fronted, chalk-and-talk teaching approach while the students preferred kinesthetic and tactile learning styles which were supported by previous literature to be more suited for science classes. The result explicitly highlighted the implications of teaching science in tertiary institutions in Yemen.

Keywords: Learning styles, Teaching style, Science education, Science lecturers and students, Science teaching and learning.

1. Introduction

The Arab and Muslim scholars have played very important role in hastening the world scientific renaissance (Woods 2004). They translated the heritage of the Greek culture which gave to their exploitation of human cognition in different areas. The Arabs continued the effort of acquiring human knowledge until it expanded and achieved a remarkable zenith between 900-1200 A.D. During this period, Muslims made significant progress and exceptional achievements in different fields such as medicine, scientific agriculture, botany, mathematics, chemistry, and optics. Works of Muslim scholars such as Ibnul Haitham (on Optics) were translated and transported from Spain to the rest of Europe. According to Woods (2004:5), in the last millennium, the Muslims were the great torchbearers of international scientific research. Every student and professional from each country outside the Islamic Empire aspired, yearned, and dreamed to go to Islamic universities to learn, to work, to live and to lead a comfortable life in an affluent and most advanced and civilized society.

The Islamic scientific invention started to wane due to the slowing down of broader Islamic scientific study, which has been ascribed by many scholars to the "end of the Muslim mind" (Razak & Abdul Majeed 1998:7). It was noted that most universities and technical schools in the Arab world adopt an approach in which teachers is viewed as the core of the teaching and learning process (Badran 2003). However, there is little support for science education at all levels in the Arab world (Segal 1996 & Castillo 2004).

Mahyoub (1996) and Nour (2003) admitted that the teaching and learning of science in Yemen was unsatisfactory and lagged behind to meet the current standards of teaching and learning modern science. Angela Abu-Asba, Hazita Azman, Rosniah Mustaffa (2012) emphasized that the whole process was insufficient in leading progress and development in the country. The study added that students learn science in order to gain and acquire facts but apparently not for the purpose of applying scientific knowledge. Mahyoub (1996) claimed that Yemeni science students have little knowledge in learning and application science and found their ability to comprehend scientific knowledge as unsatisfactory. Mahyoub (1996) critiqued the overemphasis on teacher-centered approaches and educational activities, claiming that it neglected the development of critical thinking, problem-solving, capability of inquiry and investigative skills which are characteristics of most trained scientists. Lecturers knows that students learn in different ways in the classroom and this have been confirmed by everyday experience. Thus, students learn in many ways through seeing and hearing; reflecting and acting; reasoning logically and intuitively; memorizing and visualizing, according to Reid (1984) Korean, Chinese and Japanese students are all visual learners. They prefer to read and obtain a great deal of visual stimulation. Moreover, teaching methods also vary as some instructors lectures, others demonstrate or discusses; some of them focus on rules and others on examples, some emphasize memory and others understanding (Felder, 1995:21). Tabatabaei and Mashayekhi (2013: 245) stated that "the teacher should know that everyone has natural strengths and abilities to perform well in some specific fields.

Research on teaching and learning styles is under-researched in ESL, EFL and in science education Gilakjani (2012). According to Gilakjani (2012:54), one of the weaknesses of the research in LS is the lack of investigating matching of teaching and learning styles. Though there are many variables in the educational literature, limited research has dealt with the matching of teaching styles and learning styles. One of the primary aims of this study was to construct the matching between the students' learning styles and the instructors' teaching styles feasible in real-life classroom teaching in the Faculty of Science, Sana'a University, Yemen. Therefore, this study aimed to investigate the students' learning style and lecturers' teaching styles; and whether the lecturers' teaching style fits with the students' learning styles.

2. Literature review

Many authors have done research on teaching and learning styles such as Aguirre (2005) Zhang (2007), Quiamzade and Mugny (2009), Naimie, Siraj, Piaw, shagholi, and Abuzaid (2010), Dinçol, Temel, Oskay, Erdo, lmaz (2011), Hsieh , Jang , Hwang , Chen (2011), Gilakjani (2012); Dunn & Dunn, 1993; Felder, 1995; Felder, Felder, & Dietz, 2002; Gardner, 1983; Gringerenko & Sternberg, 1995; Honey & Mumford,1992; Kinsella, 1996; Kolb, 1984; Mattews, 1991; Murray-Harvey, 1994; Oxford & Ehrman, 1993; Oxford et al., 1992; Peacock, 2001; Rayner & Riding, 1997; Reid, 1995; Riding & Douglas, 1993; Sims & Sims, 1995; and, Zhenhui, 2001. There has been scanty research on learning and teaching styles in Yemen with regard to science domain; therefore, publications are limited.

Rita Dunn in 1960 firstly puts forward the concept of learning styles and Grasha in (1996) stated that learning style depicted student's personal ability to acquire information together with the learning experiences. According to Kolb

(1984), learning style means the ways a person prefers to acquire and process information. Some researchers believe that students' learning styles related to their teachers' teaching styles (Rahimi and Asadollahi, 2012).

Artvinli (2010) defined teaching styles as the leading factors that shape and assure the success of a highly complex teaching-learning process. Grasha (2002) defined teaching style as the continuous and consistent behaviors of lecturers in their interactions with students during the teaching-learning process. Kuchinskas (1979) pointed out in a study that the instructor's teaching style is one of the most important factors that influence the learning environment. Matching and mismatching between teaching and learning styles existed in an academic setting. A mismatch is occurred when students' preferred methods of processing information are not aligned with the lecturers' preferred styles of teaching (Naimie, Siraj, Piaw, shagholi, and Abuzaid (2010)). This can lead to poor performance because they may become bored and demoralized to students as reported by Felder (1988).

According to Hsieh, Jang, Hwang, Chen (2011), Zhang (2007), Felder (1995), and Reid (1987), mismatch existed between learning styles of students in a class and the teaching style of the instructor with the potential consequence. Arabic learners in general and Yemenis in particular come from a variety of family, social, and ethnic backgrounds, the Arabic students are growing up in a paternalistic society which is a factor that helps determine their behavioral characteristics. Arab World tends to be conservative hierarchical and family centered; the individual tends to be regarded as part of a class, rather than as a separate entity. Hence, the family is the basic building block of Middle East in general and Yemenis in particular.

As an outcome of the clash between the learning style and teaching style in the class; students tend to be tired and inattentive in class, do poorly on tests, get discouraged about the course, and may conclude that they are no good at the subject of the course and quit (Felder & Spurlin 2005). Whereas, instructors from the other side, confronted by low test grades, unresponsive or hostile classes, poor attendance, and dropouts, may become overly critical of their students or begin to interrogate their own competence as lecturers (Felder & Silverman, 1988; Oxford, 1991).

Felder (1993) cited Sheila Tobias (1993) who defined the existence of two *tiers* of entering college students comprising; 1) those pursuing science degrees and 2) those with the ability and potential to switch to nonscientific fields. Tobias identified that students manifests different learning styles. Students, whose learning styles matches with the teaching style of the lecturer/lecturer retain information longer and are able to apply it more effectively. These student have favorable perceptions and attitudes towards their courses than those who experience learning/teaching style mismatches. They concluded that if educational institutions give out to adapt and address matching of teaching and learning styles, adverse effects will be manifested in the performance and output of the students

2.1 Previous studies on teaching and learning styles

There are numerous studies on the match and mismatch between the learning and teaching styles in Europe, Asia and North America in the field of ESL, EFL and science domain (Gilakjani 2012) however; there are relatively few in the Arab world specifically in the science domain. Research on learning and teaching styles has provided lecturers and students with a different view of learning and teaching within the classrooms.

A number of authors proposed that mismatches often occur and have bad effects on students' learning and attitude in class and to English (e.g. Reid, 1987; Cortazzi, 1990; Felder, 1995; Jones, 1997; & Littlewood, Liu, & Yu, 1996). Felder elaborated that students become bored and may quit the class. Many have also claimed that matching teaching and learning style improves learning, attitudes, behavior, and motivation (Willing, 1988; Felder, 1995; Reid, 1987; 1995; & Kinsella, 1995).

Reid (1996) adds that matching teaching style with learning style gives all learners an equal chance in the classroom, and builds student self-awareness. On a method for overcoming the mismatch is a balanced teaching style (Felder 1995); meaning lecturers should try to accommodate all learning styles (Reid, 1987; Melton, 1990; Felder, 1995; Oxford, 1995; Kroonenberg, 1995). Willing (1988) asserted that lecturers should do this even if it conflicts with their idea of what is effective in the class. Ehrman (1996) suggested that gradually "build(ing) as an increased array of options" for class and homework, and Kinsella (1995) "a deliberate multisensory approach". Willing (1988) warns, though, that we must also respect lecturers1 styles, because adopting an unfamiliar style reduces effectiveness. The consensus is that when student and lecturer styles are better matched, students are likely to work harder both in and outside the classroom.

Felder and Silverman (1988) conducted a study indicating that there existed mismatches between the students' learning styles and the lecturers' teaching style in class. Their study which conducted in North Carolina State University among undergraduate engineering students found that learning styles of most engineering students and teaching styles of most engineering professors are incompatible in several dimensions. The findings released that most engineering students are

visual, sensing, inductive, and active, and some of the most creative students are global; most engineering education is auditory, abstract (intuitive), deductive, passive, and sequential.

Merrifield (1996) conducted a study to identify and develop insights into the characteristics of French cultural learning style by examining the language learning strategies that learners use to improve their progress. SILL (The Strategy Inventory for Language Learning) developed by Oxford (1991) was used. The Findings indicated that French learners were more visually-oriented than auditory, tactile or kinesthetic. The findings also depicted that culture potentially influences learners' preferences, learning styles of learners from different ethnic backgrounds.

Zhang in (2007) examined the issue of lecturer–student style match among 254 students from a university in Shanghai. Results indicated that although students preferred teaching styles that matched their career personality types precisely, they were also exposed to teaching styles that complemented their career personality types. The findings of the study by Zhang (2007) and Zhang's (2004b) and other existing findings regarding the impact of style match/mismatch upon teaching and learning, suggested that ''style match'' is not always ideal. Such a conclusive remark should have implications for both research and teaching.

Guadalupe, Castaneda, Juris (2007) explored the students' learning styles and the teachers' teaching styles and whether the teacher's teaching style fits with the students' learning styles. There were 32 students studying English their teacher. According to the findings, tactile, auditory, kinesthetic learning styles were observed, and there was a match between teaching and learning styles. On the other hand, the findings of the most representative teachers' teaching styles were the visual, then the tactile and kinesthetic, then the group and individual and the least representative was the auditory.

Another study by Naimie, Siraj, Piaw, shagholi, and Abuzaid (2010) explored the impact of teaching and learning style preferences and their match or mismatch on learners' achievement among 310 English Major Students and four lecturers from the Foreign Languages Faculty of Azad University, Iran. The results of the survey revealed that matching teaching and learning styles in EFL classes can help improve students' achievement.

Gündüz and Özcan (2010) conducted a study to examine the learning styles of Arabic, Turkish and Cypriot university students studying at Near East University in Nicosia, TRNC, enrolled in the Engineering and Educational Sciences Department. This study discusses the influence of culture, gender, native language and department on learning styles. The sampling of the research consisted of 450 students studying at NEU. 150 of the participants were Turkish, 150 of them were Cypriot, and 150 of them were Arabic. The sampling consisted of 300 male and 150 female students.

The findings indicated that Cypriot students learn more reflectively then Turkish and Arabic students in terms of active reflective learning style. Turkish and Arabic students tend to learn more actively. Also, in terms of sensitive and intuitive learning, Turkish students are seemed to learn more intuitively than Arabic and Cypriot students. Arabic and Cypriot students tend to learn more sensing. Moreover, in terms of visual and verbal learning, there is not a big difference among all students. They all learn verbally. Furthermore, in terms of sequential and global learning, although there is not a big difference among the students, Turkish students seem to learn more sequentially than Cypriot and Arabic students tending to learn more globally.

Dincol, Temel, Oskay, Erdogan, Yilmaz (2011) examined the matching between the learning styles of instructors and teacher candidates and between the teaching styles of instructors and learning styles of teacher candidates among 68 teachers and 3 instructors from Hacettepe University, Faculty of Education, Department of Science and Mathematics Education. The researchers applied Grasha-Riechmann Learning Style Scale. According to the findings, matching learning styles of instructors with that of teacher candidates and matching teaching styles of teachers with the learning styles of the teacher candidates has not significant effect on the success of the teacher candidates.

Gilakjani (2012) investigated the match and mismatch between learning styles of the learners and teaching styles of the teachers among 100 Iranian students of English majoring in translation at the Islamic Azad University of Lahijan, Iran. According to the results, it was shown that visual and auditory learning style preferences were preferred as major learning styles, and the kinesthetic learning mode preference was reported as minor.

The purpose of this study is to explore the Yemeni science students' learning styles, lecturers' teaching styles, and to find if there is a match or mismatch between learning and teaching styles among Yemeni undergraduate students and their lecturers.

3. Methods

3.1 Participants

The participants of this study were second and fourth Biology science students (179) and the lecturers (50) at the Faculty of Science, Sana'a University, Yemen. The major reason for choosing the sample from the University of

Sana'a is that, it is the main university in the Republic of Yemen which is situated in the capital city of the country. The second and fourth biology science group students comprised of 51 males and 128 females from the biology division. The biology science lecturers consisted of 29 males and 21 females with ages ranging between 24-60 years old.

3.2 Instrument

The four instruments used in this study comprise the questionnaire and the observation checklist. This questionnaire contains the background information of Biology science students' profile that indicated their age categories, and gender. This questionnaire was partially guided and adopted from Reid, 1995. The questionnaire contains of 30 statements cover Reid's six learning style preferences: visual, auditory group, kinesthetic, tactile and individual. Students were invited to indicate their preferences of learning style on a five–point scale such as SA – Strongly Agree (5), A – Agree (4), UND – Undecided (3), D – Disagree (2), SD – Strongly Disagree (1), μ– Mean and σ – Standard Deviation to obtain the percentage to answer the question what is/are the science students learning styles preferences. Data on teaching styles was collected using Peacock's (2001) modified version of the Perceptual Learning Style Preferences Questionnaire (PLSPQ) by Reid (1995) (Appendix B). It contains of 12 statements cover Reid's six learning style preferences: visual, auditory group, kinesthetic, tactile and individual. Lecturers were invited to indicate their preferences of learning style on a five–point scale such as always /often/sometimes/rarely /never, do μ–Mean and σ – Standard Deviation to obtain the percentage and o answer the question what is/are the preferred science lecturers' teaching styles?

A classroom observation checklist was used during the observation process and was designed to account for all the necessary and very much related aspects of the present study. There were thirteen main categories in the observation checklist. These categories comprise the integration of the science classroom, science class lesson, students' attitudes towards learning science, lecturers' attitudes towards teaching science and science lesson atmosphere. The observation checklist was prepared by the researcher based on the requirements of the questionnaire.

3.3 Data Collection Procedures

Data collection was done in a period of one month at the Faculty of Science, Sana'a University, Yemen. The Perceptual Learning Style Preference Questionnaire (PLSPQ) was filled by the students in 30 minutes. The modified version of PLSPQ was filled by the lecturers in 20 minutes. One of the researchers had observed the lecturers in the science students' classrooms and science students' labs using the observation checklist as a non-participant observer. In addition, probing questions were asked with the intention to explore in-depth experiences of the informant. As for the observation, one of the researchers observed the students and lecturers by employing the observation checklist in two Biology science labs and six Biology classrooms as a non-participant observer.

3.4 Data Analysis Procedures

The information obtained from the questionnaire were coded and analyzed using the SPSS program (version 16) to accomplish descriptive analysis such as means (μ), and standard deviation (σ). Data were also analyzed from the science students' classroom observation checklist. Details and points of the observation checklist that were marked as "satisfactory" or "outstanding" were analyzed and interpreted, coded and were presented in table. Field notes and videotaped were used to triangulate the research findings.

4. Results and Discussion

4.1 Learning styles:

This section presents the research results of the descriptive statistics. In order to discover the types of perceptual learning styles of Yemeni students and lecturers, the descriptive statistic (means and standard deviations) of the six distinct categories were computed. The general tendency of the distribution showed that of 179 students, the Kinesthetic learning style preference ranked first (M=4.3128), followed by Tactile learning (M=4.1508), group (M=3.9587), individual learning (M=3.6257), while the responses to auditory learning (M=2.7743) and visual learning (M=2.5765) had the lowest means scores (see Table 1).

Table 1: Student (n=179) learning style preferences

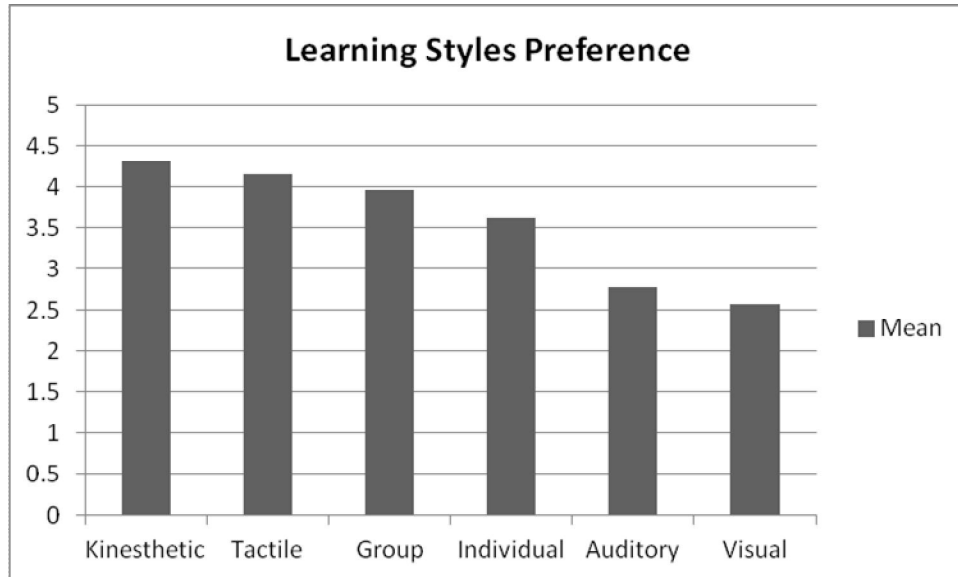| Rank	Learning styles	Mean	Std. Deviation
1	Kinesthetic	4.3128	.51538
2	Tactile	4.1508	.48787
3	Group	3.9587	.69821
4	Individual	3.6257	.78898
5	Auditory	2.7743	.91775
6	Visual	2.5765	1.09878

Figure 1: Students' learning style preference

4.2 Teaching styles:

The general tendency of the distribution showed that of 50 lecturers, the visual teaching style preference ranked first (M=4.0600), followed by auditory teaching (M=3.9100), group (M=2.8600), kinesthetic teaching (M=2.1700), while the responses to tactile teaching (M=2.1500) and individual teaching (M=2.0000) had the lowest means scores (See Table 2).

Table 1: Teacher (n=50) teaching style preferences

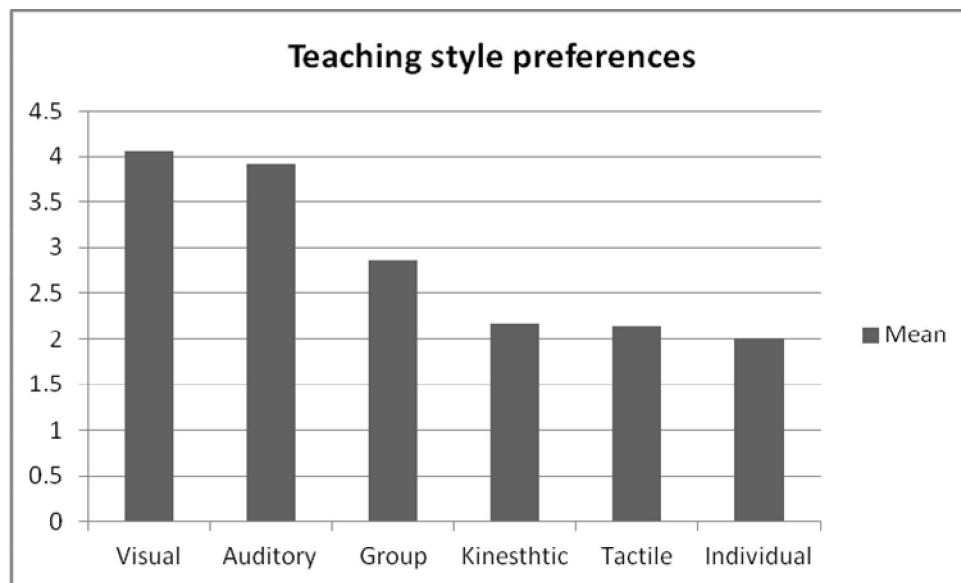| Rank	Teaching styles	Mean	Std. Deviation
1	Visual	4.0600	.68987
2	Auditory	3.9100	.84931
3	Group	2.8600	.77618
4	Kinesthetic	2.1700	.60280
5	Tactile	2.1500	.69437
6	Individual	2.0000	.76265

Figure 2: Lecturers' teaching style preference

The findings indicated that the learning styles most preferred by students were: the kinesthetic, tactile, and group learning styles; followed by the auditory and visual modes of learning. Students in this study expressed the least preference for the individual learning style. The findings also showed that the teaching styles most preferred by lecturers were: visual, auditory, and group teaching styles; followed by the kinesthetic teaching styles. Lecturers in this study showed the least preference for the tactile and individual teaching styles. There was therefore a mismatch between learning and teaching styles regarding kinesthetic, tactile, auditory and visual. There was a match between learning and teaching styles regarding group and individual.

The first mismatch between learning styles and teaching styles was "kinesthetic". This mismatch occurs when students favored kinesthetic style and disfavored by the lecturers. As a result, the higher level thinking and problem solving in lecturers' teaching is limited. Also, the range of skills that students are exposed to is limited to lecture methods such as to note down every word of the lecture to faithfully, then, need to reproduce it in the examinations. Consequently, all these are not adequate to fulfill the needs of science academic literacy skills and practices which require creative and critical types of thinking skills as well as the ability to read and interpret graphs, scientific visuals, tables, tactile and kinesthetic learning styles (role play, chanting, experiments and models, manipulative, and classroom activities (Dill 2009). There is a very little emphasis on the development of a full range of science abilities that makes use of and are taught in the first language (Arabic language).

Results revealed a mismatch between students' learning and lecturers' teaching styles regarding "tactile". The tactile learning style implies that the learners' use problem-solving activities, role-play, drama (working in small groups) and encouragement for active participation. This suggested that science students like and enjoy active participation, working with materials by hand, problem-solving activities, and role-play. When compared to the lecturers' responses it shows a negative reaction towards this teaching style. This preferred teaching style indicated the lowest positive inclination towards a tactile way of teaching. Based on the researcher's observation, it is showed that kinesthetic and tactile styles have been neglected in science teaching such as role-play and handling materials or taking notes. It is suggested that kinesthetic, tactile and group teaching styles are very important styles for science students because there are lots of opportunities for students in a group as they move around and manipulate materials to identify concepts and build physical relationships. Moreover, the tactile learning style is considered to be one of the best styles of learning science, apart from the "hands on" activity, the activities assist in the retention of facts, findings and concepts (Dill, 2009). Hence, to resolve lecturers-students' style conflicts is not an easy situation. However, from the literature review, the data have implied that culture has an influence on learning style as stated by Mertifield (1996:10). Science lecturers should consider culture-related style differences as they plan how to teach, and make a concerted effort to include

various learning styles in their daily lesson plans. Minimizing the perceived mismatch between lecturers' intentions and learners' interpretations will facilitate the chances of attaining the desired learning outcomes (Xiao, 2006).

Results revealed also a mismatch between students' learning and lecturers' teaching styles regarding "auditory". The auditory learning style is ranked as the fifth in the overall list of students' preferred learning style categories (Figure 1). Contrary to that, the auditory teaching style is ranked as the second in the overall list of lecturers' preferred teaching style categories (Figure 2). This is indicated that lecturers responded in Table 2 that they believe as by giving oral instructions because their learners will understand things better. Science lecturers like to give oral instructions and tell things verbally to their learners. On the other hand, the researchers observed that the lecturer did not change from one mode to another, where he could have created a participating and motivating environment. What is found is just an oral explanation, discussions, reading handouts and lastly the whiteboard merely. Based on the observation, the lecturer-centered approach of teaching is the prevalent in science classes. It implies that the lecturers are the autocratic figure, and rarely had discussions happened between lecturers and students. Scholars such as (Mahyoub, 1996; Badran, 2003) have confirmed that teachers of science were still using chalk- and-talk and considered this approach a good method of science learning and teaching.

Furthermore, visual learning style is disfavoured by students and favoured by lecturers. Which show a mismatch between students' learning and lecturers' teaching styles regarding "visual". The visual learning style is ranked sixth in the overall list of students' preferred learning style categories (Figure 1). When compared to the lecturers teaching style, visual teaching style is ranked first in the overall list of lecturers' preferred teaching style categories as can be seen in Figure 2. Based on the observation, teaching science at the Science Faculty depends more on the lecturers and neglect the role of the students in the classroom which lead to lack of the active learning and verbal interaction between the students and lecturers in the science classroom. However, the findings found a mismatch between the lecturers' preferred traditional approach in teaching (lecturer-centered and visual and auditory type of learning) and the students' preference towards other types of teaching and learning approaches at the faculty, such as inquiry learning, that requires kinesthetic and tactile style of learning (Dill, 2009).

Thus, this showed a mismatch towards the learning of science that requires more than just memorization and rote learning, but dwell in the realms of scientific inquiry learning and science learning standards. Consequently then, this mismatch results in the science students to be powerless recipients. From the findings students perceive what is given by the lecturer as perfect, although at times the information they receive from the lecturer is too trivial. Nevertheless, they are satisfied with it as since these students are not trained in searching and exploring information. This finding appears to be consistent with what Felder and Silverman (1988) have observed regarding the existence of mismatch between the students' learning styles and lecturers' teaching styles. Felder and Silverman (1988) noted that there is an exist mismatches between the learning styles of most students in a class and the teaching style of the lecturers, the students may become bored and inattentive in class.

On the other hand of the coin, there was a match between learning and teaching styles regarding group and individual. Results show a match between students' learning and lecturers' teaching styles regarding "group". Group learning style is ranked the third in the overall list of students' preferred learning style and lecturers' preferred teaching style categories (Figure 1). This is also reinforce from the classroom observation; where science students depicted that they found group learning style enjoyable, learned best, and got more work done when they worked with others. The phenomenon of enjoying working in groups can be explained by collectivism. Group learning style is part of Arab culture where Arab people practiced collectivism. 'Collectivism' versus 'Individualism' is one of the values conflicts that can be found among Arabs (Hill et al., 1998). In a society in which group cohesiveness is thought to be essential, as we have in Yemen, students are supposed to de-emphasize self and to be concerned about the group. This then is not a surprising result as the Yemeni students are taught to have socially acceptable behaviour without "acting out" or "speaking out", group success rather than individual performance, which is rewarded more in this society. These findings also related to the study done by Hofstede (1980), as he stated that Arab world is a collectivistic society as compared to western world that practiced individualistic culture. This is due to the Islamic values and norms which give emphasis on cooperation and unity among people.

Similarly, the results indicate that students' learning style match with lecturers' teaching styles regarding "individual". Many of the students indicated that they do not wish to study alone and there lecturers demonstrate a very negative response towards students learning individually. It depicted that the lecturers indicated that they believe that their students will understand better when they have their learners work alone in class and that their pupils will work better in class when they work alone. The findings revealed that the science lecturers do not prefer their students to work alone

for they learn better that way as aligned as to what Hofstede (1980) stated that Arab society is a collectivist society as opposed to being an individualistic society.

6. Conclusions

This study tends to investigate the students' learning style and the lecturers' teaching style and whether the lecturers' teaching style matches or mismatch with the students' learning styles. In reference to the students' learning styles, the findings revealed that the students preferred more tactile and kinesthetic learning styles; followed by group style, individual style, auditory style, visual style. Lecturers preferred the visual and auditory teaching styles, followed by group style, kinesthetic, tactile style, and individual teaching styles. The lecturers do not prefer the kinesthetic and tactile lecturers' style. Hence, the mismatch occurred because the kinesthetic and tactile learning styles between lecturers and students do not fit. Obviously, the findings revealed that lecturers did not include kinesthetic and tactile styles, higher level thinking, and problem solving in their teaching. Thus, the findings revealed that there is a difference between the learning style and teaching styles. This finding is consistent with the study done by Felder and Silverman (1988) who indicated that learning styles of most engineering students and teaching styles of most engineering professors are incompatible in several dimensions ; most engineering education is auditory, abstract (intuitive), deductive, passive, and sequential.

The findings of the study can be used as a beginning point for collaboration with both science instructors and syllabus designers at Sana'a University. Lecturers of the Faculty of Science should accommodate teaching to learning styles to improve the results of the students' learning and increase their motivation in their studies. The lecturers should have a balanced teaching style and adapt activities such as role-playing to cater to students' learning styles. It is helpful to design class tasks and activities in which students can utilize their different learning styles. This will definitely motivate almost all, if not all, students to participate in class and become engaged with the real learning.

This is hoped to improve the standard of teaching and learning of science, resulting in well-educated science graduates who will be able to make significant contributions to the development of Yemen's education. Finally, the researcher agrees with the Peacock's suggestion (2001) that the writers and selections of teaching science materials and syllabuses always remember the need to accommodate a variety of learning and teaching. She also agrees with willingness's suggestion (1988) that increased awareness of styles should be part of lecturer training, development, and assessment.

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