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Adaptation of Social Interaction Learning Styles by Freshman Engineering Students in Communication Courses

İletişim dersleri alan birinci sınıf mühendislik öğrencilerinin sosyal etkileşime dayalı öğrenme stillerindeki değişiklikler

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Özet

Bu çalışma, Birleşik Arap Emirlikleri'ndeki Petroleum Institute'te İletişim derslerinin, mühendislik öğrencilerinin sosyal etkileşime dayalı öğrenme stillerini kullanımları üzerindeki etkisini belirlemeyi amaçlamaktadır. Çalışmaya, 2012-2013 akademik yılında toplam 62 birinci sınıf öğrencisi katılmıştır. Kantitatif veriler, Grasha-Reichmann Öğrenci Öğrenme Stilleri Ölçeği *(Grasha-Reichmann Student Learning Style Scales*, GRSLSS) kullanılarak toplanmıştır. Ön ve son test sonuçlarını incelemek üzere eşleştirilmiş örnek t-testi ve Wilcoxon testi kullanılmıştır. Kalitatif verileri toplamak amacıyla, onayları alınan 10 katılımcıyla yarı yapılandırılmış görüşme gerçekleştirilmiştir. Sonuçlar, katılımcıların "işbirlikçi", "katılımcı" ve "sakıngan" stil puanlarının arttığını, "rekabetçi" ve "bağımlı" stil puanlarının ise azaldığını göstermiştir. Bu değişliklerin bazılarının öğrencilerin sürekli olarak ekip çalışmalarında bulunduklarından, bazılarının ise eğitim aldıkları ortamın çok kültürlü özelliğinden kaynaklanmış olabileceği değerlendirilmiştir. Mühendislerin ihtiyaç duydukları sosyal becerileri daha fazla edinebilmeleri için mühendislik öğrencilerinin, daha aktif öğrenme stillerini kullanmalarını sağlayan ekip çalışması etkinliklerine daha fazla yer verilmesi gerekliliği ileri sürülmektedir.

Anahtar sözcükler: Değişiklik, GRSLSS, mühendislik eğitimi, öğrenme stilleri.

Abstract

This study aimed to determine the effects of communication courses on engineering students' use of social interaction learning styles at the Petroleum Institute, the UAE. A total of 62 freshman students participated in the study during 2012-2013 academic year. The quantitative data were collected using the Grasha-Reichmann Student Learning Style Scales (GRSLSS). A paired sample t-test and the Wilcoxon test were used to investigate the pre-test and post-test results. Semi-structured interviews were also held with 10 of the consenting participants to gather qualitative data. The results indicated that the participants adapted some of their learning styles reflected by increased scores for "collaborative", "participant" and "avoidant" styles and by decreased scores for "competitive" and "dependent" styles. Some of these changes were attributed to the participants' engagement in constant teamwork as well as multi-cultural aspects of the learning context. It is suggested that engineering students be exposed to more teamwork activities, which involve more active learning styles in order to be better equipped with soft-skills that engineers require.

Key words: Adaption, GRSLSS, engineering education, learning styles.

Due to the ever-changing nature of technology, it is no longer argued whether or not engineers need to brush up on their skills and/or take up new ones as they practice in the field. Engineering departments at universities, therefore, have felt obliged to make adjustments to their curriculum to meet the needs of societies for engineers with up-to-date technical knowledge. However, it is accepted that technical knowledge per se is not sufficient to be successful engineers. They will also need to acquire soft/professional skills, which include an ethical orientation and certain communication skills.

The engineering criteria established by the Accreditation Board for Engineering and Technology (ABET) underline the

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importance of these soft skills in the standards adopted in 2000 and adjusted in 2011. According to the 3rd criterion, the soft skills engineering programs need to make sure that their graduates display include (a) an ability to function on multi-disciplinary teams, (b) an ability to communicate effectively, (c) an understanding of professional and ethical responsibility, and (d) an understanding of the impact of engineering solutions in a global, economic, environmental and societal context.

Communication Courses at the Petroleum Institute, Abu Dhabi

The skills listed above underline the need for communication and problem solving skills that are intrinsic to teamwork. There are certain engineering universities that appear to have communication departments. The Petroleum Institute (PI) in Abu Dhabi, the UAE is one of these universities. Founded in 2001, PI offers degrees in Chemical, Electrical, Mechanical and Petroleum Engineering at the undergraduate level. Within the Arts and Sciences Program, PI offers communication courses through the Communication Department. COM 101 and COM 151 offered by the department aim to contribute to the students' development of higher order thinking and communication skills. In these courses, students are required to work in teams and individually to do projects for which they gather data from various sources and analyze them. They also present their project work both in writing and orally. COM 151 also requires teams of students to make seminar presentations using a variety of media while paying careful attention to involving their audience. Seminar presentations include important aspects of communication, such as effective listening, small group communication, intrapersonal communication, interpersonal communication and intercultural communication. Students are also expected to hold regular team meetings with particular agenda items where they sharpen their communicative skills. The individual writing assignments, on the other hand, require them to evaluate content in relation to their life experiences. Overall, the curriculum of the Communication Department at PI encourages students to improve their communication competence as a soft skill they will need as engineers.

Learning Styles

Despite the expectations of engineers to be effective communicators, and therefore, the emphasized need for collaborative learning activities, some learners may not choose to go about learning in a way that would incorporate collaboration with others. This necessitates considering learning styles in planning training activities. However, defining the term "learning styles" may be essential since the way one defines the term will determine his plans of instructional activities.

It is not possible to give one single definition of learning styles. One's approach to learning will influence how he defines the term. In general terms, it can be said that learning styles are related to learner preferences throughout the learning process. Rita Dunn was among the pioneers who aimed to explain learning styles in the 1960's. According to her, learning styles refer to "variations among learners in using one or more senses to understand, organize, and retain experience" (Reid, 1987, p. 89). Keefe (1974, p. 4), on the other hand, defined the term as "cognitive, effective, and physiological traits that are relatively stable indicators of how learners perceive, interact with, and respond to the learning environment." The learning environment in this definition can embody various factors such as teachers, teaching tools and learners themselves.

Social Interaction Learning Styles

The interaction between these factors will determine the way and the amount of learning that takes place, and therefore, has become a focus of further attention for some researchers like Grasha (2006). Influenced by Carl Jung's personality types, Grasha developed a model of learning styles based on his classroom observations of his university students' interaction patterns with the teacher and other students. Grasha (2006) defined learning styles as "personal qualities that influence a student's ability to acquire information, to interact with peers and the teacher, and otherwise to participate in learning experiences" (p. 41).

He worked in collaboration with Sheryl Hruska-Reichmann and developed the Student Learning Style Scales (GRSLSS), which puts learning styles into the following six categories; competitive, collaborative, avoidant, participant, dependent and independent. Table 1 shows a brief description of the characteristics of each learning style.

Grasha (2006) warns that learners are not to be thought of as having only one of these learning styles. They can have characteristics of different styles though one or more of them may

Table 1. Characteristics of social interaction learning styles

Learning style	Characteristics
Competitive	Interested in being more successful than his peers, likes to get attention
Collaborative	Sharing with others, keen on helping peers in pairs and group work
Avoidant	Not participatory, interested in individual assignments, avoiding being called on
Participant	Participatory, taking up extra-curricular activities
Dependent	Expecting guidance from teachers
Independent	Confident, self-regulatory, independent learners that enjoy moving at own pace

be their dominant learning styles. He also suggests that learning styles can change through experience, and therefore, teachers should create opportunities for their learners to experience different styles which can raise their awareness of learning styles, allow them to make informed decisions about their most effective way of learning, and allow them to achieve more academic success.

Malleability of Learning Styles

The idea of a possible change in learning styles over time has raised interest among various researchers. Different learning style inventories have been used with this aim. Some researchers investigated "visual", "auditory", "kinesthetic" and "tactile" learning styles. For instance, in his study with learners of English as a second language (ESL), Reid (1987) found that more time spent in the United States seemed to make ESL learners more "auditory" and less "visual" and "kinesthetic", which led him to conclude that they modified and/or extended their learning styles in response to the new requirement of the academic environment in the new culture.

Some other researchers used Kolb's Learning Style Inventory (LSI). One such study was conducted by Kanske et al. (2003), who found that university students adapted their learning styles over the course of a-four-year-study. That is, senior students tended to be more "convergers" while graduate students appeared to become more "assimilators".

More recent studies used the GRSLSS to test whether or not instructional design had any effects on adaptability of learners' social interaction learning styles. To begin with, Kumar et al. (2004) implemented specific instructional activities in their course that aimed to increase learners' collaborative learning style. The results of their study showed that the participants scored higher in "collaborative" style after completing the course.

Meeuwsen et al. (2005) also incorporated team-based learning into their courses over four semesters to study the effects of this on their kinesiology students' learning styles. The results of the GRSLSS evaluation revealed that the students' scores decreased for "avoidant" and "dependent" styles while the scores increased for "participant" style. However, another study conducted by Borges and Parmelee (2011) showed that the learning styles of first year medical students changed after entering medical school as indicated by increased scores for "avoidant" and "dependent" and decreased scores for "collaborative", "participant" and "competitive" learning styles.

Similarly, Novak et al. (2006) found that their pharmacy students had higher scores of "avoidant" and lower scores of "participant" learning styles after the problem-based learning (PBL) experience they went through. Another study conducted in the Turkish context by Budakoglu et al. (2012) tested the effects of PBL on first year medical students' preferred learning style. The results of the GRSLSS testing revealed that there was a positive correlation between PBL and "collaborative" learning style.

The findings of the studies that used the GRSLSS as a data gathering instrument appear to support the assumption that learning styles can be subject to change. However, it is interesting to note that similar interventions seem to result in different changes in learning styles. To illustrate, from the above discussion, it appears that while team-based learning intervention made some learners more "participant" and "avoidant", it made participants in another study less "avoidant" and more "dependent". The same can be said for PBL intervention since one study found that learners became more "collaborative" while another one found decreased scores for "participant" learning style.

Such mixed results gave impetus to this current study, which aimed to determine whether or not the communication courses at PI affect the freshmen engineering students' social interaction learning styles. With this general goal in mind, this research aimed to answer the following questions:

- Do the students' social interaction learning styles change as a result of their learning experiences in the Communication courses?
- Related to this research question, it was hypnotized that the learners' experiences in the communication courses would encourage them to become more collaborative, participant, and independent and less avoidant, dependent and competitive.
- In cases of changes, what aspects of the courses offered by the Communication Department at PI do students feel contributed to these changes?

Method

The Respondents

In total, 75 students were administered the pre-test and 62 (82.7%) of these students took the post-test. 19 (31%) of the students who completed the second test were male and 43 (69%) were female. The age of the respondents ranged from 18 to 21, with a mean age of 20.

Interviews were held with 10 out of 22 consenting participants due to the time constraints of the students.

Data Collection and Analysis

The data were collected using the Student Learning Style Scales (GRSLSS) developed by Grasha and Reichmann, which ask respondents to reply to 60 statements on a Likert scale from one (strongly disagree) to five (strongly agree). Scores for each of the six learning styles were calculated according to the responses given.

The GRSLSS can be considered as the most accurate data-gathering instrument for this study for several reasons. As Diaz and Carntnal (1999) stated, the GRSLSS was purposefully designed to assess university students' preferences for learning. Also, its focus on different interaction patterns in classroom settings makes it strong in courses where students are expected to perform multiple roles. In addition, it provides impetus for designing courses that address student needs. The GRSLSS also accepts the fact that learners can possess different aspects of all six learning style, which avoids stereotyping of learners. On the other hand, when the Scale is looked at from the context of the Communication Department at PI, it appears to serve our needs since the communication courses at PI put a heavy emphasis on interaction patterns that require the learners to take part in a variety of team tasks throughout the course and to perform individual tasks. This nature of communication courses necessitates that the analysis of the students' learning styles be conducted with a social interaction outlook.

The first study carried out by Riechmann and Grasha (1974) to test the reliability of the earlier version of the GRSLSS showed that the reliability coefficients ranged between 0.76 and 0.83. Similarly, a recent study by Yang (2008) revealed that the internal consistency of the GRSLSS was 0.88. Taken together, these studies show that the GRSLSS is a reliable instrument. Zelazek's factor analysis (1986), on the other hand, showed that the GRSLSS had construct validity.

The GRSLSS test was administered twice during 2012-2013 academic year. The pre-test took place in the second week of COM 101 during the Fall semester, while the post-test was administered at the end of COM 151 during the Spring semester.

The data gathered were analyzed using a three-level scale developed by Grasha and Reichmann (2006). Table 2 shows the scale for each learning style.

The data were analyzed using the SPSS statistical software (version 18.0). A paired sample t-test and the Wilcoxon test were used to investigate any differences between pre-test and post-test results.

Table 2. GRSLSS scale

	Low	Average	High
Independent	1.0-2.7	2.8-3.8	3.9-5.0
Avoidant	1.0-1.8	1.9-3.1	3.2-5.0
Collaborative	1.0-2.7	2.8-3.4	3.5-5.0
Dependent	1.0-2.9	3.0-4.0	4.1-5.0
Competitive	1.0-1.7	1.8-2.8	2.9-5.0
Participant	1.0-3.0	3.1-4.1	4.2-5.0

A semi-structured interview technique was adopted to have more in-depth data related to the participants' perception of learning styles and preferred learning activities inside and outside the classroom. During the interviews, the participants were asked which particular in and outside classroom activities they preferred at different stages of the communication courses they took. The coding technique was adopted to analyze the qualitative data. For this purpose, after the interviews were transcribed, the data were coded according to the emerging themes, and an independent educator verified the accuracy of the codes. Mays and Pope (1995) said that when transcripts are assessed by additional researchers and the agreement between them is evaluated, the analysis of qualitative data is enhanced.

Results and Discussion

The results of the data gathered in response to the first research question can be seen in Table 3.

Table 3 indicates that at the beginning of the academic year the respondents' dominant learning styles were "collaborative" and "competitive" with the mean scores of 3.65 and 3.27 respectively, which fall into the "High" range according to the GRSLSS Scale presented in Table 2. It is important to note that all other learning styles had average scores, and none fell into the "Low" range. When the data collected at the end of the academic year were analyzed, the average scores for both the "collaborative" ($\bar{X}$=3.79) and the

Table 3. Comparison of social interaction learning styles scores of pretest and posttest

Learning styles	Pre-test N=62			Post-test N=62			t	p
	Min.-max.	Mean	SD	Min.- Max.	Mean	SD		
Independent	1.3-4.6	3.31	0.5748	1.9-4.8	3.57	0.6012	-2.817	0.005
Avoidant	1.6-3.9	2.74	0.4880	1.5-4	2.77	0.6008	-0.287	0.775
Collaborative	1.5-4.9	3.65	0.7473	1.5-4.9	3.79	0.6560	-1.310	0.190
Dependent	1.3-4.9	3.91	0.6262	1.3-5	3.72	0.8151	-0.873	0.382
Competitive	1.3-4.6	3.27	0.6676	1.3-4.7	2.90	0.7339	-2.882	0.004
Participant	1.2-4.8	3.63	0.6675	1.3-4.9	3.81	0.6431	-1.734	0.083

"competitive" ($\bar{X}$=2.90) learning styles remained in the "High" range. The comparison of the pre- and post-test results revealed that there was a slight increase in the mean score of the "collaborative" learning style (3.84%) although no statistically significant difference was detected between the two. This still may suggest that the learners had comparatively more incentive to collaborate with others after the communication courses. The increase in the score for this learning style was in accordance with the hypothesis of the research. Similarly, in their study of the effects of PBL on learning styles, Budakoglu et al. (2012) found that the "collaborative" learning style tended to get higher scores after exposure to PBL. Smart et al. (2004) also observed an increase in collaborative scores of their participants who were exposed to a purposefully developed instruction method.

A summary of data analysis in response to the second research question can be seen in Table 4.

Table 4. Contribution of the communication courses to the adaptation of learning styles

Contributing factors	N=10	f
Team-work	9	90
Multi-cultural atmosphere	3	30
Avoiding competition	7	70
Reading assignments	8	80
Classroom discussions	8	80
Independent learning tasks	2	20
Research project	10	100
Relating content to individual experiences	2	10
Increased English proficiency	3	30

As can be seen in Table 4, the analysis of the data showed that that the participants generally benefited from working with other team members and commented that it gave them a sense of interdependency and they, therefore, felt the urge to work harder. They thought working with others contributed to their learning. One learner said *"Some friends know things I do not know. So, if I work with them, I can learn more."*

Another participant noted that the multi-cultural nature of the cooperative work in communication courses increased his knowledge. He said *"Two of my team-members are not local. When I do assignments with them, they teach me new things and understandings."*

The communication courses at the Petroleum Institute (PI) require students to be involved in team-work activities. The seminars that the students participate in emphasize the need for collaborative work and aim to furnish them with the skills they need as team-members and future engineers who need to work in cooperation with others. This constant emphasis on collaboration is likely to have increased the participants' aptitude for collaborative learning style. One participant, in fact, stated that he was only able to see the rationale behind working with others in engineering projects after his involvement in communication courses, and therefore he was more willing to collaborate with his peers.

A significant finding of the current research was that the participants adopted less competitive learning style. This is reflected by 11.32% decrease in the mean score for the "competitive" learning style with a statistically significant difference between the pre-test and post-test results for this learning style (p=0.004). However, the SD value (0.7339) for this learning style might suggest that some learners had certain amount of preference for being avoidant. This is important to note since engineers are likely to get involved in competition against other engineers in order to create better engineering projects, which might make a case for the "competitive" learning style.

The abovementioned increase in the collaborative learning style may be further validated by the decrease in the competitive learning style, as hypothesized above.

The negative correlation between these two learning styles was apparent in the analysis of the data collected in the interviews, too. The participants appeared to perceive competition as a barrier to success, and even destructive to one's own development. As one participant stated,

"Initially, our team wanted to do better than the most capable team in class. To do this, we decided to include more subjects in collecting data for our study. However, we became so ambitious that we almost drowned in the amount of data we had to process."

This interviewee also added that their experience taught them that they could achieve better results by simply avoiding comparing themselves to others, which appears to provide evidence of decreased inclination for a competitive learning style. This quote shows that the team's initial response to the course expectations made them inclined to develop more competitive traits, which did not help in the end. Chan and Shui-fong (2008) also point out that when students are more accepting of others' better performance they are less likely to decrease their self-efficacy, which avoids limiting their success. The students in the communication courses in the Petroleum Institute (PI) evaluate their peers considering their (lack) contribution to the team-work, which may either increase or decrease their marks for certain tasks. The PI students in general appear to take a more positive approach to their friends' contribution, except for extreme cases. This may have encouraged the participants of this study to avoid making negative comparisons, but instead to focus on the positive aspects of team-work.

Another statistically significant difference was detected between the pre- and post-test scores for the "independent"

learning style, with an overall 7.86% increase (p=0.005). That is, the participants appeared to become more independent learners, which shows that the hypothesis of this research was further confirmed. The analysis of the data gathered in the interviews indicated that the course requirement regarding the students' contribution to classroom discussions with the help of pre-class reading assignments was a contributing factor. This appeared to be the case for a number of respondents, four of whom expressed the idea that the instructors' trust in their ability to identify a relevant text and share their understanding of it by relating to their own experiences helped them gain self-confidence and believe that they could manage learning on their own. As one participant stated:

"*Previously I had always been given what to read. This made things easy but not much fun. When my instructor on Communication 151 course first asked us to find a text on our seminar topic, I was scared because I did not know what I needed to do. But then the library sessions gave me some ideas, and gradually I learned to do it on my own.*"

The same respondent also remarked that his marks in the communication courses increased significantly after his engagement in independent learning activities. This finding is consistent with the observation that learners' perception of effective teaching qualities encourages them to take a deep approach to studying, and this makes learning more meaningful, and one of these qualities is providing learners with independent learning opportunities (Lizzio et al., 2002).

Another factor that seemed to contribute to the increase in the independent learning style was the research skills the learners were required to exhibit. They were required to work in small teams in order to identify a problem situation, formulate research questions and collect data to help them offer solutions to the identified problem. Though all the respondents stated that they were challenged to a great extent at the beginning of the 101 course, they developed certain skills that helped them become self-reliant, and consequently, increased their independent learning style scores. One participant noted that he enjoyed being given the chance to work independently by carrying out his individual responsibilities of summarizing main points of his readings. He stated that this helped him to improve his writing skills indirectly.

The hypothesis of the study was confirmed with the detection of the increase in the "participant" learning style score (4.6%) together with the decrease in the "dependent" learning styles (4.86%), despite the lack of any statistically significant differences between the pre- and post-test results for these learning styles. These trends in the data suggest that the students became more willing to participate in both inside and outside the classroom and that they developed comparatively more independent learning skills. These results are consistent with the study carried out by Meeuwseen et al. (2005) which showed that team-based learning had the effect of increasing the scores for the "participant" style and decreasing the scores for the "avoidant" and "dependent" styles.

When asked for her opinion on how she felt about classroom activities, one interviewee answered "*Small group discussions make me feel my opinion is valued. So, I tend to say more now compared to my high school years.*"

Another interviewee indicated that he appreciated the opportunity of interpreting his experiences in the light of his readings, which helped him take more initiatives in classroom discussions. This seems to lend credence to the constructivist view that learning becomes more meaningful when learners apply new knowledge to real world contexts and interact vigorously and critically with the new content and apply it in to real world situations (Burnham & Coates, 2007).

Given the nature of the communication courses at the Petroleum Institute (PI) in Abu Dhabi and the soft skills engineers generally expected to display, the scores for the "avoidant" had been expected to decrease. However, this expectation was proven to be wrong. Some learners continued to prefer the "avoidant" learning style, which may be due to the linguistically challenging aspects of the courses. The average score reflected a minimal increase (1.1%) which was statistically insignificant. Similar cases have been noted in the literature (Borges & Parmelee, 2011; Novak et al. 2006). One interviewee in this study tied this increase to his lower level of English compared to his classmates. He stated that the readings he was required to do challenged him, making it difficult for him to rephrase his understanding in his own words. Another reason for the appearance of an increase in this learning style may be cultural. In the given context, listening more than speaking appears to be regarded as a virtue which may discourage people from speaking their minds. Also, one participant with a higher score for the avoidant learning style was identified to have a speech deficiency, which could be one reason for his preference of this particular learning style. Overall, these can be interpreted as factors that contributed to some learners' adopting the "avoidant" learning style. Despite this, three students indicated that their increased level of proficiency helped them to become more participants in the classroom discussions due to the feeling of empowerment.

Conclusions and Recommendations

The present study examined the effects of collaborative learning through team-based activities on adaptation of social interaction learning styles. The first set of analyses included quantitative data to determine any changes in the participants' learning styles over a course of an academic year. It was

found that the participants scored in the "High" range for "collaborative" and "competitive" learning styles both at the beginning and at the end of the academic year while none of their learning styles scores fell in the "Low" range. Despite this persistence of dominant learning styles, certain changes in the scores were detected: the participants' scores for "collaborative", "participant", "independent" and "avoidant" styles increased while those for "competitive" and "dependent" styles decreased.

This highlights the fact that learning styles are malleable and that different factors can be at play. Respondents attributed learning style changes to a variety of factors such as being involved in team-work with a multi-cultural nature and completing reading assignments.

Cartney (2000) asserts that the changing nature of learning styles poses a problem for their credibility. However, this can be seen as a potential strength since learners can update their ways of gaining knowledge and skills in response to their course requirements and future professions.

The results of the current study have implications for educators. First of all, it appears to be necessary to engage engineering students in more teamwork activities not only in communication courses but also in more field-specific courses. These activities need to encourage students to adopt more independent, collaborative and participatory learning styles since these cultivate the skills they will need more often as practicing engineers. Instructors teaching engineering communication courses might consider asking their students to carry out team projects with the aim of addressing particular issues faced in their immediate environments. For instance, their projects can focus on possible ways of utilizing solar energy in particular buildings on their campus. By working in collaboration with others, they can do a literature review to raise their awareness of what has been done so far in the field, and aim to develop a more cost-effective method. Later, they can take different roles to present their work to an engineering audience.

It is important to remember that not all students can be expected to pick up cooperative learning skills as they experience it. They may benefit from being explicitly taught the skills they need to exhibit when engaged in cooperative learning experiences (Johnson et al., 1998). They also need to be shown examples of future engineering work which will require them to exhibit the kinds of skills they are learning in class. With this aim in mind, they can be assigned to read related research articles or do research projects directly related to the soft skills practicing engineers need to have.

It should also be remembered that engineers more often work in teams to develop projects, and therefore, they will need to employ a variety of learning styles. What needs to be avoided, though, is the potential performance decreasing effect of competition. In addition, it may be useful to help learners to identify their preferred learning styles at the beginning of a course and have some conversations with them about the course requirements and their implications on how they like to learn more and best. It needs to be made clear that the mismatches between the two do not necessarily mean that they need to panic, but they could actually learn how to adapt by making necessary changes. Educators may also consider monitoring their learners' development of learning styles and provide help when needed.

Engineers often work with people from different ethnic backgrounds, as in the case of the UAE. This can be reflected in the classroom by encouraging learners to team up with students from different backgrounds. Initially, they may like to stay in their comfort zones of working with people whose culture they are familiar with; however, should they be explained the reasons they need to cooperate with such people, they will be more likely to be accepting of other cultures. To help this process, instructors can organize some social activities which lend themselves to break the ice. Including the topic of intercultural communication in their course syllabus will also help. Role-plays and case-studies dealing with intercultural aspects of engineering field will prove useful, too.

Results of this study also suggest some areas where further research could supplement our knowledge of learning styles. One specific recommendation for further research is to investigate how changes in learning styles affect learners' academic success. Researchers can also consider how students' learning styles continue to adapt after they start working in their particular fields.

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