Flipping e-Learning for Teaching Medical Terminology: A Study of Learners' Online Experiences and Perceptions

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Abstract
Since e-learning has become popular in recent years, research studies have been conducted about which instructional methods are the most effective in online learning environments. The purpose of this study is to investigate one promising method by applying the flipped classroom model to a Medical Terminology Course. This course was provided fully online as part of a Medical Documentation and Secretarial associate degree program in a vocational college. We analyze learners' experiences associated with this application. Based on this flipped classroom method, learners were required to study interactive multimedia content and applications asynchronously. For synchronous activities, mainly learner-centered approaches—collaborative learning, problem solving, and discussion—were used. In the context of this study, learners' usage of the system, submissions to the study process questionnaire, and academic achievement were collected as quantitative data. Learners' opinions towards the flipped classroom model were obtained as qualitative data. We found that learners' academic achievement was significantly related to their perceptions of deep learning and their time spent on learning activities. Problematic aspects to the flipped classroom were time expectancies, insufficiency of instructional materials, and lack of advice received from the instructor.

Keywords: medical terminology, flipped classroom, deep learning, learning process, online learning

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In recent years, online learning has gained more significance with an ever-increasing demand from a substantial and diverse array of learners. For instance, the total number of massive open online course (MOOC) learners was announced as 101 million in 2018 (Class Central, 2018). For the effective implementation of online learning, certain instructional models have been proposed like the flipped classroom, which was initiated by Bergman and Sams in 2006. For

learners who missed their classroom lectures, Bergman and Sams developed video lectures for learners to view outside of the classroom. After these efforts, the model was subsequently developed to its current state: "that which is traditionally done in class is now done at home, and that which is traditionally done as homework is now completed in class" (Bergman & Sams, 2012, p. 13).

The principle idea of the flipped classroom model is to transform the traditional instructional method to a novel approach with the use of instructor-developed videos and interactive activities such as problem-based and collaborative activities. In the context of the flipped classroom model, learners initially access and study course content (e.g., notes, presentations, videos) in advance of course classroom (in-class) sessions. Next, with their newly gained knowledge, they participate in classroom sessions in order to study problems, progress in concepts, and engage in collaborative studies (Tucker, 2012). The flipped classroom model provides learners with the chance to access course materials at a time and place that suits their needs, and with a student-centered perspective it changes the "focus from the instructor to the learner, and promotes active learning and problem-solving" (Galway, Corbett, Takaro, Tairyan, & Frank, 2014, p. 2).

Existing studies have analyzed the impacts of the flipped classroom on factors like academic performance (Missildine, Fountain, Summers, & Gosselin, 2015; Street, Gilliland, McNeil, & Royal, 2015; Koo et al., 2016), satisfaction (Gilboy, Heinerichs, & Pazzaglia, 2015; Street et al., 2015; Morgan et al., 2015; Koo et al., 2016), and engagement (McLaughlin et al., 2014; Clark, 2015; Morgan et al., 2015). On the other hand, few studies have investigated the effect of the flipped classroom model on perceptions of learning at deep and surface levels and fewer studies that have considered the learning process where the flipped classroom model was applied.

In the current study, the flipped classroom model was implemented in an online Medical Terminology course provided at a state university in Turkey. The content of the course covers a great number of medical terms, which must be memorized by learners. However, in previous years, learners experienced problems in the memorization and retention of terms. In order to increase learner achievement in the course, the flipped classroom model has been preferred for the implementation in the course. Thus, it is essential to investigate the flipped classroom model's effects on the learning process; hence, the first aim of the current study was identified as investigating the relation between learners' perceptions of their learning (deep-surface) and their academic achievement. Since the flipped classroom model requires a high level of participation with asynchronous activities, it is necessary to analyze learners' progress outside of the classroom (Guajardo Leal, González, & Scott, 2019) where the flipped classroom model has been applied. Therefore, the second and third aims of the current study are to examine the impact of student participation in asynchronous activities on learners' perceptions of their own learning process and also their academic performance. The needs and evaluations of learners is important for improving existing courses for future implementations of the flipped classroom model. Therefore, the current study additionally attempts to explore learners' perceptions related to the application of the flipped classroom model. Based on these facts, this research study is expected to fill the gaps by (a) adding to the existing literature for Turkish context, (b) considering online learning processes for flipped classroom model, and (c) adding to the literature of deep and surface learning.

Teaching Medical Terminology in Medical Secretarial Education

Medical secretaries work as the communication and coordination center of the team and use medical terms intensively, especially in communication (Tekin, 2009). Medical secretaries are employees who take an active role in the whole process, from the documentation of health records through to their archiving. Accurate writing, coding, and analysis of medical data contained in health records depends on their knowledge of medical terminology (Davies, 2007).

"Medical Terminology" courses are provided to students of medical secretarial programs in order for them to learn medical terms specific to the healthcare field. These courses are mostly taught as a two-hour-per-week, single-semester course during the first year of their program. In Turkey, a lack of sufficient teaching staff for Greek and Latin medical terminology, the lack of teaching methods other than traditional ways and methods, and the availability of limited Turkish language printed resources poses a significant disadvantage for this course. It is therefore a significant issue for educators in Turkey to find ways to improve the design and delivery of the course to fulfill the learners' needs.

Use of Flipped Classroom Model in Health Sciences Courses

Health sciences are considered an important field using the flipped classroom model in learning environments. Gilboy et al. (2015) flipped undergraduate nutrition classes by providing videos, textbooks, and supplemental reading materials as before-class activities, and implementing jigsaw (jigsaw is a kind of online activity that requires learners complete this activity collaboratively) as an active learning strategy during class. The evaluation of the flipped classes revealed the majority of learners preferred watching videos rather than attending face-to-face lessons and they preferred participation in classroom activities (Gilboy et al., 2015). Furthermore, learners stated the advantages of the flipped model was being able to study at their own time and pace and being able to apply their knowledge in class.

Morgan et al. (2015) applied the flipped classroom model to four different gynecologic oncology topics of the obstetrics and gynecology department. In the before-class activities, learners were required to watch videos online, whereas, for the in-class activities, learners were required to participate in coached discussions of cases through an online environment. The evaluation demonstrated significantly high participation (80% video view, 94% participation in discussions) and satisfaction rates (3.31 over 4) related to the use of flipped classrooms.

Koo et al. (2016) flipped a pharmacotherapy course for undergraduate pharmacy students. To be completed before attending class, students were provided with online videos and self-assessment questions related to foundational concepts. During the face-to-face class sessions, students were required to study patient cases followed by small group discussions and elaborations within larger study groups. The assessment resulted in students having significantly increased academic success and levels of satisfaction. Especially, students indicated the benefits of flexibility of viewing videos when time permitted and of knowledge application in their case discussions.

Besides these studies, a recent systematic review considered prior studies related to the flipped classroom model in medical education. Chen, Lui, and Martinelli (2017) analyzed 82 different studies and found students were generally satisfied with the use of the flipped classroom model thanks to its significant advantages like usefulness of online materials, ease of access to learning resources with self-pacing opportunities, and the appropriateness of interactive in-class activities for improved motivation and engagement. Students also indicated the capability of the

flipped classroom model in satisfying "greater task value," "increased enjoyment," and "decreased boredom" in comparison to traditional instructional models. The only negative perception of students was related to the requirement for studying course materials prior to attending class.

Based on these studies, there are not enough studies evaluating the effect of the flipped classroom in the different programs in the health sciences. In particular, studies done on learners in Turkey are needed.

Deep and Surface Learning in Flipped Classroom

The deep learning concept was firstly proposed by Craik and Lockhart (1972) as the advanced-level or active cognitive processing, whereas surface learning was identified as low-level cognitive processing like memorization. Deep learning refers to learners' high interest in learning and understanding together with their focus on relations among different aspects of the content as well as their hypotheses or ideas about the problem or topic. Surface learning refers to learners' intention to pass the course with minimum effort such as memorizing or utilizing procedures without any reflection (Marton & Säljö, 1976).

Learning strategies resulting in deep learning were proposed as "meaning making and comprehension, declarative learning, higher order thinking, meaningful learning and active engagement, intrinsic motivation, and knowledge transfer" (Czerkawski, 2014, p. 30). Surface learning strategies were proposed as "reproduction and repeat, procedural learning, highly influenced by assessment, engagement when required, extrinsic motivation, and difficulty connecting ideas to prior learning" (Czerkawski, 2014, p. 30). The current literature shows that the flipped classroom model can enhance and facilitate deep learning through active learning activities in the classroom (Roehl, Reddy, & Shannon, 2013). However, there have been very few studies about flipped classroom model and deep learning (Danker, 2015; Floyd, Harrington, & Santiago, 2009; McLean, Attardi, Faden, & Goldszmidt, 2016; Yılmaz, Öztürk, & Yılmaz, 2017).

Floyd et al. (2009) investigated the relationships among perceived course value, student engagement, and deep and surface learning strategies in an online learning environment. The researchers evaluated deep and surface learning according to the scales developed by Biggs, Kember, and Leung (2001). Deep learning strategy occurred when students perceived they were engaged in the learning process ($r = .386$, $p < .001$) and their perceived value of the course content was high ($r = .555$, $p < .001$). As expected, deep learning strategy and surface learning strategy were negatively correlated with each other ($r = -.439$, $p < .001$). As a result, the ultimate goal of enhancing deep learning should result from understanding and enhancing perceived value and engagement.

Danker (2015) investigated how the flipped classroom model engaged students in deep learning and guided exploration from the perspective of the students' improved aspects of deep learning. The evaluation of the study revealed that exploratory learning through guided inquiry-based activities (e.g., exploration of concepts through inquiry exercises) in the flipped classes was successful in engaging students on a deeper level.

Yılmaz et al. (2017) compared a structured flipped classroom (i.e., involving structured learning tasks and learning resources and requiring assessments to be completed in class), flexible-structured flipped classroom (i.e., involving same learning tasks and learning resources as structured flipped classroom but allowing learners to complete assignments in a week), and a traditional classroom teaching environment in terms of academic success of students who adopted

deep and surface learning approaches. Students with both deep and surface learning approaches in the structured and flexible-structured flipped classroom environments showed significantly higher academic success than students with a deep learning approach in the traditional learning environment. However, no difference was found between the academic success of students with both deep and surface learning approaches in the structured and flexible-structured flipped classroom models.

The flipped classroom model has been proposed as a novel and effective approach. While this model is implemented in online learning, learners study course content asynchronously and then participate in synchronous sessions in order to achieve deep learning through interactive activities. Thanks to such benefits of the flipped classroom model, it has been used in many fields with many in the field of health sciences. On the other hand, only a limited number of studies considered deep learning or the asynchronous participation of learners, which are both significantly important for learner achievement when online courses are provided in the flipped format. In this regard, the current study focuses on the implementation of the flipped classroom model in the context of an online Medical Terminology course in order to enhance the effectiveness of the learning process. Hence, this research was designed in order to answer the following research questions:

1. Is there any relation between learners' perceptions of their own learning (deep-surface) process and their academic achievement?
2. Is there any relation between learners' perceptions of their own learning (deep-surface) process and their participation in asynchronous activities?
3. Do learners' academic achievement and perceptions towards learning change according to time spent using interactive multimedia content?
4. What are the opinions of learners related to their experience of the flipped classroom model?

Methods

Research Design

This research was designed as a mixed methods research study. In this regard, the following quantitative data was considered: learners' usage of the system as provided by the learning management system (LMS) system usage logs (duration of usage time for interactive activities), learners' submissions to the study process questionnaire, and learners' academic achievement (i.e., final exam grades). As the qualitative data, learners' opinions towards the flipped classroom model were considered within this study.

Study Group

The research was conducted in a Medical Terminology course as part of a fully online Medical Documentation and Secretarial program of a vocational college at a state university in Turkey. Although 118 learners (98 female and 20 male) registered in the Medical Terminology course, the number of learners who participated in all the necessary activities and survey was 26. Therefore, the sample of the study was 26 participants, whose demographic characteristics are provided in Table 1.

Table 1

Analysis of Demographic Data for Sample Group

	Variables	Frequency (*f*)	Percentage (%)
Gender	Female	24	92.3
	Male	2	7.7
Age	16–19	7	26.9
	20–23	15	57.7
	24–27	1	3.8
	28 and older	3	11.5
Total		26	100

Research Context

The Medical Terminology course is for vocational level students and covers "integumentary, skeletal, muscle, nervous and digestive systems" as the content. The Medical Terminology course, which lasts 14 weeks, was structured to adopt a flipped classroom model during the 2017–2018 spring semester. The course was developed within the LMS environment by integrating various learning resources and activities (collaborative group work, group discussions) for completion asynchronously or synchronously (see Figure 1).

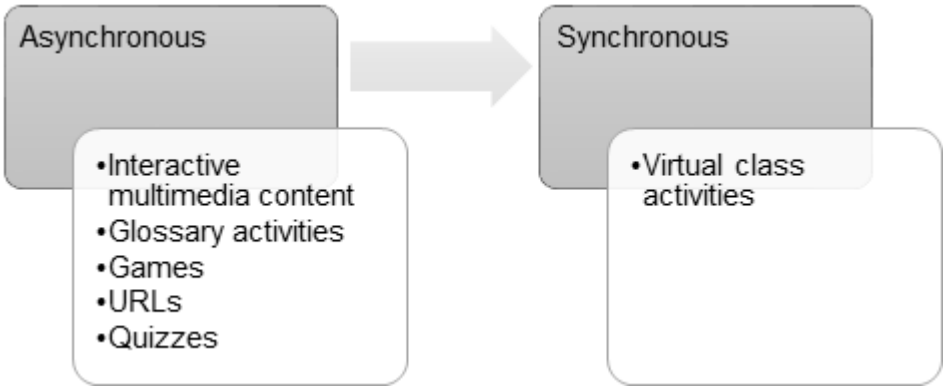

Figure 1. Asynchronous and synchronous activities.

Interactive multimedia content including texts, images, audios, and videos was provided as an aid to learners' understanding and for their individual study. They also supported learners' understanding of terms through various presentations means as demonstrated in Figure 2. The textual content provided an introduction related to parts of the body, whereas the audio content used sound recordings of medical terms, and the video content was developed in order to present summarized content of the course. In addition, flashcards and drag-and-drop questions integrated to online learning packages allowed for learner repetition of medical terms.

Figure 2. Interactive multimedia content.

In the first week of the semester, learners were introduced to the flipped classroom model and how it would work for their course. Since learners were familiar with the traditional instructional methods, a level of resistance to this new model was observed in the initial weeks of the course. In order to deal with this resistance, online discussion forums were held and students received feedback every week. In addition, participation in virtual classes and asynchronous activities were evaluated and bonus points awarded by the lecturer.

Learners were required to study interactive multimedia content prior to attending a virtual class. In these study sessions, they read text-based materials, watched videos, and listened to audio recordings for the purpose of learning the required medical terms. Learners were additionally supported with other asynchronous activities such as glossary activities, games, URLs, and quizzes on course-related practices.

During the weekly virtual classroom sessions, group activities were designed in place of subject narration. Initially, learners read and understand medical terms in these sessions. The collaborative activities included correct writing of medical terms based on audible texts, finding organs and structures correctly on anatomical drawings, writing meaningful texts using the given medical terms, and identifying incorrectly written medical terms in an example text. From their collaborative studies, the learners produced learning outputs and submitted these studies as their course assignments. The role of the instructor during online class was defined as managing the activity, creating groups, performing follow-up, and directing those students in need.

Data Collection Tools

The data collection tool used in the study was the "Study Process Questionnaire," as proposed by Önder and Beşoluk (2010), which is a Turkish adaptation of the Study Process Questionnaire (R-SPQ-2F) originally developed by Biggs et al. (2001). The scale is structured as a five-point, Likert-type scale with items ranked as "Always" (5), "Usually" (4), "Sometimes" (3), "Rarely" (2), and "Never" (1). In total, the scale consists of 20 items in two factors, which are classified as "deep learning" and "surface learning." At the end of the semester, learners voluntarily responded to items of the scale, hence reliability analysis was conducted based on the data of the learners who participated in the survey (i.e., 26 participants). The Cronbach Alpha value was calculated and found to be .84. In addition, the Cronbach Alpha coefficients related to the factors of the scale are shown in Table 2.

Table 2

Reliability Results of the Scale

Factors	Item Counts	Cronbach's Alpha
Deep learning	10	.93
Surface learning	10	.81

The sample items of the scale are presented in Table 3, please see the Appendix 1 for all of the items (in English).

Table 3

The Sample Items of the Scale

Item number	Item
6	I find most new topics interesting and often spend extra time trying to obtain more information about them.
20	I find the best way to pass examinations is to try to remember answers to likely questions.

Participants' opinions related to the application of the flipped classroom model were gathered through an online survey composed of eight open-ended questions, which asked about their experience in relation to the model as follows:

1. When you compare the Medical Terminology I courses in both semesters (fall vs spring), what are your thoughts about them?
2. What do you think about the learning materials, which have been presented to you in the Learning Management System? How did it contribute to your learning, motivation, and participation?
3. What are the most challenging parts of the learning materials? How did you overcome any difficulties?
4. What would your suggestions be to improve these learning materials?
5. What do you think about the flipped classroom model?
6. How did this new learning method contribute to your learning, motivation, and participation?
7. What are the most challenging aspects of this new learning model? How did you overcome any difficulties?
8. What would your suggestions be to improve the flipped classroom model?

The same 26 participants who submitted the Study Process Questionnaire also responded to these questions.

In addition to these data, learners' time spent using interactive multimedia content, their learning activity participation rates, and their final exam grades were also considered in the analysis. Learners' allocation of study time on interactive multimedia content was obtained from the LMS and defined as study hours. Learners' participation in weekly asynchronous activities was obtained from the LMS and graded as "attended" or "not attended." The final exam grades of learners were acquired from the student affairs system and defined as a score between 0 and 100.

Data Analysis

For the analysis of the quantitative data, SPSS version 17.0 software was used. Since the number of participants was deemed inappropriate for the use of parametric tests, non-parametric statistical tests were preferred. For research questions 1 and 2 the correlation analysis, for research question 3 The Kruskal Wallis H-Test, and for research question 4 qualitative data analysis has been conducted. For the analysis of the qualitative data, open coding was applied. According to Strauss and Corbin (1990) in qualitative research, the three different types of coding are open, axial, and selective coding. Open coding is an explanatory process about working on the data in an in-depth way. This gives an opportunity to the researchers for gathering new insights without preconceived components (Strauss & Corbin, 1990). This coding process has been conducted by two of the researchers and prior to interpretation of the qualitative data, Cohen's kappa coefficient was calculated in terms of intercoder agreement strategy. Two different field experts have checked all codes and interrater reliability was found to be .86, which is considered as a good reliability value (Creswell, 2007). Also, the member checking strategy has been used (Creswell & Miller, 2000; Merriam, 1998) by reaching out to participants who answered open-ended questions via telephone and discussing their answers in the context of the researchers' interpretations.

Results

RQ-1: Is there any relation between learners' perceptions of their own learning (deep-surface) process and their academic achievement?

In order to identify learners' perceptions about their own learning process, a correlation analysis was conducted between the data gathered from the "Study Process Questionnaire" and the learners' final exam scores. In the correlation analysis, Spearman's Rho coefficient was considered and the results are shown in Table 4.

Table 4

Results of Correlation Between Learning Process and Academic Achievement

Variables	*N*	*R*	*P*
Academic achievement Deep learning scores	26	.394	.046*
Academic achievement Surface learning scores	26	-.442	.024*
Academic achievement General scores	26	.043	.834

*$p < .05$, two-tailed

A statistically significant and positive relationship was found between learners' perceived deep learning levels and their academic achievement ($r = .394$, $p < .05$). As learners' perceived deep learning level increases, their academic achievement increases as well. In contrast to this finding, a significant and negative relationship was revealed between learners' perceived surface learning level and their academic achievement ($r = -.442$, $p < .05$). That is, while learners' perceived surface learning decreases, their academic achievement increases.

RQ-2: Is there any relation between learners' perceptions of their own learning (deep or surface) process and their participation in asynchronous activities?

Learners' participation in weekly asynchronous activities were graded as "attended" or "not attended." Afterwards, correlation analysis was applied in order to reveal the relation among learners' perceptions of their learning (deep or surface), their participation rates to asynchronous activities, and their academic achievement.

Table 5

Results of Correlation Analysis of Learning and Participation

Variables	***N***	***r***	***p***
Learning perception scores Participation scores	26	.305	.129
Deep learning scores Participation scores	26	.547	.004*
Surface learning scores Participation scores	26	.329	.101
Academic achievement Participation scores	26	.508	.008*

*$p < .05$, two-tailed

Correlation analysis revealed a significantly positive relationship between participation scores and deep learning scores ($r = .547$, $p < .05$), and a significantly positive relationship between participation scores and academic achievement ($r = .508$, $p < .05$). This finding can be interpreted that while participation in learning activities increases, academic achievement as well as perceived deep learning level also increases.

RQ-3: Do learners' academic achievement and perceptions towards learning change according to time spent using interactive multimedia content?

The Kruskal Wallis H-Test was applied in order to analyze whether or not learners' academic achievement and perceptions of deep versus surface learning are related to their allocation of study time on interactive multimedia content. Results based on this test are shown in Table 6.

Table 6

Results of Correlation Analysis of Allocated Study Time and Learning Achievement

Duration	*n*	Mean Rank	*SD*	X^2	*p*
0:00–7:59	10	7.50	2	13.53	.001
8:00–15:59	5	9.80			
16:00 or more	8	19.00			

The findings demonstrated that learners' perceptions of deep vs. surface learning did not significantly change based on their allocated study time on interactive multimedia content. On the other hand, learners' academic achievement significantly differed in terms of their time spent on interactive multimedia content ($\chi 2[2] = 13.53$, $p < .05$). This finding indicates that time allocated for study has a significant effect on academic achievement. According to the group's average results, the most successful learners were those who studied interactive multimedia content for 16 hours or more. This finding revealed the importance of performing interactive activities before and after online class for achievement.

RQ-4: What are the opinions of learners related to their experience of the flipped classroom model?

Open-ended questions were posed in order to explore learners' perceptions of the flipped classroom model. Surprisingly, the findings revealed that learners had positive perceptions towards traditional methods rather than the flipped classroom model. According to the learners, traditional methods were seen as preferable, while the flipped classroom model can result in an inefficient experience since it requires participation in course sessions based on activities. Additionally, the learners stated a decrease in their motivation since they were required to study prior to attending class, allocate more time, and learn through individual effort. Especially, while working on course materials, they felt overwhelmed due to their other responsibilities and a lack of time. In order to understand the course content, they developed strategies such as increased repetition and notetaking. Additionally, learners were required to participate in synchronous activities in order to deeply understand the course content, which resulted in confusion and inefficiency from the learners' perspective. Related opinions of the learners are as follows:

> I could not study course materials each week, I felt under pressure but couldn't find a solution since I had limited time. [P9]

> The most difficult requirement was participating in activities before completely understanding the course material. This was because I got confused. So, I gave up involvement in activities after a time. Instead, I made more repetitions to comprehend the material. [P2]

According to the learner, this situation caused a level of confusion and he/she gave up involvement in the activities after a while. Also, the learner stated that he/she made more repetitions in order to comprehend the materials.

Generally, learners indicated that the flipped classroom model was deemed as being inefficient and ineffectual. At the same time, they indicated their dissatisfaction regarding the online instructional materials provided for them to complete as asynchronous activities. This revealed that consideration of attitudes and learning process needs to be planned in a more detailed and appropriate manner.

However, there were also positive views about the materials and methodology. In contrast to previous opinions, one of the learners stated that:

> I participated in this course willingly, just as before, but this term was funnier and more motivating to study. [P15]

> Actually, I couldn't understand very well how it contributed to my learning. Overall, I thought that it was my responsibility, which it should. In addition, I really enjoyed in-class activities. [P7]

These diverse opinions may be due to the implementation of the flipped classroom model, their previous learning experiences, and also their individual differences.

Discussions and Conclusion

In the flipped classroom model, course content is delivered through technologies (e.g., videos, podcasts, screencasts) that learners can gain access to at any time and from any place. This approach results in the allocation of more time for interaction, enhancement of higher-order thinking, and for enrichment during in-class sessions. The principle role of the instructor is identified as a guide in this process, whereas learners take on active roles assimilating information, creating new ideas, etc. (Bennett et al., 2013).

The current study attempted to analyze the effects of the flipped classroom model on variables from the students' perspective. Despite of the fact that the study has a relatively small sample size, the findings still could be valuable from many aspects for educators. In this regard, first the relation between learners' perceptions of their learning (deep-surface) and their academic achievement were considered and a positive result was found. This finding was similar with other studies (Bhagat, Chang, & Chang, 2016; Koo et al., 2016; Missildine et al., 2013; Street et al., 2015) that found an increase in learner success when the flipped classroom model was implemented. On the other hand, some studies (Clark, 2015; Morgan et al., 2015) found no difference in learners' achievement when courses were transformed to the flipped format. In the case of the current study, learners gained knowledge about the definition and use of medical terms. Accomplishing deep learning within such a course will help its students apply this knowledge to other medical courses and to their future professional work life. Positive effects of the flipped classroom model on academic achievement may also be observed in the long term, since learners construct their knowledge through active involvement in the learning process, resulting in deep and persistent learning.

Analysis of the current study revealed higher achievement scores for those who has higher participation rates in virtual class activities. This finding is also parallel with certain studies in the literature (Clark, 2015; McLaughlin et al., 2014; Chen, Wang, Kinshuk & Chen, 2014), which found an increase in engagement for courses designed in the flipped format. Another finding was that learners' achievement was based on time spent on interactive multimedia content. This result confirmed the importance of learning materials on learner success in the context of the flipped

classroom model. This finding was similar to that of a study conducted by Gilboy et al. (2015), which revealed increased preference of learners towards out-of-class videos compared to face-to-face lessons. In addition, in their study, Carver, Muhkerjee, and Lucio (2017) revealed that learners' time spent in online learning predicted whether "A" grade would be achieved or not. In order to increase learners' asynchronous participation, learning activity interactivity and richness need to be considered. The preference of today's learners towards short and interactive videos should be an essential guide for course developers. Besides, learners can be supported with a greater number of interactive activities that may include group studies and communication tools such as online chat and forums, which all support peer work and therefore lead to increased collaboration that engenders better understanding of the course content.

Related to their flipped classroom experiences, learners in the current study encountered certain challenges. Requirements to study prior to attending class led to learners feeling overwhelmed, since they felt they needed to allocate more time to the course. This was a common finding of studies seen in the literature (Gostelow, Barber, Gishen, & Berlin, 2018; Koo et al., 2016) in which learners stated time requirements as a downside to the flipped classroom approach. The other reported challenge was lack of opportunity to ask questions of their instructor while studying during asynchronous activities, which was also revealed in other studies (Gilboy et al., 2015; Jones-Bonofiglio, Willet, & Ng, 2017). These kinds of challenges may be preventable with introductory sessions about topics to be studied prior to synchronous activities, hence achieving a more effective flipped classroom experience.

The online course materials were sometimes felt to be insufficient. In this regard, instructional materials can be improved based on learners' preferences in order to increase learner motivation and use of these materials. Analysis, design, and development phases for the creation of instructional materials can be performed with the involvement of not only the instructors and instructional designers, but also of the learners themselves. In this way, more adaptable and preferred asynchronous materials and increased participation rates may be achieved.

The results obtained in the current study showed that the flipped classroom model applied to a Medical Terminology course affected the students' deep learning and academic achievement. Similar studies in medical (Pierce & Fox, 2012; Prober & Heath, 2012; Sharma, Lau, Doherty, & Harbutt, 2015), pharmacy (McLaughlin et al., 2014), and nursing education (Critz & Knight, 2013; Hao, 2016; Presti, 2016) showed that this method can be applied successfully in healthcare education. Hence, the findings of the current research could be useful as a guide for instructors and instructional designers of similar courses that aim to use the flipped classroom model.

Suggestions and Implications

This study has certain recognized limitations with regard to sample size. The number of students who expressed their opinions in terms of methodology and materials was not as high as originally expected. It would be better to collect data from a larger group in order to see its effects. In addition, one-on-one interviews could be held with students as a means to obtaining more in-depth data.

Since the students were more familiar with traditional teaching and learning methods, such a radical change in teaching and learning approach was seen as a considerable challenge. Not more than 50% of students watched the prescribed asynchronous videos prior to the course. In the application of this study, it was seen that some students attended classes without having watched the prescribed asynchronous videos. First, the reason for such low rates of videos having been

watched should be investigated and students' expectations taken into consideration. Since the course materials were reported insufficiently, the students need to be included as stakeholders in the material development process. The results of the current study showed that it is important to reevaluate the design of the learning process by considering the views of the students. In addition, it may be advisable to provide detailed guidelines for the flipped classroom and to take measures to provide a smoother transition where the method will be applied for the first time. Finally, a design-based research approach could be implemented to enrich the learning process and outcomes by deepening the context.

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Appendix 1
Study Process Questionnaire

Items

1. I find that at times studying gives me a feeling of deep personal satisfaction.
2. I find that I have to do enough work on a topic so that I can form my own conclusions before I am satisfied.
3. My aim is to pass the course while doing as little work as possible.
4. I only study seriously what's given out in class or in the course outlines.
5. I feel that virtually any topic can be highly interesting once I get into it.
6. I find most new topics interesting and often spend extra time trying to obtain more information about them.
7. I do not find my course very interesting so I keep my work to the minimum.
8. I learn some things by rote, going over and over them until I know them by heart even if I do not understand them.
9. I find that studying academic topics can at times be as exciting as a good novel or movie.
10. I test myself on important topics until I understand them completely.
11. I find I can get by in most assessments by memorising key sections rather than trying to understand them.
12. I generally restrict my study to what is specifically set as I think it is unnecessary to do anything extra.
13. I work hard at my studies because I find the material interesting.
14. I spend a lot of my free time finding out more about interesting topics which have been discussed in different classes.
15. I find it is not helpful to study topics in depth. It confuses and wastes time, when all you need is a passing acquaintance with topics.
16. I believe that lecturers shouldn't expect students to spend significant amounts of time studying material everyone knows won't be examined.
17. I come to most classes with questions in mind that I want answering.
18. I make a point of looking at most of the suggested readings that go with the lectures.
19. I see no point in learning material, which is not likely to be in the examination.
20. I find the best way to pass examinations is to try to remember answers to likely questions.