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Using social media platform X to enhance student medical English learning: an attempt based on design-based research (DBR) in a medical English for specific purposes (ESP) course

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Abstract

This study aimed to (1) elaborate on microblogging-based instruction, which was built on social media platform X and designed based on the four phases of the design-based research (DBR) framework (Amiel and Reeves in *J Educ Technol Soc* 11(4):29–40, <https://www.jstor.org/stable/jeductechsoci.11.4.29>, 2008); (2) put microblogging-based instruction into practice in a medical English for Specific Purposes (ESP) course; (3) examine students' perceptions of the pedagogical value of X platform usage on their learning experiences; and (4) investigate how well microblogging-based instruction enhances the students' specialised-language performance. On the basis of the four phases of the DBR framework, a study was conducted with students studying a medical ESP course to identify the problems in the teaching practices used in ESP courses. To improve the identified problems, following the second phase, social media platform X was used to supplement ESP face-to-face instruction. Three tasks were designed for the students to do on X. These tasks were implemented and assessed on 19 EFL first-year premedical undergraduate students over 16 weeks at a university in the Kingdom of Saudi Arabia. Data collected from the students included a copy version of the ESP final test, a questionnaire, and semi-structured interviews. The results revealed that X-based instruction improved students' ability to use medicine-specialised language, offered opportunities for students to become more familiar with medicine-specific terms, perceived ability in using writing and reading skills, collaborative learning, and generated thoughtful discussions outside the confines of the classroom. However, the students' inadequate knowledge of the specialised subject, the stress of making X mandatory, and log-in overload remain key challenges against the effective appropriation of X use in an ESP context.

Keywords: English for specific purposes, Social media, X, Design-based research, Medical students

Introduction

Social network sites (SNSs) promote collaboration, community building, interaction, and participation among the users (Hsu & Liu, 2023; Junco et al., 2011). The widespread use of these tools among today's students, who can be described as digital natives of the next generation (McBride, 2009; Prensky, 2001) and their potential for communication have attracted the interest of researchers to adapt these tools into their educational practices and explore the possibilities they offer for education, particularly language learning (Gao et al., 2012).

This study focused on social media platform X (formerly known as Twitter), an SNS commonly considered as 'one of the microblog services that allow users to send and receive real-time on the website, from mobile application, or via SMS messages' (Tang & Hew, 2017, p. 97), and with which users only need a valid email address to sign up. X users can share information with pictures or videos and posts tweets of up to 280 characters (formerly, 140 characters), which are displayed on the author's profile page and available for other X users to see and interact with. A tweet can contain a hashtag, which is 'a tagging mechanism allowing users to attach a word or a phrase with the hash (#) symbol to a tweet' (Lomicka & Lord, 2012, p. 7) and with which it helps users generate focused information with specific themes or content.

X promotes positive learning outcomes (Bista, 2015; Junco et al., 2011, 2013; Kasens-Noor, 2012), enhances engagement, expands content learning, increases student autonomy, and contributes to community building (Evans, 2014; Junco et al., 2011; Ebner et al., 2010; Elavsky et al., 2011). It also has great potential for promoting language learning (Antenos-Conforti, 2009; Blessing et al., 2012; Gao et al., 2012; Junco et al., 2011). However, only a few studies have assessed its pedagogical value for specialised-language learning in the field of English for Specific Purposes (ESP) (Pérez-Sabater & Montero-Fleta, 2015).

To help Saudi ESP first-year premedical students improve their specialised language ability in medicine to pursue effective subject-specific learning and fulfilling career goals, this study explored the potential of X use in a medical ESP course, the most popular social media platform among Saudi students (Aloraini & Cardoso, 2020). To this effect, the researcher first developed microblogging-based instruction and assessed its pedagogical effect on 19 female ESP premedical students. The design of this teaching initiative was not 'a one-shot proposition' but rather progressively refined (Collins et al., 2004, p. 18). The design-based research (DBR) framework developed by Amiel and Reeves (2008) was adopted.

Literature review

Problems with teaching ESP courses in EFL contexts

For students, especially those accessing their education through a nonnative language, mastering the vocabulary and academic language skills required in their majors is challenging (Evans & Green, 2007; Evans & Morrison, 2011; Rose et al., 2020). To equip these students with the essential English competence required to function effectively in academics and professional communication, many universities globally provide ESP courses to their students. In this sense, ESP courses are 'centred on language, skills, discourse

and genre of specific disciplines,' thereby its role has expanded to equip students with 'the conventions of their particular communicative domain of English' to enhance their learning as well as their future careers (Hyland, 2022, p. 2).

Research into the value of ESP courses has shown that many are inadequate, not preparing students to handle academic requirements (Akyel & Ozek, 2010; Mazdayasna & Tahririan, 2008). Most Saudi universities offer ESP courses to develop students' technical vocabulary and academic skills. However, learners' linguistic skills and knowledge required to perform competently in their academic disciplines were not adequately addressed, teaching practices were based on textbooks and exam-based tasks, and there was a lack of authentic materials in the specialised language and insufficient focus on developing autonomy (Gaffas, 2019). Similarly, Alshayban (2022) investigated the language needs of 43 employers working in banking sectors in Saudi, and found that these employers encountered challenges in speaking and writing skills, underscoring the importance of designing ESP learning materials that are informed by the language needs of the target groups.

Hotak et al. (2024) reported a number of problems that contributed to demotivation among ESP pre-medical students at Kabul University of Medical Sciences. These problems include the use of out-dated teaching methods, outmoded learning materials, and the absence of thought-provoking activities, resulting in a negative impact on students' specialised language improvement. In Morocco, Elimadi (2024) concluded that teaching ESP courses necessitates qualified ESP teachers who can adopt the role of researchers, delving into seeking innovative teaching methods and engaging tasks to enhance their students' specialised-language knowledge.

To date, there are a number of ESP courses for medical students have been published to identify strategies for improving English language learning and teaching (Basturkmen, 2010; Boshier & Smalkoski, 2002), however, there is dearth of studies investigating the use of X in ESP courses although, as noted by Bloch (2014, p. 398), 'formerly popular technologies like email and blogging are slowly being usurped by Twitter and Facebook'. In addition, Bell (2022) stated that the literature on EAP 'has been concerned with the "what" of EAP, i.e. its content, rather than the "how", i.e., its teaching approaches and methodology' (p. 1) and commented that 'it is both puzzling and disappointing that in a field in which most of the practitioners are working as teachers, there is evidently such a dearth of professional research interest in the theory and practice of EAP teaching' (p. 2). Basturkmen (2021) reflected a similar view that ESP teachers should report on the use of teaching initiatives in their own settings, and how these initiatives are implemented and evaluated, emphasizing that such research studies serve as a source of evidence-based recommendations for ESP teachers seeking to try out new instructional methods.

Thus, this study examines a teaching initiative and reports on how a microblogging-based approach using X can promote students' ability to use medicine-specialized language. The study was particularly concerned with investigating students' perceptions of the use of X in their ESP course and whether its use enhanced their learning experiences.

Affordance and constraints of X use in the classroom

A key characteristic of a tweet is its conciseness. X's restriction of each post to 280 characters (formerly 140 characters) is useful for students to be focused and

communicate important information concisely and intelligibly (Pollard, 2014). This brevity of tweets has also been seen as a restriction to boosting students' thinking and a cause of increasing misunderstandings among students (Kassens-Noor, 2012; Prestridge, 2014; Castrillo, 2013); however, it also enhances students' ability to think creatively and develop their reflections (Gunuc et al., 2013; Kassens, 2014). Writing concise tweets is also easier and less burdensome for both students and teachers. In other words, it is quicker and easier for teachers to write and send to students tweets to remind them of due dates for assignments, exams, or campus events (Lowe & Lafey, 2011) and also for the students to follow course-related discussions, thus lowering the pressure of getting tired (Tang & Hew, 2017).

X can enhance communication and collaboration that extend the physical and temporal boundaries of the classroom, thereby helping students share and gain new knowledge, ask questions, receive feedback, and absorb real-world insights from teachers and classmates in a timely fashion. It can also motivate hesitant students to become active participants in their learning (Borau et al., 2009; Junco et al., 2011; Tiernan, 2014). Tweets supplemented with the hashtag symbol can enable learners to get access to up-to-date news and relevant information, which can increase students' motivation, facilitate active engagement, and foster collaboration and learning (Pollard, 2014; Junco et al., 2011, 2013; Lin et al., 2013). Participants in Lee and Markey's (2014) study felt X tasks as 'icebreakers' (p. 291) and attested that X facilitated 'inter-cultural communication with native informants' (p. 295), thereby improving their language skills.

Several studies have investigated whether tweeting, described by Ebner et al. (2010) as microblogging, can support student engagement and content learning (Junco et al., 2011; 2013; Blessing et al., 2012; Kassens-Norr, 2012; Kim et al., 2015; Luo & Xie, 2018). For this purpose, teachers used X to send key course-related topics to help the students remember key content information (Blessing et al., 2012), to support in/after class discussions and ask and answer questions (Junco et al., 2011; Kim et al., 2015). Junco et al. (2011) asked 70 students taking a course for prehealth professions to use X in multiple educational activities, but the control group (55 students) did not use X as a regular part in their class. The researchers discovered that the X-using group had a higher semester grade point averages than the control group. Blessing et al. (2012) used X to remind students of course concepts. In their study, the experimental group received humorous but course-related tweets, whereas the control group received just humorous tweets. At four points during the semester, students completed a cued recall task based on the previous three to four chapters of course material. The results found that the X group remembered key course concepts significantly better than the control group. Prestridge (2014) analysed the tweets of 180 undergraduate students studying an education course and found that the use of X enabled students to be active learners and enhanced their engagement with the course content, most commonly by paraphrasing key course-related information and posting it directly on X. Moreover, the students in their tweets not only stated the key points discussed in the class but also described how these points could be applied. This type of learning enabled students to build knowledge and then analyse and assess how it can be applied, thus enhancing their metacognitive skills, which indicates a higher level of learning processes.

Social media platform X use in pedagogy is not without its disadvantages. Barriers include lack of privacy (Aloraini & Cardoso, 2020), lack of familiarity with X (Evans, 2014; Welch & Bonnan-White, 2012), distraction due to overwhelming information (Rinaldo et al., 2011), feelings of academic incompetence (Lackovic et al., 2017), and the perception of an 'undue burden' (Welch & Bonnan-White, p. 338). Providing students with training sessions and clear descriptions of X-related tasks and what is expected promotes student familiarity with X and improves attitudes towards its use (Rinaldo et al., 2011; Tang & Hew, 2017). Lack of initiating or maintaining the involvement of native speakers on X is another problematic area (Lomicka & Lord, 2012).

Use of X in language learning

X can help develop students' language comprehension and production. Borau et al. (2009) called X the 'perfect tool to support learning English', and Fouz-Gonzales (2017) reported that 'Twitter [can be] used to teach vocabulary' (p. 634). X may offer language learners the opportunity to communicate in the target language (Rosell-Aguilar, 2018) and provide 'a practical means to communicate in authentic real-time situations' (Fewell, 2014, p. 230).

In an online survey on the potential of X as a language learning tool by Rosell-Aguilar (2020), most of the 370 language learners (English, Spanish, French, and Italian) responded that X can contribute to language learning for various reasons, including exposure to the target language, access to information and news, communication, and interaction with other users of the target language. The respondents further indicated that X use helped them learn new vocabulary (nouns, verbs, and adjectives) as well as grammar points (such as verbs, prepositions, adjective agreements, and forms of negative). Others felt that just exposure to the target language in the tweets led them 'to get a feeling of what is and isn't correct usage' (Rosell-Aguilar, 2020, p. 7).

Antenos-Conforti (2009) requested 22 Italian language learners to follow the accounts of native-speaking Italian X users, and they were free to interact with all users of the X community. On the basis of the analysis of the students' tweets, a questionnaire and an open-ended follow-up questionnaire were distributed to those students who tweeted regularly and interacted with the X users. At the end of the 14-week period of the study, almost half of the learners were overwhelmed by interacting with the Italian X users and felt the X promoted their ability to negotiate meaning and exchange information in an informal manner. They stated that posting tweets with native speakers provided them with an audience with whom they could practice the language and from whom they could receive comprehensible input; X thus facilitated 'the classroom community by creating a virtual extension of the physical classroom and providing an opportunity for membership in the L2 community' (p. 24). Blattner and Dalola (2018) explored whether exposure to native English speakers' tweets promoted the language learning of 25 ESL students preparing for study at a U.S. university. The results revealed the suitability of X for exposing students to linguistically and culturally authentic input not found in textbooks and encouraging the learning of new linguistic features. Sending students regular repeated input can draw their attention to specific aspects of language (Hattem, 2014; Hattem & Lomicka, 2016).

Another promising benefit of X is that sending students regular and repeated input can draw their attention to specific language aspects that are usually unnoticed. Guided by the noticing hypothesis (Schmidt, 1993), Blattner and Dalola (2018) explored whether exposure to native English speakers' tweets promoted the learning experience of 25 ESL students preparing for study in a U.S. university. Both content analysis and survey data revealed the suitability of X for not only exposing students to linguistically and culturally authentic input that was absent in textbooks but also encouraging the discovery of new linguistic features in the target language and allowing learners to notice and experience these forms. Castrillo de Larreta-Azelain (2013) indicated that X positively affects students' writing ability by increasing their confidence and reducing anxiety about writing in another language, effectively preparing students for final writing activities.

Theoretical framework

Recognising the role of design in developing research (Reeves, 2006), the present study emphasised the integration of a theory in conducting a rigorous enquiry to refine the innovative learning environment under investigation. To this end, the pedagogical design was developed based on the theory of social constructivism, which suggests that meaning is socially and culturally mediated (Vygotsky, 1978). The theory operates on the premise that learners are not passive in an absolute world but rather active participants in the effective construction of meaning. As such, a social constructivist would maintain that 'knowledge is not merely constructed but it is coconstructed' (Hoven & Palalas, 2011, p. 705). Therefore, meaning is transformed in sociocultural contexts, in which learners are seen as 'collaborative meaning-makers among a group defined by common practices such as language, use of tools, values and beliefs' (Spikol, 2009, p. 125). The notion of scaffolding, or the zone of proximal development proposed by Vygotsky (1978), defined as 'the distance between what learners can achieve on their own and what they can only achieve with distance' (Pardo-Ballester & Rodriguez, 2013, p. 188), plays a vital role in the learning process. In other words, by using scaffolding, teachers and peers can provide feedback and support, enabling less advanced learners to construct knowledge and produce target language forms that they would be unable to produce on their own.

Teaching medical English via social media platform X

English for Medical Purposes (EMP) is an area of ESP (Belcher, 2004) that plays 'an important role in developing students' familiarity with medicine-specific lexical items' (Le & Miller, 2020, p. 102). To date, several ESP courses for medical students have been proposed for improving English language learning and teaching (Basturkmen, 2010; Boshier & Smalkoski, 2002). However, little attention has been paid to the use of X in ESP courses. Pérez-Sabater and Montero-Fleta (2015) used X in an ESP course (English for Architecture Purposes) for Spanish-speaking architecture students. The students were required to provide corrective feedback on their peers' vocabulary, grammar, and spelling errors by reformulating the sentences containing the errors or reminding their peers to avoid using the errors. Most students limited their responses to congratulating their peers and reformulating the sentences; a few pointed out errors to be avoided. The students exhibited similar writing characteristics at the content and style levels because the less proficient writers tended to accommodate their writing styles to that of the more

proficient ones. Moreover, although X was a suitable tool to help ESP students learn English, X 'provides a global communicative visibility' (p. 146), which discouraged those students with a lower language level from tweeting. The findings indicated that using X for ESP instruction aided in subject-specific language improvement, facilitated the use of architecture-specialised terms, and promoted awareness of the 'formal aspects of writing' (p. 146).

Fouz-González (2017) included 121 Spanish EFL students enrolled in a medical ESP course. The X-based approach, whereby the students a daily tweet with a link or video files explaining the pronunciation of the target words, was used to improve the pronunciation of segmental and suprasegmental aspects that are commonly mispronounced by EFL Spanish learners due to lack of explicit instruction, exposure to the target language, difficult sound spelling correspondences, or a combination of these factors. The results revealed that X-based instruction contributed to significant improvements in the learners' pronunciation of the target features.

Although medical professionals must acquire solid competence in English medical spoken and written discourse to cope effectively with the requirements of the medical field, most Saudi students enrolled in colleges claimed that ESP courses they had completed prior to their studies did not have much impact on their specialised-language improvement (Al-Nassar & Dow, 2013; Al-Seghayer, 2011; Gaffas, 2019; Wedell & Al-Shumaimeri, 2014).

On the basis of these data, a language support course was created focusing on providing flexible medicine specialised-language practice expanding beyond classroom time and space. To ensure extended additional language practice, X-based instruction was introduced as a pedagogical tool to supplement the face-to-face ESP course, and its pedagogical value was assessed based on the following research questions.

RQ1 Can X-based instruction help ESP students improve their medical English?

RQ2 Is the student engagement correlated with the improvements in their medical English obtained from X-based instruction?

RQ3 How do students perceive the pedagogical value of X usage in an ESP course in their learning experience?

RQ4 Did the students believe that X-based instruction enhanced their learning experiences in the medical ESP course?

Methodology

Research method

DBR has evolved as a methodology for researching educational learning designs in naturalistic settings (Hoven & Palalas, 2011). Although it is a relatively new approach to conducting educational research, there is a growing interest in including the applications of DBR in the CALL literature (Barab & Squire, 2004) and in ESP in particular (Bush & Sorensen, 2013; Hoven & Palalas, 2011, 2013; Reeves & Lin, 2020). The main focus of DBR is to design CALL instructional materials driven by the data that flows from the

iterative cycles of testing the design, as well as by the exchanges that occur when the people involved in the design discuss the implications of the findings for design refinement and for the synthesis of design principles (Reeves & McKenney, 2013). DBR, therefore, enables researchers to investigate the recent developments of language learning theories in SLA and CALL to design a digital instructional intervention that is subjected to recursive testing and refining through an interactive cycle of design to reach outcomes of interest.

The use of DBR is suitable for ESP research for two reasons: First, design of learning materials is a core element in ESP teaching and learning, but few studies have dealt with the development of ESP learning materials that focus on both designing learning materials and testing their pedagogical value (Bell, 2022), leading to theory-based principles development that may contribute to improving ESP teaching and learning. Second, ESP practitioners are encouraged to design appropriate learning materials that match their students' language needs; therefore, they need to learn how to proceed with their design and test its quality as well as produce design principles that help practitioners in other ESP contexts (Hutchinson & Waters, 1987).

Reeves and Lin (2020) described how they developed a augmented reality-based technological learning model based on a rigorous four-phase DBR model focused on enhancing English oral communication competence of EFL students taking English for Tourism Purposes. In their DBR study, Hoven and Palalas (2013) designed a CALL learning intervention by using mobile technology to expand learning beyond the classroom by enabling ESP students to use their mobile devices to interact with teachers, classmates, and real-life environments. Together, the findings imply that DBR was suitable for improving current educational practices and creating a learning intervention that reflects the real needs of the students in their naturalistic learning environment.

Accordingly, the present study used DBR as the main framework to investigate a pedagogical design in its naturalistic setting, with a focus on tailoring microblogging-based tasks to support specialised-language learning in a medical ESP course through an iterative process and refining the understandings to guide other practitioners in using X in similar educational contexts (Barab & Squire, 2004, cited in Reeves & MaKenney, 2013). A four-phase DBR procedure was used (Fig. 1), with each phase connecting with the intervention of X use in the ESP course. To increase the reliability and validity of this preliminary study, data were collected from multiple sources, including tests, surveys and interviews.

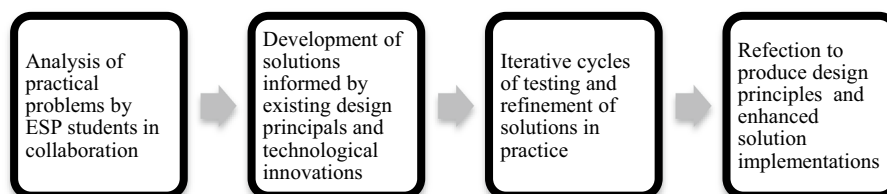


Fig. 1 Design-based research framework according to Amiel and Reeves (2008)

Participants and context

Nineteen first-year undergraduate students (age range: 18–20 years) taking an ESP course for medicine participated in the study. All of them were female native Arabic speakers. They had been receiving formal EFL education in Saudi for an average of 9 years and had completed a general English course in the first semester of university. Their English proficiency was ranked as advanced based on a placement test taken at the beginning of the semester. They all had X accounts and used their mobile phones and X app to access X. Names mentioned in the present study are pseudonyms.

This DBR project was conducted in the English Language Centre at a public university in Saudi Arabia for one semester. The course observed was an ESP course for medical English offered to all students in the second semester of a preparatory programme. It used two international textbooks: *Oxford English for Careers: Nursing 1 and Nursing 2* (Greenan & Grice, 2007). It is a required course for university entrants intending to enrol in one of the medical colleges at the university.

In the ESP course, students received 16 h per week, 12-h lectures were offered in 3 days and 4-h lecture split over 2 days, and each session lasted for approximately 1 h. At the time this DBR project was conducted, the ESP course was delivered in a face-to-face classroom. To accommodate students' busy schedules and respond to their need for flexible learning with fewer time and place constraints, a hybrid solution using X-based instruction was planned. The course blended 16 h of in class with added practice via X.

Data collection and analysis

This DBR intervention is assessed using multiple methodologies (Anderson & Shattuck, 2012). Therefore, a mixed-methods embedded design (Creswell, 2014) was employed before, during, and after each phase. Specifically, before each phase, a preinterview was conducted with the students to glean their opinions on how they learned in the ESP course and the problems impeded their learning. During and after each phase, qualitative data (participants' experiences during and after the learning tasks' activities) were collected.

Pretests and posttests were used to assess learners' specialised-language ability before and after receiving instructions, and a delayed posttest was administered after the training to measure whether the improvements were maintained over time.

Additionally, questionnaires and semi-structured interviews were administered at the end of the study to obtain the amount of the students' X usage as well as canvass their opinions towards the approach adopted once they had received instruction.

ESP test

To examine the influence of X-based intervention on students' specialised-language learning before and after receiving instruction (RQ1), a pretest on week 1 and posttest on week 12 were administered to the students. A delayed posttest was delivered four weeks after the training (week 16) to measure whether gains were maintained over time. The ESP test was a copy version of a test developed by a group of ESP instructors at the English Language Institute to evaluate students' specialised-language knowledge and how their learning in the ESP course has progressed. The test, which lasted 1 h, included

50 MCQ questions that were divided into four sections. Each section was designed to assess students' knowledge of language use and medical terms, and their ability to listen, and read. The students were informed that their performance on the test did not impact their grades to obtain a realistic sample of their performance and anxiety-free situation (Fouz-González, 2017).

Because the same test will be used in the pre-/posttests, an effort was made to ensure that students did not conscientiously learn for the posttest. Therefore, no advance notice was given to the students that the same test would be used again. Additionally, the order of the MCQ items in each section of the test was changed each time. The test scores were analysed using nonparametric statistical analysis because the number of students was small and the normality of distribution could not be guaranteed. The Friedman test was conducted to measure the differences in students' ESP scores across the three times.

Spearman's rank-correlation test was used to examine the correlations between the students' engagement and their medical English improvement (RQ2).

Questionnaire

Evans' (2014) questionnaire was used to explore the extent of students' X usage, its impact on student learning experiences, and their views towards using it in their ESP course (RQ3). The questionnaire consists of two parts: the first part included questions on demographic data and four questions on X use, and the second part contained 12 items rated on a five-point Likert scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*) (Appendix A). Although Evans' (2014) questionnaire was built on exhaustive literature reviews to extract the most relevant items (Ebner et al., 2010; Johnson, 2011; Lowe & Laffey, 2011; Schroeder et al., 2010) several stages of pilot testing were conducted.

The first stage assessed its comprehensibility and evaluated the feasibility concerns for the main distribution; pretesting of the questionnaire was conducted on a group of students (N = 14) similar to the main study group. On average, the respondents took 35 min to complete the questionnaire, which was more than the anticipated 15 min. This was attributed to two main reasons. First, the participants were concerned to understand if X would be integrated in their ESP course as a compulsory course task and how it would be a part of the grade distribution, resulting in unceasing deliberations among themselves while answering the questionnaire. Second, the participants frequently sought more clarification from the researcher about the Arabic meaning of some words in the items, such as 'boundaries' and 'modules'. The questionnaire was therefore translated from English into Arabic to reduce misunderstanding caused by language barriers.

Semi-structured interviews

To elucidate how well X-based instruction enhanced students' learning experiences (RQ4), individual semi-structured interviews were scheduled (see Appendix B) with randomly selected study participants. Interviews were conducted at the end of each iteration as an opportunity to share views and thoughts. The students reflected on the intervention stage—that is, the tasks that were implemented and lesson delivery. Participation in the interviews did not impact grades for the X project or the course. The interviews were conducted in Arabic and were primarily held in the students' classrooms. Each interview

lasted for 20–30 min, and all were recorded with the participants’ permission. A total of 24 interviews were conducted over the 12 weeks. The translation process of the students’ interviews was similar to that used for the questionnaire. However, due to time limitations, the researcher randomly selected four written Arabic transcripts with their translated versions into English and submitted them to the same two translators.

The collected data were analysed systematically and continuously to inform preparation for the prototyping phase and possible refinement or iterations of the X-based tasks during that phase. Students’ interviews were analysed by adapting the procedures of Braun and Clarke (2006). A constant comparison approach to analysing the data was followed in which each transcript was read and re-read to gain a detailed understanding of the data and identify meaningful parts (Lincoln & Guba, 1985). Through a process of inductive reasoning, initial codes were constructed, reflecting students’ views about X use in the ESP course. This initial coding allowed the researcher to interpret the students’ learning experiences with X use and to create an emergent list of ideas in reference to the pedagogical value of X use in the ESP course. Revision of the emergent codes occurred, and conceptual associations were established between codes and emerging themes were reviewed weekly. This allowed ongoing collating of codes into broader themes, whereas the analysis remained open for generating new themes or refining preliminary themes. Initial themes were generated (Braun & Clarke, 2006) and then reported, discussed, and debated with the researcher and a PhD student studying Applied Linguistics at the regular meeting at the campus. Finally, the analytic process yielded the following themes: *enhanced familiarity with medical terms, perceived ability in English skills, expanding learning medical contents, increased collaborative learning, combatting hesitancy, increased satisfaction with the course, sustaining learning interest and challenges encountered.*

Procedure

Following the four phases described in the DBR framework, the researcher conducted a mixed-research study, designed a task, assessed it, and documented the results along with the practical implications. The four phases of the study lasted 16 weeks and are shown in Fig. 2.

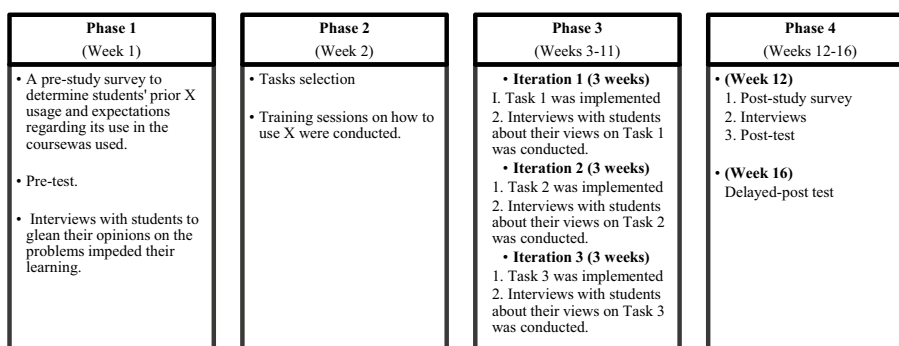


Fig. 2 The four phases of the study according to DBR framework

Phase I: analysis of practical problems by researchers and practitioners in collaboration

Amiel and Reeves (2008) suggested that DBR should begin with “the negotiation of research goals between practitioners and researchers ... in establishing research questions and identifying problems that merit investigation” (p. 35). In the current study, however, establishing the research questions and identifying and discussing the problem supported by a review of the literature to understand and contextualise the problem (Sect. “Literature review”) as well as the researcher reached out to 12 students who had completed their ESP course. Phase 1 began in week 1 of the 16-week semester. In Phase 1, a pre-test and pre-study survey to determine students’ prior X usage and expectations regarding its use in the course were used and interviews with the ESP students were used.

Students’ accounts revealed conflicting feelings about the value of studying the ESP course. They expressed the goal of ESP as enhancing familiarity with medical terminology and fluency in specialised communication. However, a common view was that ESP is ‘complex’ (Alaa) because ‘it has medical concepts that are too complex for me to understand’ (Maram), and ‘there are a lot of difficult medical terms, originally Latin, that require a lot of time to study them’ (Hala). Although it was perceived as difficult, most considered it ‘key to successful academic study’ (Rawan). Some students expressed a hope to ‘engage [ESP] in more interesting ways than the traditional tasks’ (Rose). It was agreed that ‘to establish a good background in the medical field [students] need to use other resources beyond [textbooks]’ (Layan).

Phase II: development of solutions informed by existing design principles and technological innovations

Phase 2 began in week 2 and one of its aims was to develop X-based tasks for ESP students underpinned by the themes explored in the literature and the analysis of data collected from interviews with ESP students in Phase 1. On the basis of ESP students’ interviews in Phase I, X-based tasks featured in this study were intended to (1) follow topics covered in traditional classrooms, (2) expose students to medical terms and specialised language used in the real world, and (3) generate specialised knowledge by using X or, as termed by Rinaldo et al. (2011), ‘learning by tweeting’ (p. 33). In class, the students’ tweets were critiqued daily for quality and language accuracy.

The second aim of Phase 2 was to provide a detailed introduction to X. The students received five training sessions held during class, each lasting 1 h. Using PowerPoint presentations, the students were taught the basics of X—how to open an account, post tweets, use hashtags, retweet or like tweets, reply to others, create threads, and how to enable privacy settings. These sessions were supplemented by questions-and-answer periods over the next class meetings.

The researcher created a new account, separate from the one she actively used for professional communication. This account was created by the researcher for this study, and the students were asked to follow this account and to follow each other so they could interact with each other during the study. Furthermore, relevant profiles and hashtags to follow, including @WHO, @CDC, @SaudiMOH, #asthma, #cough, #health, and #helthtech were suggested, and students were invited to identify others to share with

classmates. Those with their own accounts could choose to use it or create a separate account for the course. As recommended by Junco et al. (2011), the teachers posted tweets regularly to ensure students’ persistence in using X, stimulating discussions, and offering feedback, support, and encouragement.

The students were encouraged to use hashtags before their tweets to expand their reach (Boure et al., 2014), read their friends’ and the course instructor’s tweets, and post five tweets per week. They were also encouraged to follow and interact with professionals and build social connections that digitally spanned greater distances. Following recent studies (Junco et al., 2011; Peters et al., 2019; Borau et al., 2009; Anthony & Jewell, 2017), X use was mandatory. Participation was worth 10% of the final grade.

Phase III: iterative cycles of testing and refinement of solutions in practice

In Phase 3, to test the solution proposed in Phase 2, a X-based task was designed and assessed on 19 ESP first-year female undergraduate students.

Implementing X-based instruction: iteration 1

On the basis of students’ accounts collected in Phase 2, emphasis was given to activities focusing on subject-specific language. Task 1 was developed and lasted for 3 weeks. In Task 1, the students were asked to paraphrase the definitions of 30 teacher-selected medical terms and post definitions on X. Figure 3 illustrates students’ tweets defining

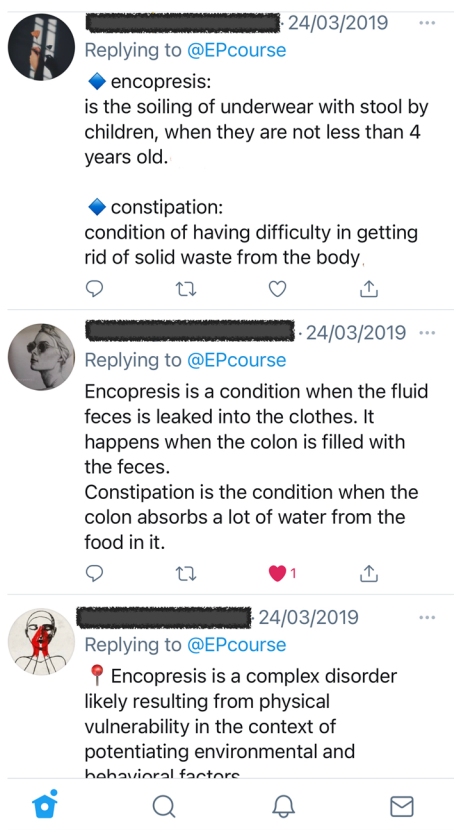


Fig. 3 Task 1: Definition of ‘encopresis’ and ‘constipation’

the meaning of two terms, and students would receive one point if they did so. The researcher used the ‘favourite’ and ‘retweet’ features when a correct definition was posted. The students were required to read the feedback the teacher provided via direct messages and the reply feature. Tweets were critiqued in class for content quality and language use. Language feedback was based on lexis, verb forms, articles, prepositions, and semantic fields. This task was successful in providing students with additional vocabulary-based activities.

Iteration 2

The students reported that X piqued their curiosity, but tweeting medical term definitions was not enough to extend discussions outside the classroom. Students felt that they required more practice to encourage the continuity of class discussion. On the basis of their views about Task 1, Task 2 was designed to encourage students’ discussions and it lasted for 3 weeks. The students were asked to read five medical documents and watch five videos posted by the teacher, tweet back their comments, and answer questions raised by other followers (see Fig. 4), and they would receive one point if they did so. They were required to continue conversations begun in class via tweets and deepen the discussion on medical topics they found complex. The reading topics and videos were based on course content, followed by multiple-choice activities and true/false statements on X to incorporate subject-specific terminology. While the students appreciated this task, they struggled with understanding the text due to limited medical knowledge. In the following example, the researcher posted a link to an article about Tourette’s syndrome and asked the students to tweet their comments (Fig. 4).

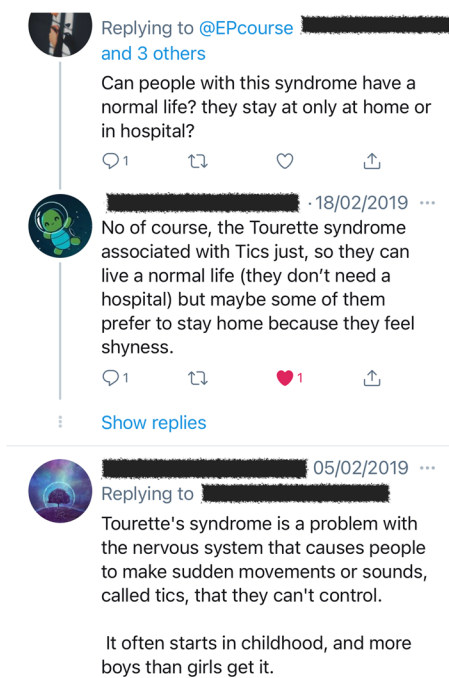


Fig. 4 Task 2: Students’ tweets on Tourette’s Syndrome

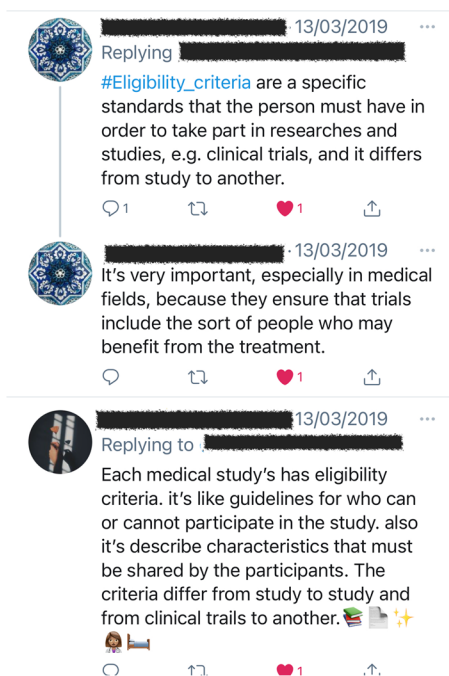


Fig. 5 Task 3: Students' tweets on eligibility criteria

Table 1 Descriptive statistics and mean ranks of the ESP test

	Mean	SD	Minimum	Maximum	Percentiles			Mean rank
					25th	50th	75th	
Pretest	5.89	3.69	1.00	13	3.00	5.00	9.00	1.00
Posttest	48.52	2.11	43.00	50.00	48.00	49.00	50.00	2.79
Delayed posttest	44.63	5.05	34.00	50.00	39.00	45.00	49.00	2.21

Iteration 3

Because the students reported that the content of the material in the reading text or the videos was too advanced for them, the third task was designed to give the students the choice to select and reflect on 10 trending medical or hashtag-driven topics by tweeting comments or answering questions raised by followers. This task lasted for 3 weeks. The students would receive one point if they did so. This task had two goals: minimise the teacher's interference unless the students requested clarification and enhance students' motivation as they selected a topic that matched the level of their medical knowledge and at the same time facilitate real-life experiences where they can engage with professionally oriented contexts. Figure 5 displays the tweets of two students on 'eligibility criteria'.

Phase IV: documentation and reflection on produced design principles

In week 12 (Phase 4), a post-test and post-study survey to explore the extent of students' X usage, its impact on student learning experiences, and their views towards using it in their ESP course were used. Interviews with the students were conducted. Four weeks later (week 16), a delayed post-test was administered to the students to measure whether gains were maintained over time.

Results and discussion

The first research question addressed the potential of this X-based approach to help students develop their mastery of medical English knowledge. Table 1 presents the descriptive statistics and mean ranks of students' scores on the ESP test across three times. In the preintervention, most students had limited ability in medical knowledge (mean rank = 1.00). The scores the students obtained in the posttest revealed that students' ability in medical English improved (mean rank = 2.79). The results of the delayed posttest revealed that X-based instruction not only helped the students improve their mastery of medical English but also maintain that improvement over time (mean rank = 2.21). The difference in students' ESP test scores obtained at the three points in time was analysed using the Friedman Test, and a significant difference was found ($\chi^2 = (2.19) = 33.44$, $p = 000$), thereby confirming an improvement in the students' medical English level.

Researchers have acknowledged that the potential of using X-based approach in improving students' language learning (Hattem & Lomicka, 2016). Studies that have investigated X use in ESP contexts (Pérez-Sabater and Montero-Fleta, 2015; Fouz-González, 2017) have also suggested that X-based instruction can be suitable for ESP students, but Fouz-González (2017) examined how X-based instruction improves ESP medical students' pronunciation of target features in general English words and the lack of empirical evidence in Pérez-Sabater and Montero-Fleta (2015) required further investigation to support the claim in those studies. The data in the current study offers valuable evidence as it examined how X-based instruction can improve students' medical English use and supported its claim with pre-/post and delayed- tests.

Notably, because the use of X in this study was used to supplement the ESP course, it was challenging for the researcher to ensure that the improvement made by the students was a result of X-based instruction or because they were exposed to medical learning materials in their traditional face-to-face ESP course. To control this issue, this study investigated if there was any link between the students' medical English improvements and their participation on X, as well as explored their views about X use on their learning experience. Moreover, the goal of this study was to use X as a part of their ESP course and to help students improve their mastery of the medical English language. Nevertheless, the results support the claim that X can be an effective tool to complement course content and to help students learn course-related information, consistent with other studies (Blessing et al., 2012; Lowe & Laffey, 2011).

The second research question addressed the possible correlations between students' participation scores and their medical English development. To calculate students' participation on X, this study used a point system developed by Mompean and Fouz-Gonzales (2016). Students received one point if they paraphrased the meaning of medical terms that post by the teachers (30 terms–30 points); they received 1 point if they

Table 2 Students' ESP scores and their participation received points

Student ID	ESP test score	Participations points
ESP1	31	44
ESP2	33	50
ESP3	40	50
ESP4	33	44
ESP5	29	27
ESP6	36	44
ESP7	43	30
ESP8	44	50
ESP9	43	43
ESP10	44	49
ESP11	48	50
ESP12	43	49
ESP13	40	49
ESP14	48	50
ESP15	42	49
ESP16	43	47
ESP17	31	49
ESP18	28	36
ESP19	37	29

read a medical document or watch a video posted by the teacher, tweet back their comments, and answer questions raised by other followers (10 documents = 10 points); and they received one point if they reflected on 10 trending medical or hashtag-driven topics by tweeting comments or answering questions raised by followers. Therefore, if the students accomplished all of these tasks, they would receive 50 points. Nonetheless, students with higher levels of participation on X (+50 points) revived gifts from the researchers, but their participation scores were not included in the analysis.

Table 2 compares the pretest and posttest scores and the points gained when students participated on X. Spearman's rank-correlation test indicated a positive correlation between the students' ESP scores and their points of participation on X ($r_s(19) = 0.497$, $p = 0.030$). This implied that increased participation on X may have helped improve their medical English.

X use for educational purposes can help enhance student engagement and improve grades (Junco et al., 2011; Rinaldo et al., 2011). The present study revealed that the students participated much more actively (mean participation rate: 44.15%) than that in the study by Fouz-Gonzales (2017) (mean participation rate: 24.5%). This may be because X-based instruction was used to supplement face-to-face instruction and to enhance course-related interaction, facilitating the students to perceive its use to help them understand medical English. This could also be related to the fact that because it was decided to give credits for X use and because the students know that their tweets will be graded, they become keener to use X (Tang & Hew, 2017). As for the link between the students' engagement in the study and their medical English performance, a positive correlation was found between students' participation on X and their improvement in using medical English, as measured by the ESP test, indicating that the more students

used X, the more their grasp of the specialised language and knowledge construction improved.

The third research question addressed learners' amount of X usage and their views about the pedagogical value of using X in their ESP course. At the end of 14 weeks, the respondents were asked to report the amount of X usage in their ESP course and to answer 12 agree/disagree statements to indicate their view about the pedagogical value of X use in their ESP course. The results from students' frequency of X use indicated that the majority of the participants (68.4%) reported they log in to X continuously, 26.3% log in several times a day, and only 5.3% log in once per day. While a great majority of students (57.8%) followed 301–500 people, approximately 20% of them followed 101–200 people, and only 15.8% followed 201–300. In terms of the number of their followers on X, 68.4% of the students reported they had 11–50 followers, and 26.3% had 201–300 followers. Regarding the average number of tweets, most students (84.2%) reported posting > 30 tweets, with 10.5% posting 21–30 tweets and 5.3% posting 11–20 tweets.

The respondents were asked to answer 12 agree/disagree statements. The results revealed that the students highly valued the use of X in their ESP course (see Table 3). First, the students positively rated items related to X's ability to help them obtain course-related information (item 1; $M=4.84$, $SD=1.37$), keep a record of what they learned (item 2; $M=4.63$, $SD=1.95$), and read others' tweets (item 3; $M=4.01$, $SD=1.76$). Students reported enjoying using X (item 4; $M=3.73$, $SD=1.66$), perceived X as an effective teaching tool (item 5; $M=3.62$, $SD=1.41$) for use in future ESP courses (item 6; $M=3.45$, $SD=1.28$).

However, they gave a slightly low rating to posting tweets (item 7; $M=1.26$, $SD=0.56$). This result is nevertheless accepted in the belief that because the quality of their tweets was counted in students' final grades, the students tended to be more cautious about the quality and genuineness of their tweets (Pérez- Sabater & Montero-Fleta, 2015). It can also be attributed to the fact that some students perceived themselves as lacking medical knowledge, so tweeting on medical topics was intimidating (Lackovic et al., 2017).

Third, using X required the students to put more time into the class than they would in a regular ESP class. As such, they did not feel that X helped them save time or effort (item 8; $M=1.26$, $SD=0.25$). This result could be related to the students' heavy workload; on top of their regular deadlines, the students had to tweet to earn credit. This required time for them to plan their writing, edit their spelling and grammar, and pay attention to the quality of the information they produced. Furthermore, the students perceived that X connected them to their instructors and classmates outside the classroom (item 9; $M=3.57$, $SD=1.12$). Students agreed that using X provided them with a space to interact with their instructor (item 10; $M=3.57$, $SD=1.80$).

Finally, the students did not display an avid interest in using X for social purposes (item 11; $M=1.94$, $SD=0.43$) or socialising (item 12; $M=1.75$; 0.66). These results were not statistically significant and had small effect sizes. This result suggests that using X in learning does not necessarily change views on its value for socialising and networking. However, it can transform social networking into educational networking.

The fourth research question addressed students' views about whether X-based instruction enhanced their learning experiences in the medical ESP course. The analysis

Table 3 Students' perceptions of using X in the ESP course

Statements	M	SD
1. X is a good way to get course-related information	4.48	1.37
2. X is a good way to maintain a record of what I learn	4.63	1.95
3. Reading posts by other students was a positive aspect of using X	4.01	1.76
4. I enjoy using X	3.73	1.66
5. X can be an effective tool for teaching a course	3.62	1.41
6. I would like to see more use of X in my modules	3.45	1.28
7. X is a good way to post information	1.46	0.56
8. X enabled me to save time and effort	1.26	0.25
9. X enabled me to communicate with my tutor outside class	3.57	1.12
10. X closes the gap between students and instructors	3.57	1.80
11. I use X for social activities	1.94	0.43
12. I use X to make personal connections	1.74	0.66

of the students' interview responses yielded seven themes. These themes, along with the students' comments obtained in the interview data, are presented below.

Enhanced familiarity with medical terminology

Although several students expressed mixed feelings about using X, they reported positively about their experiences, calling X 'an amazing tool in learning new medical terms' (Maha) and 'a more engaging way' to learn (Anwar). They perceived that using X was useful for obtaining and acquiring subject-specific knowledge. Tweeting about a term helped integrate the word's meaning into the students' linguistic system. This helped better prepare the students to notice errors and correct themselves.

They reported that reading their peers' tweets on a term definition helped direct their attention to confusing details in some medical terms.

I didn't know that 'heart attack' and 'stroke' describe different problems, but after I scrolled back through Manal's and Aisha's tweets and interpreted their meaning, it shed light on the difference.

–Maram

Students described that using hashtags helped them learn medical terms and clarify new medical concepts:

It was very useful to use the hashtag symbol to look for certain tweets about asthma. I read tweets posted by doctors. Moreover, I read tweets written by patients struggling with asthma...with the hashtag, I felt that I was on track with everyone else.

–Fatima

They explained that posting images was 'an easy way to...learn a new medical word' (Amal) and 'an interesting way to remember words' (Heba). Others agreed that visual images facilitated term acquisition and made memorisation less tedious:

Some tweets were in the form of images, and others were links to videos. Images... saved a thousand words and helped me acquire and recall meanings.

–Layan

Some students perceived X as ‘a dictionary’ (Heba), and others saw it as ‘an online vocabulary notebook’ (Rose) for saving key medical terms and recording word definitions. They also remarked that because they used some of the interactive features on X, such as *like or retweet* or *save* for recording key medical terms, it became easy for them to prepare for their next class and review what words they had discussed in the class.

Perceived ability in medical english skills

The students perceived that X improved their writing skills and helped create habits of looking up words and using concise expressions. Although this contradicts data generated from the students’ responses on the questionnaire (i.e. when they lowered their rating of tweeting at the end of the study), it indicates that the students become more aware of X’s usefulness in improving their English writing.

Before I post a tweet, I work hard to find the appropriate words and straightforward expressions to ensure that my followers understand my message as quickly and easily as possible.

–Nada

Before tweeting about a selected text, the students would practise analytical reading, deduce the meaning of unknown terms, and make inferences to ensure their tweets’ accuracy. Thus, they encountered reading strategies focused on the rhetorical features of the target community. Handi observed that even when reading a difficult text about the brain, she could understand the text’s semantic/linguistic aspects and infer the meaning of unknown medical terms:

Before I wrote my tweet on brains, I selected the article and found some words were difficult, so the best thing I did to accomplish that task was to analyse difficult words and make use of prefixes, sentences, and information around the problematic word to work out the meaning of the text.

–Handi

Other students shared thoughts on the reading topics to develop their medical knowledge:

Handi’s tweets about the essential tremor or ‘ET’ helped to keep me attentive to key points in the ESP course that I hadn’t paid much attention to.

–Rawan

X provided the students with opportunities to practise specialised language, but this demanded time and effort. Before tweeting, the students had to read course-related information, think about what original ideas to build on, plan how to write their tweet,

and then edit it. These accounts mirrored their questionnaire responses about how X did not save them time or effort.

Expanding learning medical contents

Most students reported that they used X to obtain and share information useful for learning their ESP course and to access resources for the latest medical-related topics that could not be learned from their ESP textbook. These resources included watching videos on surgical operations or interviews with famous health professionals, browsing up-to-date medical-related posts and following the accounts of health organisations and the health community on X, and retrieving information from recommended links shared by their teachers or posted by their classmates or other X users.

Interview quotes like 'X is a useful learning environment in which we expand our medical background' (Rose), 'I learned a lot about diabetes topics from only clicking the links posted by the teachers and my classmates' (Asma) and 'I felt that only by posting a question on X, I received various information that could widen my medical background' (Rawan) abounded in their interview accounts about the impact of X on expanding their medical knowledge.

Some students voiced their appreciation of the value of X use in keeping them updated about the most common chronic diseases in Saudi Arabia. One student commented that exchanging tweets with her classmates exposed her to 'interesting medical procedures taken by other countries to treat obesity and diabetes, and which were completely not discussed in their ESP textbook' (Rawan). Another student mentioned that she read a tweet shared by a follower that enhanced her awareness of a new procedure for treating diabetes.

It was an interesting post shared by one of the followers. It was about the islet transplant procedure, a technique used to treat diabetes. You know diabetes is the most common chronic disease among Saudi people, and to learn more about how this procedure is effective and at what rate of success it is achieved is important to me as a premedical student. Although this treatment is not discussed in our ESP textbook, X introduced me to this interesting information and to other X users who were exchanging information about this topic, and this allowed me to expand my knowledge about it.

–Asmaa

Some students reported that they sometimes did not engage in discussion on X with other students, but they repeatedly watched videos and explored the links to resources shared by other students to catch up on what they missed and to expand their learning. However, they only did so when they were really interested in a particular medical topic. Other students felt that tweets posted by their teachers were of great value to them in terms of deepening their medical knowledge. Although they acknowledged that some tweets were about topics that were not included in their ESP textbooks and thereby, they were not assessed on them in their quizzes and exams, students saved teacher's tweets to read them later and deepen their knowledge.

I saved all my teacher's tweets because she posted information that is important for our academic and professional development, and when she posted extracurricular threads, I saved them quickly for later review.

–Layan

Increase in collaborative learning

The students used X to share ideas and compare notes with their peers and the teacher. They valued the collaborative aspect of X, which extended discussions outside the classroom.

There was a long discussion in class about Tourette's syndrome, and we continued on X afterward. We asked interesting questions, shared views on how it can be treated, and learning occurred without meeting physically in the classroom.

–Hala

They felt that working collaboratively expanded learning opportunities beyond the classroom and that tweeting course-related information helped them build professional contacts. Lama said that X helped her feel connected to experts and professional networks:

X encouraged me to follow and communicate with medical experts, and this enhanced my knowledge of the most recent real-life medical topics, which in turn increased my interest in sharing the information gained with friends in and outside the classroom.

–Lama

Combatting hesitancy

Most participants felt that X prompted shy students to speak up because it reduced 'fear and embarrassment' (Mai) and 'was less threatening' (Amani). X permitted time to organise their thoughts, so the students were more confident in voicing them:

I'm not confident in speaking in front of others in the class. However, on X, I had time to prepare my answer and check it several times before I posted it.

–Maram

Satisfaction with the course to use in future classes

The students' views on X as a teaching tool to increase satisfaction supported their responses to the questionnaire (i.e. having strongly enjoyed using X as a learning tool and would consider using it in their future ESP courses). The participants concurred that

X changed their perceptions of ESP courses. While acknowledging that ESP is ‘incredibly important but also difficult’ (Amal), the students expressed appreciation for using X. It helped them learn more about course materials by connecting course content to real-life experiences. It helped one student gain knowledge by ‘showing me how to apply course-related material to the real world, [making] me more interested in the course’ (Rawan) and another by ‘adding depth to our classroom discussions, [it made] me more satisfied with the course’ (Amani). Furthermore:

Everyone says ESP is a hard course because it requires learning Latin words and medical concepts...but after using X, learning ESP turned out not as hard as we expected.

–Najwa

Sustaining learning interests

The students’ accounts revealed that medical interests were one of the major driving forces behind the use of X in their ESP course. Phrases like ‘to stay updated with the latest health issues’, ‘searching for health answers’ ‘interesting medical procedures to learn’, ‘up-to-date medical topics’, and ‘following health professionals and surgeons to get their medical news’ dominated students’ narratives. One student expressed how she became interested in learning more about separating conjoined twin operations after reading a trend about it on X. Fatima added:

I read a trend on X about conjoined twin separation and felt the value of using X in our fields to actively seek the latest medical news. This trend took me to read various threads discussing this type of operation, and this is very interesting to me.

The students expressed a high level of convenience and flexibility of X and felt that this feature helped sustain their interest in using X. They felt that X offered them a convenient channel to enhance their ‘by engaging us to discuss topics and communicate our thinking with other classmates even if we were not physically present in the classroom’ (Fatima). They used phrases such as ‘flexible’ (Lama), ‘comfortable’ (Rawan), ‘handy’, and ‘accessible’ (Rose) to describe their experience with using X.

Challenges encountered

Most students cited the challenge of self-perceived inadequate knowledge, which hindered their X contributions. They stated that the topics discussed on X were ‘beyond our knowledge’ (Lama), and ‘because the discussions on X tended to be very deep, we were less likely to post a tweet’ (Ameera). They described X as ‘a heavy load’ (Amani), adding:

I actually learned a lot about medicine, but because we are still beginners in this field, we are not sure if we can contribute the right information.

–Maram

Some students stressed over grades, suggesting that X use should not be graded. Still, they noted X as having a positive influence on hard work:

It was a big challenge for me, and the idea that my tweets would be checked and graded really increased my concerns. However, that helped me because I was ready to work hard.

–Rawan

Another challenge students perceived was that ‘posting 10 tweets became log-in overload’ (Layan), creating ‘an inconvenient duty to check X every second’ (Huda). Students did not like ‘being bound to X for the rest of the day’ (Alaa) because they still had to meet deadlines for other courses. Some students wished to reduce their daily tweets from 10 to 2, whereas others wanted to tweet more. The participants agreed on X’s potential for exchanging ideas but viewed it too demanding for those who felt obliged to complete several tasks before posting a tweet due to their poor English language proficiency:

Because my English is poor, I spent several hours just thinking about writing a tweet that was both coherent and concise, checking grammar, and spelling. It was not easy.

–Aisha

A few students also reported that limited English language proficiency constrained their interactions with their teacher and classmates on X. For example, one student indicated that although her teacher encouraged her classmates and her to tweet and would even discuss some of the grammatical errors before the class, she would just ‘read her classmates’ tweets but would never tweet because it was difficult to write in English’ (Hala). One student felt ‘not comfortable’ posting tweets with poor language or full of grammatical mistakes; another felt embarrassed because she ‘used very simple English words to communicate with the followers on X’ (Lama). Aisha commented, ‘If I felt my language simple or wrote something unintelligible, it would be very embarrassing, so I stopped tweeting’. One student reported that when she posted a tweet that did not receive any likes at all, it was only because her ‘tweets were full of language errors’.

The qualitative analysis confirmed the quantitative results, giving us an explanation as to why students perceived X as a useful pedagogical tool in their ESP courses. The students reported that tweeting about the meaning of specialised vocabulary enhanced their familiarity with the terms, which reinforced their knowledge of both meaning and proper use. They used hashtags to locate subject-specific posts, which enabled them to read terms in various contexts, reinforce recall, and connect the terms to related topics (Lackovic et al., 2017; Luo & Xie, 2018). This supports Pérez-Sabater and Montero-Fleta’s (2015) finding that X exposes students to scientific words and helps them successfully incorporate vocabulary into tweets.

As in previous studies, X’s richness in providing multimodal resources for medical terms increased students’ internalisation of specific terms (Blattner & Dalola, 2018; Fouz-Gonzales, 2017; Hattem, 2014). This mirrors Fouz-González’s (2017) study, which found that using X in a language classroom enhances students’ language abilities by increasing their ability to notice patterns in the target language. The students in the

current study were asked to define a medical term and tweet about it in their words. Thus, X enabled multiple exposures to medical terms, offering the chance to identify different dimensions of meaning and deepen knowledge. For a term to be acquired, it must first be noticed and then recalled at spaced intervals (Nation, 2001; Mezek, 2013).

Unlike previous studies (Kassens-Noor, 2012; Prestridge, 2014), the students in the current study did not find that X's character limitation restricted the in-depth critical thinking required for collaborative writing, nor did it increase misunderstandings between classmates and the teacher. Tweeting within the limit forced students to better organise ideas, find appropriate words, and check texts for errors. The students focused on writing in a clear, precise format because the tweets were visible, and they wanted their contributions to benefit their peers. Pérez-Sabater and Montero-Fleta (2015) reported that tweeting made participants attentive to the formal aspects of writing in English; others (Castrillo de Larreta-Azelain, 2013) reported that involvement with X contributes to writing competence. Consistent with previous studies (Peters et al., 2019; Tiernan, 2014), the current study found that X enhanced student engagement, particularly for those who were not confident interacting in traditional classes. Shy students were encouraged to communicate in English (Borau et al., 2009), voice their opinions, and ask questions, which they might have been reluctant to do in traditional classrooms.

While X enhances learning experiences, some challenges exist. The students expressed that their limited background in the medical field inhibited their contributions, and they tended to view topics discussed on X as beyond their knowledge. Thus, instructors should plan the learning process carefully; they need to clearly define course objectives and learning goals and develop instructional activities that suit learner knowledge levels and require interactive participation. Instructors might consider conducting a needs analysis before incorporating X to address their students' current linguistic skills and the knowledge they need for their future roles.

Conclusion

The results described above suggest that the X-based instruction, which was designed, assessed, and analysed following the DBR framework by Amiel and Reeves (2008), helped improve students' medical English ability from pretest to posttest, and this improvement was maintained over a month after the X intervention. The results highlight how micro-blogging-based tasks can provide opportunities for immersive experiences that enhance students' grasp of the specialised language and knowledge construction required in their intended career.

Drawing from the findings, four main lessons are learned. First, the literature on X usage in educational settings concurs that being a digital social media novice or lacking familiarity with how to use it are central issues affecting students' motivation to use X, reducing their expectations of its pedagogical benefits (Tang & Hew, 2017; Welch & Bonnan-White, 2012). Thus, X training sessions should include both operational and interactive features to increase students' interest in using X in their course and to deal with any potentially uncomfortable situations.

Second, providing clear information about X-related activities is important for students to actively participate. Tang and Hew (2017) suggested that providing students

with clear descriptions of the X-related tasks and what was expected from them to do promoted them familiarity with X and enhance positive attitudes towards using it.

Third, for learners to construct knowledge and produce target language independently, teachers and peers should provide appropriate support. Scaffolding and regular academic support should be provided to ensure persistence in using X (Vygotsky, 1978).

Fourth, although Adams et al. (2018) found that giving course credits for X use did not stimulate participation; the current study indicated that awarding marks for tweeting motivated the students to tweet. Furthermore, when the students know that their tweets will be checked out and graded by the teachers, they would not use surface-level (Tang & Hew, 2017, p. 111) posts. They would avoid contributing a tweet that is meant to be simply a rehash of other students’ comments or a tweet that does not demonstrate thoughtful comment. Giving course credits to X usage has also been recommended elsewhere (Chawinga, 2017; Ebner et al., 2010; Peters et al., 2019).

Because of time and access constraints, the current study was confined to one course, offered to a small sample size, and relied on self-reported data. It would be useful to investigate the use of X across a wider range of contexts, such as subject area, year of study, and the perspectives of male and female students. In addition, it would be useful to explore the value of X use versus other social media tools to determine its impact on student engagement and learning.

Appendix A: pre- and post questionnaire

Section A: choose the responses that best match your opinion

What is your age?	Less than 18 18–21 22–24 29–34 35–42 43 or over
Which of the following do you use most often to access X?	Desktop computer and web browser Laptop and web browser Mobile phone and web browser Mobile phone and X app Mobile phone and SMS Tablet and X web browser Tablet and X app
Do you have an X account before you use X in this course?	Yes No
How often do you log on to your X account?	Less than once a month Once a month Less than once a week but more than once a month Once a week Less than once a day but more than once a week Once a day Several times a day continuously

How many people do you follow on X?	10 or less Nov-50 51-100 101-200 2001-300 301-500 5001-1000 More than 1000
How many people are following you on X?	10 or less Nov-50 51-100 101-200 2001-300 301-500 5001-1000 More than 1000
How many posts or retweets do you make per week?	Less than 1 01-May 06-Oct Nov-20 21-30 More than 30

Section B: in this section, please respond whether you agree or disagree with the statements about using X in your ESP course

Statements	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1. X is a good way to get course-related information	1	2	3	4	5
2. X is a good way to maintain a record of what I learn	1	2	3	4	5
3. Reading posts by other students was a positive aspect of using X	1	2	3	4	5
4. I enjoy using X	1	2	3	4	5
5. X can be an effective tool for teaching a course	1	2	3	4	5
6. I would like to see more use of X in my modules	1	2	3	4	5
7. X is a good way to post information	1	2	3	4	5
8. X enabled me to save time and effort	1	2	3	4	5
9. X enabled me to communicate with my tutor outside class	1	2	3	4	5
10. X closes the gap between students and instructors	1	2	3	4	5
11. I use X for social activities	1	2	3	4	5
12. I use X to make personal connections	1	2	3	4	5

Appendix B: X interview questions

-
1. Can you tell me what do you think about social media?
 2. Can you tell me what do you think about X?
 3. Can you tell me about your experiences of the use of X in your ESP class?
-

-
4. Can you tell me whether has had any type of impact on your learning of the ESP course?
 5. What did you most value about the use of X in the ESP course?
 6. What did you most undervalue about the use of X in the ESP course?
 7. Does it affect your involvement during lecture or outside of the classroom?
 8. Do think that using X added to your classroom experiences?
 9. Is there anything else you would like to add about how to use X in the ESP course?
-

Author contributions

The author confirms sole responsibility for the following: study conception and design, data collection, analysis and interpretation of results, and manuscript preparation and submission.

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Availability of data and materials

Data and materials will be available upon request.

Declarations

Ethics approval and consent to participate

The intervention under study was part of a plan to improve the ESP course's teaching approach and was implemented by the English teacher after extensive training and piloting. The students had been informed of this intervention and had agreed in writing to be taught using the X-based approach. All participants will remain anonymous and data will be recorded and processed before completion. Only the researcher involved in conducting the research will have access to this data as it is strictly confidential and once the study has been completed all participant data will be destroyed.

Competing interests

The authors declare no competing interests.

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