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Exploring the Potential of Game-Based Differentiated Instruction in English for Specific Purposes Writing Education

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Abstract

The incorporation of applied games in university differentiated language instruction is increasingly prevalent. This interventional study was conducted through non-crossover design in the academic years 2020-2021 among the students of Isfahan University of Medical Sciences. The quantitative and qualitative data were gathered by soliciting participants' attitudes towards English for Specific Purposes writing through (game)-based differentiated instruction, assessing their academic and professional writing, and debriefing their insight into how differentiated instruction might enhance English for Specific Purposes writing. While the quantitative data were analyzed through Wilcoxon signed-rank test and repeated measures ANOVA, the qualitative data were content analyzed through theme-based analysis. It was revealed that mixed reality harnessed the synergy of augmented reality and virtual reality in English for Specific writing education. Findings showed that single-minded preoccupation with a game type undermines the potential of game-based differentiated instruction in English for Specific Purposes writing. The results and implications are explained.

Keywords: differentiated instruction, game, socio-cognitive approach, writing, English for Specific Purposes

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1. Introduction

Game-based learning is unquestionably a new ambiance for observational learning in English for Specific Purposes (ESP) education. Despite synthetic scenes of new games, most students are highly interested in game-based ESP learning (Wang et al., 2018). The academic and professional needs for which students learn ESP skills underline the importance of differentiated instruction. This type of language learning in university refers to the socio-cognitive approach to ESP learning that is characterized by making tailor-made arrangements for students' needs (Bannur et al., 2014). Due to the importance of ESP writing in communication and the burgeoning of the socio-cognitive approach (Auris, 2021; Cheung, 2016; Green, 2013), there has been a surge of interest in game-based language learning over the last decade and a shift from one-size-fits-all teaching to differentiated instruction (Suprayogi, 2017). However, given that ESP writing is a multifaceted combination of different but complementary dimensions tied together by their academic and professional orientations toward the actual world, differentiated instruction needs to be specially manipulated. Although a myriad of games was previously developed for university language learning (e.g., Kutlu, 2013; Moncada-Comas & Diert-Boté, 2022), there has been a scarcity of research on the amalgamation of applied games as a perfect vehicle for an accurate representation of the needs (e.g., Teo et al., 2022), which stresses more research is still required to fill the lacuna.

As a potential source of differentiated instruction, Augmented Reality (AR), Virtual Reality (VR), and Mixed Reality (MR) sit well with the current view of postsecondary education for ESP learning (Alfadil, 2020; Habeb Al-Obaydi et al., 2023; Martin, 2019). Based on a review of previous related theories, Bošnjak Terzić and Pavičić Takač (2020) introduced the socio-cognitive approach for ESP learning, including major components of the workforce, relations with audience, imaginative practice, and contextual mastery. Richards and Schmidt (2013) asserted that audience expectations are at the core of one's socio-cognitive approach to ESP education. According to Qiu et al. (2021), although the games are used to meet expectations, the principal direction of ARs and VRs is different in university language education; that is to say, while the focus of AR is on the receptive skills, productive skills are situated at the focus of VR. Research has indicated that VR is

associated with immersive learning (Blyth, 2018) and virtual dialogue (Nicolaidou et al., 2021). In tandem, MR advances AR and VR to adequately instantiate actual settings in language learning contexts (Lee & Park, 2020; Tang et al., 2020).

Therefore, as another successor of the socio-cognitive approach, while being associated with differentiated instruction, game-based language learning (Carroll & Grenon, 2021; Derakhshan, 2022; Hung et al., 2018) is replete with fluctuation of real-world phenomena, and attention should be given to how students are propelled further into the exploration of the scenes (Reinders, 2012). The games also tend to incorporate components of differentiated instruction that promote students' cognition (Berns et al., 2016). This way, to be viable activities, there is often an assumed prescription for how applied games should be tailored to the needs. In many contexts, some games are related to the expectations in the actual world. Similarly, Huang et al. (2022) maintained that linking ESP classrooms to the real world through the immersive scenes of applied games helps students be part of the education.

Although research on game-based differentiated instruction has been gradually accumulating in language skills education, there has been scant attention in ESP education. Similarly, Holtzman et al. (2005) have stated that writing skill is the primary communication vehicle for students in college and professional contexts. Yet, it has moved into the shadows in the previous decade of game-based differentiated instruction research. Lan et al. (2018) gave good reasons for this scarcity by pointing out that the current literature has mainly attended students as the passive recipients of materials embedded in the games (e.g., Franciosi, 2017; Holden & Sykes, 2011), to the one-size-fits-all scenes of the games. The socio-cognitive approach regards games as interactive language learning environments focusing on adaptive ESP education, while meeting the expectations are at the center of attention (Gural & Shulgina, 2015). Therefore, from a socio-cognitive perspective, this study departs from undifferentiated game-supported instruction by exploring the potential of ARs and VRs as two popular applied games showing potency for concretizing the needs in ESP classrooms. As Khazaie et al. (2022) have announced, due to the heterogeneous nature of ESP learning, it seems indispensable for teachers to carefully match the game scenes with the ESP skills they teach to enhance students' competence in the actual world.

The distinct element in academic and professional development is having students engage with the workspace while in the ESP classrooms (Ascione, 2018). Therefore, the importance of regulating the scenes of games is noteworthy in ESP education, where both receptive and productive skills contribute a lot to the quality of communication that students must establish to address needs. Teo et al. (2022) argued that with verbal clouds of ARs, students could successfully understand conflict situations and work towards the academic ESP goals. The importance of students' immersion for ESP learning is well captured in Arnó-Macià and Mancho-Barés's (2015) study, endeavoring to dwell upon what VR-based ESP learning module is and how diversified features of the games facilitate students' communication. Nevertheless, as Chen and Liu (2021) stated, there is little research on how applied games are employed for differentiated language instruction to foster students' communication with the prime goal of booming in their academic and occupational undertaking. The prospect is that with the recent rise of the games in higher education (Gómez & Suárez, 2021; Whitton & Langan, 2018), which entered differentiated language instruction in the two previous decades (Peterson et al., 2022), more attention can be devoted to socio-cognitive approach in ESP writing education (Teng, 2021).

At the same time, while numerous studies have been conducted on each component of game-based language instruction (e.g., Gamlo, 2019; Thompson & von Gillern, 2022; Vandercruysse et al., 2013) in higher education, no study has investigated these components simultaneously to examine the transversal nature of the differentiated instruction for ESP learning. To bridge this research lacuna, this study explored the potential of game-based differentiated instruction for ESP writing education among west Asian students.

2. Literature Review

2.1 Differentiated Language Instruction

As a pretty new education method, differentiated language instruction has been defined from different views since its conception (Sapan & Mede, 2022). For Archambault et al. (2022), differentiated instruction means customizing lessons to students' cognitive abilities to be prepared to cooperate in addressing their needs. Landrum and McDuffie (2010) conceptualized differentiated instruction in higher education as using different strategies for teaching the same lessons to all students, affecting their engagement during the course. Suprayogi et al. (2017) claimed that one-size-fits-all and differentiated instruction are two ends of a continuum in university language education. Teachers can move on the continuum depending on students' cognition in language learning. However, Dack (2019) referred to differentiated instruction as accommodating teaching to each student's learning process through defining proactive roles for students and later developed educational technology-supported modules for instantiating the audience expectations (Karst et al., 2022). Proactivity involves portraying the expectations of the audience to encourage effort among students to address the needs.

Following the growing interest in the mainstream socio-cognitive approach, concerned primarily with shifting the focus of students' attention to audience needs, researchers were more interested in reifying content materials and activities (Chang et al., 2021; Harsono, 2015). During the previous decade, however, interest in the socio-cognitive approach in ESP education has turned researchers' attention to working out viable strategies regarding students' cognition in the process of meeting the needs (Xia, 2021), and hence attention kept on enhancing students' communicative competence and their interpersonal communication (Kang et al., 2021; Nizamova, 2021). Differentiated language instruction in higher education tends to represent more lively settings for practice and encourage students to commit to learning for needs (Müller & Mildenberger, 2021; Ramlo, 2021).

Examining a sample of 200 English teachers at universities of the UAE, Ismail and Al Allaq (2019) focused on students' interaction in differentiated language classrooms. Results revealed that cooperative learning and differentiated instruction

sit well with each other. Differentiated language instruction was found to increase classroom interaction. One of the limitations of this explanation is that it does not explain why differentiated instruction and cooperative learning enjoy a mutual relationship in university language classrooms.

Similarly, in a biphasic study with 400 instructors in teacher education colleges of Ethiopia, Zelalem et al. (2022) examined the practices of differentiated instruction. The results indicated that differentiated instruction encouraged students to produce their ideas. It was also found that differentiated instruction calls for teacher training. The key problem with this explanation is that a clear boundary was not for differentiated instruction in college general and specific language classrooms.

In another study, Kohnke (2022) explored the viability of differentiated instruction through chatbots. Qualitative analysis of interviews showed that differentiated ESP instruction sets the scene to ensure smooth experiences in the world for all. This way, differentiated instruction facilitated conversations within the academic community by hosting all students.

Regarding research on differentiated language instruction in higher education, it is to be noted that research is scarce, and previous studies have well attended to instruction in relation to academia, possibly following the mainstream education research toward academic needs (Bredow et al., 2021). Even the studies done on differentiated ESP instruction have focused on their contribution to academic needs (e.g., Broucker et al., 2021; Lepori, 2022) rather than audience expectations. However, to support the growing attention to the socio-cognitive approach in language education and to make a feature of professional needs (Schnaubert et al., 2021), this study examines the potential of differentiated instructions in ESP writing classrooms.

2.2 Socio-Cognitive Approach

Following the socio-cognitive approach to teaching foreign language writing (Weir, 2005), and its reintroduction by learning communication in higher education (Ayu,

2020; Liao et al., 2022), it is becoming increasingly important for educators and administrators to justify instructional-learning procedures to students' needs. Language instruction in higher education has recently been restructured to focus more on students' learning processes (Pirhonen, 2022). The updates included contemporary approaches to improve students' learning.

The socio-cognitive approach has been adopted in higher education for teaching communicative skills of writing (He & Jiang, 2020). To be more specific, in Asian higher education, the socio-cognitive approach to teaching writing relates to gathering students for having communication with the real world (Tarmizi et al., 2022). Jackson and Cho (2018) introduced the recent models of the socio-cognitive approach in blended language classrooms of higher education described by three tiers: cooperative engagement, personalization, and empowered learning. Cooperative engagement means bringing students together to help each other learn the skills. Personalization pertains to customizing instructional-learning settings in relation to students' cognitive learning process. Empowered learning is the integration of tailor-made activities through educational technology to gain competence.

Various studies have examined the socio-cognitive approach to language learning in higher education. Chandrasegaran (2013), considering writing as a cognitive and social process, explored the effectiveness of adopting the socio-cognitive approach in the university language classrooms. The analysis revealed that the student partnership during writing facilitated the cognitive process of writing. The main limitation of the incorporation of approach, however, was a holistic policy to deal with students' concerns. Through the socio-cognitive approach, Sosnik (2018) also studied the socio-cognitive approach through modular units in language classrooms of higher education to enhance 4Cs skills that help collegiate students develop the creative, critical thinking, communication, and collaboration needed for success in real-life contexts. He evinced that these units give students a hands-on experience.

Similarly, Ling et al. (2022) argued that students' active role in cognitive and social research, is perhaps gaining a greater voice as colleges integrate widening

participation in the move towards educational technology-oriented language learning. According to Ling et al. (2022), research evidence has shown that students' cognitive engagement is essential for the acceptable performance of students through ESP classrooms to professional contexts because engagement in language classrooms can foster rapport among students and promote students' achievement. Therefore, this study endeavors to continue this budding line of inquiry on socio-cognitive approach to ESP writing (e.g., Malinowska, 2022; Rezaei & Marandi, 2022).

2.3 Game-based Language Learning

With the recent burgeoning of the socio-cognitive approach and differentiated instruction in language classrooms of higher education has come the exploration of how students' academic and professional needs can be portrayed (Davis & Phyak, 2016; Jennings, 2018; Li, 2022; Van Lier, 2014). An ideal vehicle utilized in such research efforts is the applied game, developed in different formats since its materialization in the 1990s (Wen, 2019). To be more specific, to van Heijst et al. (2019), the applied game is an augmentation to the process of language learning (e.g., AR). Hammer et al. (2018) defined game-based language learning as a 3D environment to instantiate real-world phenomena. Connecting the scripted scenes of ARs with the immersive scenes of VRs through MRs establishes a natural context for commuting between classrooms and workspaces. In ESP skills education, Hsu (2018) defined game-based language learning as a tool (e.g., MR) to address students' needs in a manner that is sufficiently interoperable to be tailored spontaneously to students' different proficiency levels.

MR-based language learning performs two major functions: immersive platforms are used to instantiate the world with the support of others. At the same time, annotations are employed to enhance the language learning process (Li & Wong, 2021). With the proliferation of educational technology in universities, administrators are looking for direction on how to capitalize on games to promote students' communicative competence. In this regard, game developers and teachers may customize the scenes to enhance students' communicative competence in

academia or tailor the settings to help students get on with professional tasks (Sykes, 2018). Gaol and Prasolova-Førland (2022) highlighted the interoperability of the MRs that provides an opportunity for gear to different situations. In a well-validated MR-based language activity, a field trip is used to tackle the needs that merit immersive study. In scripted scenes, emphasis is placed on the academic aspects of universities language education.

Since their introduction to English language courses of higher education, the applied games have been well researched, helping to identify their potential. For instance, in a review article, Zou et al. (2021), examined a series of studies on game-based language learning in higher education. Findings showed the potential of games in university language classrooms as they tended to enhance learning language skills, promote engagement, and foster a social go-togetherness among students. However, the existing studies rarely compared or contrasted the potential of different types of applied games in university language education. In another study, Katz et al. (2022) investigated the effectiveness of VR in language classrooms for immigrants in universities of Finland. They proved the applicability of VR for differentiated language instruction. The evidence suggested quite strongly that the scenes of the games should be developed with the end-users in mind. Finally, Govender and Arnedo-Moreno (2021) reviewed 114 studies on applied game-based language learning on how these modules affect students' performance. The major findings that emerged from reviewing these studies are as follows: narration, levels, and feedback were the key components of games; the games were developed according to students' age to practice receptive (vs. productive) skills. Thus, game-based language instruction has the flexibility to provide individualized learning.

Despite their prominence in higher education research, applied games have been the focus of few studies in ESP skills education, focusing mainly on general language education in their one-size-fits-all format (e.g., Blum, 2022; Khazaie et al., 2019; Pappa & Papadima-Sophocleous, 2019; Riahipour & Saba, 2012). According to Liton (2015), in ESP classes, games provide an opportunity for real communication. It is believed that ESP learning is a socio-cognitive process considering building peers' support as a catalyst for interpersonal communication (Feak, 2012). As to the application of games for ESP learning, vicarious experience of real-life phenomena

through the scenes of applied games is reasonably required (Zhang & Ardasheva, 2019). Therefore, the major aim of this study is to promote a socio-cognitive approach in the game-based differentiated instruction modules. It is believed that when expectations of an audience are instantiated, scene can be set up and changed according to students' needs, which accentuates further study on game-based differentiated instruction for gaining communicative competence in ESP classrooms. Students need to be empowered to take control of games in ESP by asking how they could employ scenes in a positive manner to affect social change (Pusey, 2018).

As regards the studies on game-based language learning, for example, in a qualitative study, Hung et al. (2018) reviewed 50 empirical studies conducted from 2007 to 2016. The results indicated that most of the research was done at the university level with prominent features such as custom-built and variegated practice scenes. In another study, Escudeiro and de Carvalho (2013) examined the applicability of games in university language instruction relative to the use of English skills for meeting professional needs in six situations. The findings showed that, both language learning and professional competence were enhanced in game-based language education. Similarly, Blume (2020) endeavored to uncover the strategies teachers and game developers employ to promote the applicability of games in language classrooms of higher education. Analyzing survey data from EFL teachers revealed that considering their prior experience in developing the games was a prerequisite for helping students become competent in communication.

This study takes a socio-cognitive stance in endeavoring to realize the potential of games for differentiated ESP instruction examining instantiation through new generation of games in writing classrooms of university. Accordingly, the research questions are as follows:

Research Question(s)

1. What are students' attitudes toward the (game-based) differentiated instruction for learning ESP writing?
2. Is there any significant difference between students' academic and professional writing in the (game-based) differentiated instruction through AR, VR,

or MR?

3. How did participants perceive the (game-based) differentiated instruction of ESP writing?

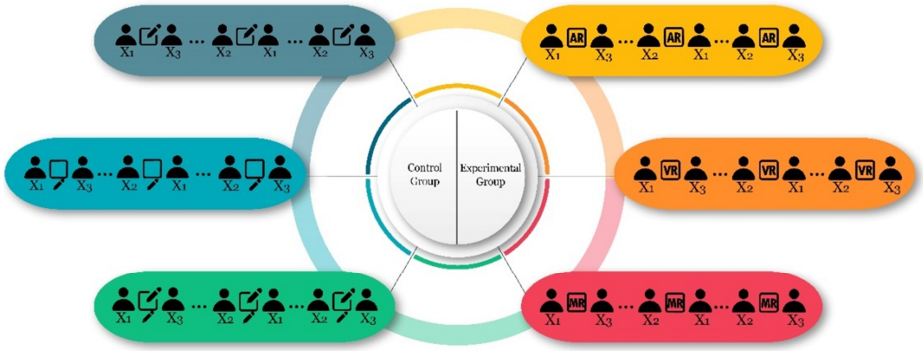
3. Method

3.1 Participants

The participants were selected through convenience sampling from 641 male and female students who took the obligatory course of ESP in the academic years 2020-2021 at Isfahan University of Medical Sciences. They were students in the medical library, health information technology, occupational health engineering, environmental health engineering, nursing, medicine, and operating room. They were native speakers of Persian, Arabic, Urdu, and Hindi. The average age of participants was 19.4 (standard deviation: ±.061). Six hundred and six students signed an online consent form agreeing to participate in the study. To determine participants' English writing, an *English Language Test for Healthcare Professionals* was administered. The test had two writing tasks. After scoring participants' tests, they were defined in three levels: lower-intermediate (55-69%; n = 216); intermediate (70-88%; n = 219); and upper-intermediated (89-100%; n = 171) English writing proficiency. The participants were assigned into control and experimental groups through random stratified sampling; this way, they were paired in heterogeneous dyads and assigned into subgroups of control and experimental groups through block randomization. The makeup of the groups and subgroups is displayed in Figure 1.

Figure 1

The Make-up of the Groups



Note. x can be student of medical library (L), health information technology (HIT), occupational health engineering (OHE), environmental health engineering (EHE), nursing (N), medicine (M), and operating room (O). 1 = student with pre-intermediate writing proficiency; 2 = student with intermediate writing proficiency; 3 = student with upper-intermediated writing proficiency.

3.2 Procedure

This study with two different interventions was conducted through the non-crossover design as follows:

3.2.1. Attitude and Perception Survey (week 1 and week 8)

To gauge the participants' satisfaction and debrief their perception of ESP writing through the (game)-based differentiated instruction, adopting Hilliard et al.'s (2020) questionnaire, a survey with eight items was conducted in week 1 and week 8 through the message panel of the Learning Management System *NAVID*. The two-phase survey was conducted in the participants' first language. Participants' perception of the differentiated instruction was debriefed through the comment boxes of the survey and two open-ended questions either orally or in writing. The sample items of the survey are shown in Figure 2. To maximize the effectiveness of the survey and to establish its content and face validity, the questionnaire was piloted and reviewed by other researchers not involved with this study.

Figure 2

Sample Items of the Survey

Potential of reified activities:

- [in the beginning/during the course] I believed that reifying activities helped facilitate ESP writing through differentiated instruction. (5-point Likert scale response options)

Reasons for usefulness:

- If you thought [in the beginning/during the course] reifying the activities enhanced writing through the differentiated instruction, what was reason for this way of thinking? (multiple-choice question)

Establishing good condition for writing through differentiated instruction:

- How could teachers help students develop writing skills for communication? (open-ended item)
- What best practices exist to help educators incorporate actual-world scenes into ESP classrooms successfully? (open-ended item)

The participants took part in the surveys anonymously. Four hundred seventy-five students completed the surveys (participation rate = 78%). Of the 475 students, 211 completed the comment boxes and wrote about their perception of the course in response to the open-ended items. Out of these, the comments and responses of 18 students (nine students from each group) with the highest and lowest ESP writing scores were qualitatively analyzed. To allow the participants freedom to explore their perceptions, they were told that they could modify the questions. Stepwise measures (Riazi, 2016) were taken to assure the trustworthiness of this qualitative phase of the study as follows:

At two levels, the data gathered by the researchers and their interpretations were represented to participants to check; the researcher's decisions were elaborated for participants during the survey; the procedure that researchers used to make decisions was represented to participants through an audit trial; and to warrant relevance of findings, a thick description of the survey was prepared by the lead researcher and uploaded on his webpage in *NAVID* to be accessible for other researchers. The participants' comments and responses to the open-ended questions

of the survey were transcribed and analyzed by the lead researchers. Transcripts were made from audio recordings of oral comments and responses.

3.2.2 Instruction and Assessment (weeks 1-16)

To gather quantitative data and to answer the second research question, in each session, during a 16-week course, a set of two topics and strategies for ESP writing s specified to be introduced to participants. Sessions were conducted through flipped classroom; thus, in each session:

3.2.2.1 First, Participants Regularly Heard the Pre-recorded 30-minute Lectures

Regarding each participant's academic discipline, the materials and strategies for holding lectures were selected from *English for the students of medical librarianship* (shokrpur & Mahbudi, 2016); *English for students of health information technology* (Dehnad et al., 2020); *English for the students of occupational health and safety* (Alavi, 2018); *English for the students of environmental health* (Amal Saleh et al., 2018); *English for students of nursing* (Kayhani et al., 2019); *English for the students of medicine* (Tahririan & Memehrabi, 2020); and *English for operating room students* (Allahdad, 2020). The books were approved by the high council of education at the Ministry of Health and Education. The researchers, in collaboration with seven subject-area teachers, presented the lectures.

3.2.2.2 Then, Students Practiced the Skill through the Follow-up Tasks with their Peer Students

The follow-up tasks were either online or game. The tasks with the same themes had students learn writing by practicing it. In tasks, teaching writing was broken up into sections. The participants were asked to practice in dyads and write on the highlighted sections and share it with their partners as well as the teachers. In the online tasks, the participants (in each academic discipline) were required to collaborate to write and add subtitles and/or annotations to the pictures in 15 minutes. In Appendix A, shots of tasks with no subtitle and annotation, with subtitle, and with annotation are displayed.

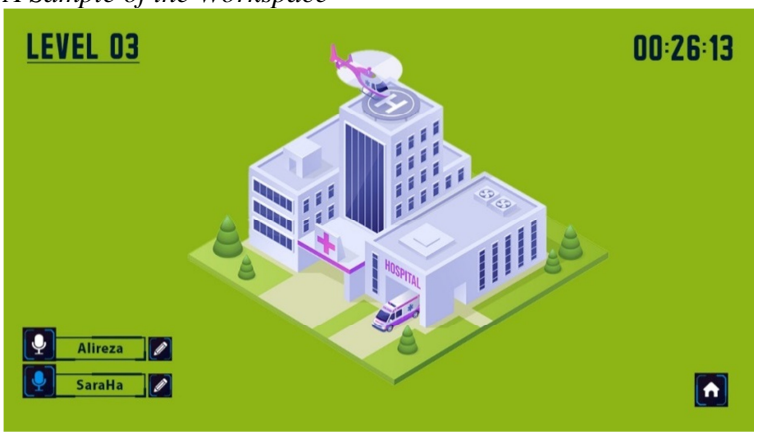
In the games, participants were required to practice writing through the ARs, VRs, or MRs in dyads for collaboration with their peers in 15 minutes. Students would choose a button from the side list, write a text for it together, and drag and drop the text to the highlighted sections of the pictures in the game. If they did the writing correctly, the pop-ups would turn green; otherwise, they would turn red. In appendix B, samples of the games are displayed.

The English games were developed through the Unity engine in the center of games and entertainment at the University of Isfahan under the supervision of the lead researcher. The link to the games was put in the *NAVID*.

c) Finally, each session was completed by (0-20 score) writing assessment: Writing assessment was a combination of formative assessment in academia and workspaces. The assessments in the classrooms were conducted through the exam menu of *NAVID*. While in each session, the participants' writing was assessed through an online assessment in 20 minutes, their professional writing was assessed in a virtual workspace every four sessions through an Objective Structured Video Exam (OSVE) in 10 minutes (Jafarpour, 2003). The techniques used to assess participants' writing were: transforming and expanding sentences; that is to say, the participants were required to provide missing words or correct expansion for the blanks. Seven content teachers, except those who tutored the participants, assessed the participants writing using OSVE. The OSVE was a scoring rubric with three subphases with a focus on students' readiness in 1) using lexical items and syntactic patterns (0-6 scores); 2) communicating brief massage (7-13 scores), and 3) freely communicating the ideas and thoughts (14-20 scores). The researchers in collaboration with seven content teachers adopted Jafarpour's (2003) criteria and developed the OSVE; accordingly, its face and content validity were authenticated (Strijbos et al., 2021). Three assessors scored each participant's writing. The computed Intraclass Correlation Coefficient for the scoring reliability was .79. A virtual hospital is shown in Figure 3. Students of environmental engineering were asked to use their ESP writing skills to carry out solutions to the wastewater system of a hospital.

Figure 3

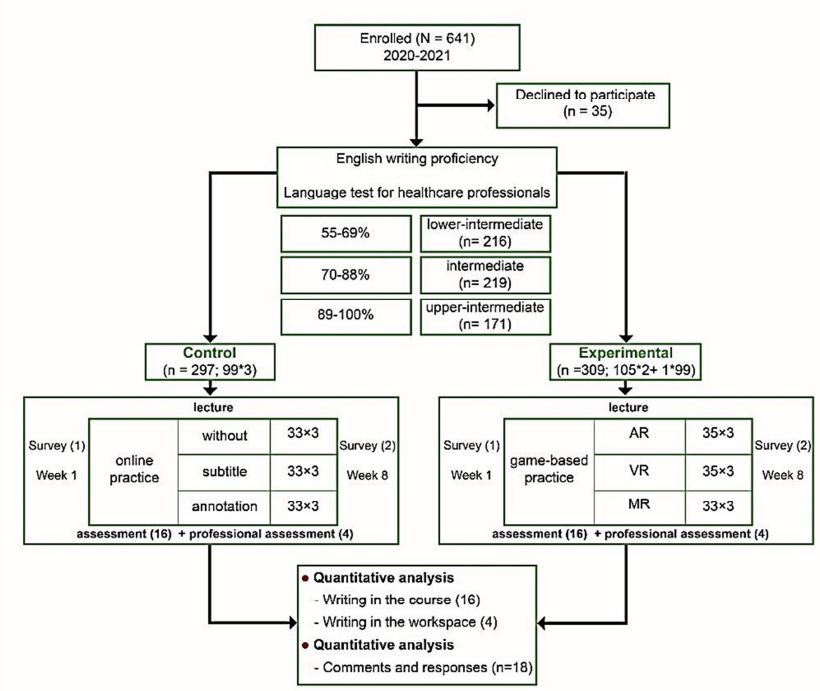
A Sample of the Workspace



The trial profile of this study is displayed in Figure 4.

Figure 4

The Trial Profile of the Study



4. Results

4.1 Quantitative Findings

4.1.1 Potential of Reified Activities

Two items in the survey solicited participants' attitudes and debriefed their perception on reifying activities in ESP writing; that is to say, '[in the beginning/during the course] I believed that reifying activities in differentiated instruction facilitated ESP writing.' The findings revealed that students in the control group were more interested in the reified activities when they were provided with the opportunity to put written annotations on images of the activities. Two hundred and fifty (83.3%) students selected 'neural' at the beginning of the study, compared to 232 (77.3%) during the study. The difference in median rank scores was significant ($z = -2.558$, $p<.05$).

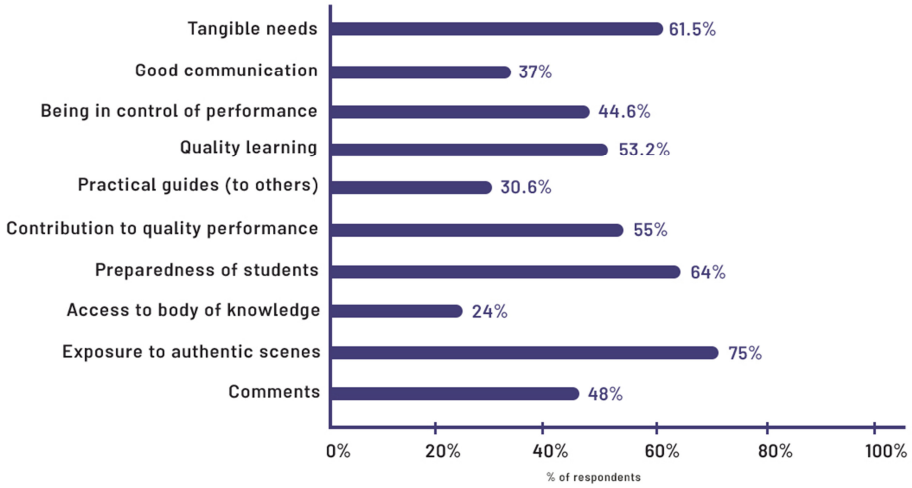
In the experimental group, during the course, students were more interested in the instantiation of reality in the ESP writing activities as they were allowed to commute between the images and write on them through annotations. Given interoperability was possible in the MRs, 247 (82.4%) students selected the 'agree' and 'strongly agree' options during the study. The difference in median rank scores was significant ($z = -14.12$, $p<.001$).

4.1.2 Reasons for the Usefulness

Two multiple-choice items of the survey asked participants to specify the possible reason(s) for the usefulness of the reified activities in the differentiated instruction: 'If you thought [in the beginning/during the course] reifying the activities enhanced writing through the […] differentiated instruction, what was a reason for this way of thinking?' Participants in the control and experimental groups selected two or more of the pre-defined options. During the course, 231 (47.5%) expressed their perception of the reasons for the usefulness of the reified activities in the comment boxes. Frequencies (%) are shown in Figure 5.

Figure 5

Ways Reified Activities Enhance Writing



4.1.3 Analyzing the Participants' Progress and Professional Performance

To address the second research question on the potential of the (game)-based differentiated instruction in ESP writing, initially, the participants' progress was analyzed through repeated measures ANOVA; to that end, sphericity was checked ($\chi^2_{119} = .091, p > .05$).

As shown in Table 1, in the control group, the mean and standard deviation of the participants' ESP writing progress in the no annotation and subtitle subgroup were 12.66 and 1.79. The mean and standard deviation for the subtitle subgroup were 12.95 and 1.84 and for the annotation subgroup were 12.88 and 1.81. In the experimental group, the mean and standard deviation of the AR subgroup were 14.29 and 1.87. In the VR subgroup, the mean and standard deviation were 13.1 and 1.82 and for the MR subgroup the mean and standard deviation were 14.9 and 1.5.

According to the results, the participants made significant progress during the course ($F_{15,8910}$ = 5997.590, p<.001). Regarding the ESP writing progress, the interaction of time and practice in the subgroups in the two control and experimental groups led to significant differences among the subgroups ($F_{15,8910}$ = 533.35, p < .001). There was a significant difference between the subgroups of the

control and experimental groups ($F_{5,594}$ = 25.61, p < .001). It can be implied that reifying the practice settings facilitated ESP writing through (game)-based instruction. The high proportion of variation in the participants' ESP writing progress was illuminated by the reified settings of practice through the (game)-based differentiated instruction (η^2 = .178).

Table 1

Repeated Measures ANOVA for the Participants' Writing Progress

	M	SD	Effect	F ratio	df	η^2
without	12.66	1.79797	Time	5997.59**	15	.910
subtitle	12.95	1.84673	Time* subgroup	533.35**	75	.818
annotation	12.88	1.81364	subgroup	25.64**	5	.178
AR	14.29	1.87331				
VR	13.10	1.82152				
MR	14.90	1.56385				

** p<.001

To complete the answer to the second research question regarding the potential of (game)-based differentiated instruction for ESP writing in the professional contexts, repeated measures ANOVA was employed; in so doing, sphericity was checked (χ^2_{119} = 1.812, $p > .05$).

As to professional writing, in the control group, the mean and standard deviation were 8.87 and 1.9 for the no subtitle and annotation subgroups. The mean and standard deviation for the subtitle subgroup were 8.96 and 1.91 and were 11.72 and 1.83 for the annotation subgroup.

As is shown in Table 2, participants gave a better performance in the workspace as time passed ($F_{3,1782}$ = 1030.07, p < .001). Similarly, the interaction of time and subgroup resulted in participants' better performance in the workspace ($F_{15,1782}$ = 200.04, p<.001). There was a significant difference in the professional writing of the subgroups ($F_{5,594}$ = 242.05, p<.001). It can be inferred that students' lower professional writing score was mainly due to under-exposure to ESP practice. Interoperability in the reified game-based differentiated instruction illuminated the high proportion of variation in participants' professional writing (η^2 = .671).

Table 2
Repeated Measures ANOVA for the Participants' Professional Writing

	M	SD	Effect	F ratio	df	η^2
without	8.8763	1.90641	Time	1030.07**	3	.634
subtitle	8.9653	1.91083	Time* subgroup	200.04**	15	.627
annotation	11.7250	1.83351	subgroup	242.05**	5	.671
AR	12.6975	1.79937				
VR	15.1375	1.66264				
MR	15.2300	1.74609				

** p<.001

4.2 Qualitative Findings

To answer the third research question, thematic analysis was used. To this end, Neale and Nichols's (2001) procedure was followed: The selected participants' comments and answers were read by the lead researcher and five coders who knew the participants' first language well; one-third of the data were coded and a codebook was developed; the coders used the codebook to code the whole data, nine codes were identified; finally, codes were converted into seven themes. The data were analyzed via the Quirkos qualitative data analysis software.

It was found that the control group students widely put forward three views regarding the reifying writing activities in online differentiated instruction, that is, they could "enjoy the support of peers," the teachers provided "coaching," and it "improved the practice of academic writing." For instance, CS3 commented that "In the first sessions, I could not understand the content of the recorded lectures. But the support of my peers eased my understanding and added to the quality of my writing in the classrooms." CW2 state that "The teachers' guide was a great benefit of differentiated instruction." Therefore, control group students made progress in their academic writing with the support of peers and friends in the flipped classrooms. Meanwhile, they could learn the ESP writing strategies by subtitles or annotation transitions to the images.

The experimental group participants highlighted "the representation of actual situations," "vicarious learning," "immersive learning," and "customized scenes of the games." Nevertheless, while students from the AR subgroup underlined the pedagogical values of the applied games, students from VR subgroup underlined

the professional values of the games.

According to the selected participants' comments and responses, in the MRs, coordination between academic and professional contexts was easier. For instance, EM2 stated that team learning and active peer-to-peer support are strongly reinforced by practicing writing through VRs and MRs". EM3 also stated that "while from one of the eyeglasses, I could practice ESP writing for academic purposes, from another eyeglass I could practice for the professional purposes." More than two-thirds of the selected students (74.1%) commented that learning ESP through game-based differentiated instruction was an appealing proposition, one that provided students in search of solutions for the needs.

5. Discussion

The major aim of this study was to explore if the applied games were facilitating differentiated instruction in ESP writing classrooms in west Asia. In this regard, the potential of AR-, VR-, and MR-based (vs. online) differentiated instruction in flipped classrooms was examined. The results demonstrated the socio-cognitive approach (Chakrabarty, 2022), suggesting that cooperation in ESP writing according to needs resulted in students' communicative competence. Students' effective ESP writing in academic and professional settings indicates that differences in the needs may be dealt with through the interoperability of practice (Bannur et al., 2014). Overall, the great ESP writing competence in both academic and professional situations revealed that applied games have the potential to give students' differentiated instruction.

Evidence for both academic and professional writing highlights that the betterment of game-based differentiated instruction in ESP classrooms was achieved through MR. Accordingly, upon ensuring that both AR and VR were applicable games in differentiated instruction in ESP writing, MR could be conceived as the great language learning equalizer among the applied games.

It can be argued that students who could commute between various scenes of games were more involved in observing others and ESP learning activities. Because

under such circumstances, students can have easy access to different augmented scenes, they might learn through watching experiences of others (vicarious learning) and become immersed in their professional role. Consistent with Berns et al.'s (2016) findings, students who can experience the actual needs in collaboration with others through the scenes of games might be more capable of meeting the audience's expectations in real time. But the reason why only students in an MR-based class reached the learning standards and the rest stayed behind the line of merit of game-based differentiated instruction was that ARs could not provide them with a learning situation where every student achieves competence for professional needs equally. Thus, depending on the (academic and professional) needs, gearing to AR or VR is recommended. With regard to the particular nature of ESP learning, Qiu et al. (2021) similarly argued that scenes of applied games can differently affect students' communicative competence by instantiating academic and/or professional needs.

In addition, the interplay between observational learning and the applicability of diversified scenes of AR and VR for communication in academic and professional contexts is partially in congruence with the outcomes of similar studies (e.g., Blyth, 2018; Lee & Park, 2020) which verifies the immersive VRs for professional communication. This finding is partially consistent with those of Khazaie et al. (2019). They found that students developed more robust agency in their ESP writing journey when the practice scenes were tailored to the expectations. From this view, engagement is linked to variegated scenes for practicing communicative skills (Karst et al., 2022). The interconnection between engagement and communicative competence can be legitimized from the perspective of the socio-cognitive approach (Richards & Schmidt, 2013). It which it is argued that students' partnership can pave the way for vicarious learning and enhance students' competencies, thereby promoting their academic and professional performance.

Moreover, students' different attitudes in the beginning and during the course were defined as the point of comparison regarding the potential of game-based instruction for ESP writing. While the association of game-based modules and differentiated instruction in academia was stronger in AR and MR groups, it was stronger in the VR and MR groups as far as instruction was offered for writing in professional contexts. Along these lines, qualitative data analysis was carried out to

shed light on the potential of game-based differentiated instruction in ESP writing classrooms. The thematic analysis of the comments revealed some differences in factors relating to learning ESP writing for communication between the two groups.

More categorically, as for further learning through interpersonal interaction, observation of fellow students' learning is argued to promote ESP writing skills and communicative competence. Regarding effective communication through collaborative practice, it is claimed that interpersonal relationships among students in real-life-like scenes contribute to their performance (Sykes, 2018). Observational learning is claimed to be acquired by portraying the world's reality in tasks for differentiated language classrooms (Tarmizi et al., 2022; Wang et al., 2018). Similarly, a significant correlation was identified interoperability of the tasks and students' ESP writing for communication of the needs.

Regarding interoperability in the tasks, students taking positive attitudes towards the exchange of the scenes in conjunction with needs have greater competence in communication (Gaol & Prasolova-Førland, 2022). With regard to real features of the applied games, Zou et al. (2021) found that the portrayal of academic and professional settings in the applied games help students conceptualize the actual needs by drawing on real-world facets embedded in the games. As shown by the qualitative data, the game-based group had creative ESP writing in meeting the needs. It is argued that observational learning in real-life-like settings, learning relevant communication skills, and mediation of peer students in conjunction with highlighting different needs can facilitate ESP writing, thereby enhancing students' communicative competence (Malinowska, 2022). Additionally, further perceived ESP writing is consistent with the view that students who receive undifferentiated instruction perceived on-size-fits-all tasks in communication dimly (Rezaei & Marandi, 2022).

Overall, the stronger interconnection between differentiated instruction and communicative competence in ESP writing courses might be attributed to the interoperability between the customized scenes of the games. Adopting the socio-cognitive approach in game-based differentiated instruction helped shape the collaboration for learning ESP writing through vicarious learning in the flipped

classrooms, ushering in academic and professional development.

From a research point of view, further empirical studies on game-based differentiated instruction in ESP education in relation to audience expectations may help to promote the quality of learning in academia and services in workspace, consequently enhancing the status quo of ESP for life (Chandrasegaran, 2013).

6. Pedagogical Implications

Students' different academic and professional needs should receive closer attention in ESP education as accurately representing the world in the course is purported to develop students' communicative competence to meet the needs (Archambault et al., 2022; Landrum & McDuffie, 2010; Suprayogi et al.; Sapan & Mede, 2022). Commuting between ESP classrooms and workspace can enhance students' competence for meeting variated expectations. From a research point of view, further empirical studies on game-based differentiated instruction in ESP education in relation to audience expectations may help to promote the quality of learning in academia and services in the workspace, consequently enhancing the status quo of ESP for life (Wang et al., 2018). Therefore, variegated game-based modules aimed at reifying activities in ESP classrooms should be developed. Differentiated language instruction through such modules can effectively broaden students' hands-on experiences (Dashtestani, 2022; Shohel, 2022; Teo et al., 2022).

7. Limitations and Suggestions for Further Study

Regarding the limitations of this study, the participants were selected from among students of four countries through convenience sampling methods to examine the potential of game-based instruction in ESP writing. The students were mostly from the academic disciplines of medicine. Future studies exploring the potential of game-based instruction among students from different countries of west Asia and from different academic disciplines would help realize the untapped potential of this type of instruction in ESP education. Besides, this study was limited to ESP writing as a constituent of productive skills for communication. Longitudinal studies on

game-based instruction for other ESP receptive and productive skills could outline a greater vision of using games for ESP education.

8. Conclusion

Adopting the socio-cognitive approach, the results of this study on the potential of game-based differentiated instruction revealed that interoperability of the real and cued scenes is the primary determinant of success in ESP writing. It was also revealed that applied games not only engaged students, but also helped them be prepared for future academic and professional contexts. In addition, the results showed that vicarious learning is the vehicle for students' engagement and communication in ESP classrooms. Furthermore, as regards differences in needs, cued scenes of AR in ESP writing sit well with academic needs and the immersive scenes of VR improved workforce readiness among students. Similarly, the comparison of participants' attitudes showed that MR provides ample opportunities for ESP writing in relation to audience needs. The qualitative data analysis showed that the clear perception students in the experimental group had of the applicability of differentiated instruction for ESP writing could be attributed to the augmented real-like scenes of the games. It could be concluded that applied games sit well with ESP writing and viable communicative competence, where observation of peer students' learning is conducive to collaborative engagement and quality performance.

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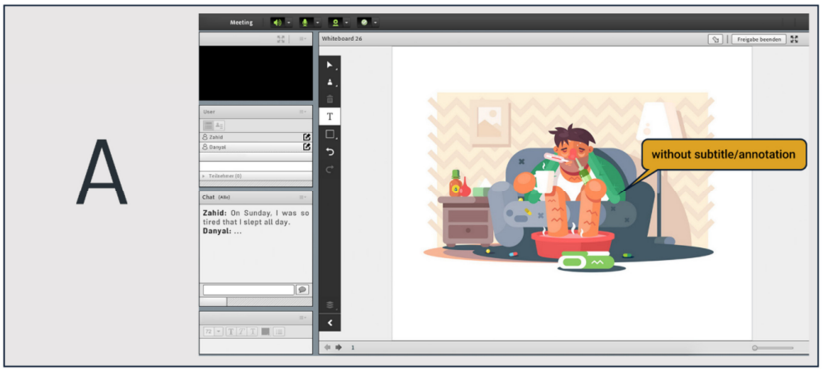
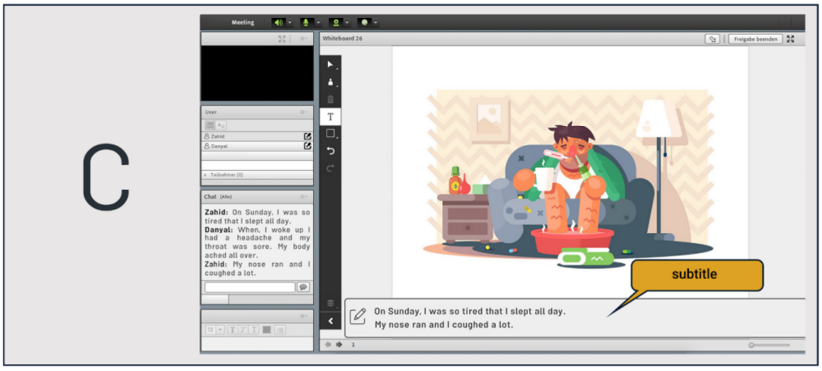
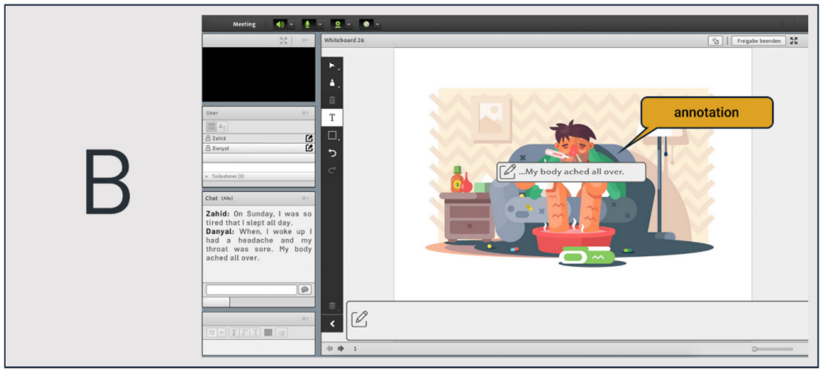
Appendix A


A
without subtitle/annotation

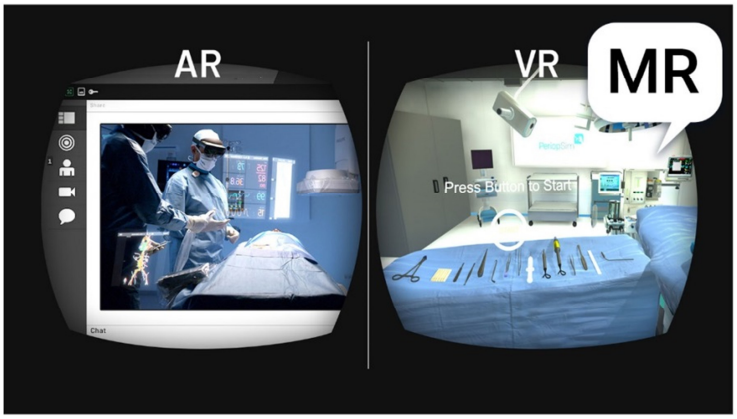

C
subtitle
On Sunday, I was so tired that I slept all day.
My nose ran and I coughed a lot.


B
annotation
...My body ached all over.

Appendix B


Chapter 12
AR
It is essential to plan the management of dyspnea together with the individual patient.
alan Gari
Sindrasi Korba
dyspnea
plan
investigations


LEVEL 03
Operating Room
VR
Player 1
Alireza
Player 2
SaraHa
1 Surgical Mayo Table
2 Monitoring System
3 Diathermy Machine
4 Anesthesia Machine


AR
VR
MR
Press Button to Start