An Investigation into the Applicability of Robot-AR-Aided LMOOCs for Language for Nursing Purposes Teaching and Learning

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*Abstract*— **A characteristic feature of Language Massive Open Online Courses (LMOOCs) is their capacity to evidence-based education that is effective in representing the actual world. Recent integration of social robots and cues of augmented reality have fostered rich opportunity to leverage episodes of practicing Language for Specific Purposes in the professional contexts. Language for Medical Purposes education informed by the evidence captured during students' interactions with social robot-augmented reality-aided LMOOCs gives great promise for doing comprehension of academic and professional contexts. In the academic years of 2020-2021, in the Medical University of Isfahan, this interventional study using a parallel design employed evidence-based medical college language learning approach that incorporates the augmented body of social robots with the written clouds of ARs into the episodes of different types of LMOOCs endeavored to investigate 295 nursing students' LNP reading comprehension progress. In view of this, a focus-group interview was conducted, as well, to debrief the participants’ perception of the course. Findings revealed that when students took part in videotaping the episodes for the robot-augmented reality-aided LMOOCs, they either read equally well or outperform situations with evidence from teacher-made LMOOCs. We discuss the students' active participation along with synergistic impacts of combining social robots and AR clouds for representing factual evidence of healthcare fields in Language for Nursing Purposes reading skills education. The student-made and blended robot-augmented reality-aided LMOOCs can accurately instantiate actual scenes of the world and hold significant potential for guiding real-world scaffolding.**

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Keywords—reading; Language Massive Open Online Courses; social robots; augmented reality

#  Introduction

The importance of evidence-based Language for Specific Purposes (LSP) learning has been underscored in research [1]. In particular one thing that researchers can agree upon is that evidence-based learning facilitates Language for Nursing Purposes (LNP) skills learning [2]. For this reason, educational technology (EdTech) tools have been incorporated into Language Massive Online Open Courses (LMOOCs) to instantiate academic and professional contexts.

As evidence for the modern LMOOCs, the humanoid robot has been revitalized by representing real world through the cued scenes of augmented reality, namely Robot-AR [3]. In a set of college language modules, Robo-AR has been employed as a construction for representing professional contexts [4]. LNP reading relates to receptive skills employed by students for comprehending meaning.

The LMOOCs have been researched in the literature, and many studies have investigated their applicability in medical college language education. Applicability of different generations of these courses has been examined in medical college language skills. Some studies have also investigated the interoperability of different EdTech tools in the LMOOCs in easing the process of medical college comprehension [5].

Compared to the research on the LMOOCs in college medical language skills education, fewer studies have explored the role Robot-ARs could play in developing LMOOCs for LNP reading skills education [6]. Ince et al. (2021) underscored the scarcity of research for social robot- and new-generation-of-game-aided LMOOCs in LSP skills education and pointed out that it is a good question whether the combination of two would represent real-life scenes of language use for evidence-based learning [7]. The few studies probing the applicability of LMOOCs for medical college language skills education have focused on only one component (viz., game- or social robot-aided LMOOCs). However, LNP education is not detached from the reality of healthcare contexts, but also learning through academic and professional evidence as they are integrated [8]. Furthermore, despite the evidenced-based construct of LNP skills, previous studies have integrated the digitalized the exercises of the textbooks into LMOOCs that are to a great extent void of real-life features [9]. Researchers further recommended the use of actual scenes of understanding college language skills to present students with more genuine opportunities for learning LNP receptive skills [10]. Accordingly, further investigation of the realistic portrayal of healthcare fields through the interoperability of social robots and ARs in the LMOOCs (viz., Robot-AR-aided LMOOCs) for evidence-based LNP reading skills education remains a desideratum.

Here, in this study, we were mostly concerned with the factual evidence of the courses for learning LNP skills in relation to academic and professional needs, as well as students' participation in joining the Robot-AR-aided LMOOCs for LNP reading. Thus, the research questions are as follows:

1. To what extent did the Robot-AR-aided LMOOCs facilitate the students' LNP reading skills learning?
2. How did the participants perceive the Robot-AR-aided LMOOCs for LNP reading practice and learning?

# Method

## Participants

The participants were selected from among Persian and non-Persian students of nursing, operating room, and midwifery who took the obligatory two-credit course of LNP in the academic years 2020-2021 in the *Isfahan University of Medical Sciences*. They were selected through convenience sampling method. Having the consent of 295 students, general medical college language proficiency test was conducted.

The 80 items of the test were selected from among the items of Ministry of Health Language Examination. Using the standard formula of Proficiency Levels = (no. of correct responses/no. of items)\*100%, the participants were identified in three levels of upper-intermediate, intermediate, and lower-intermediate language proficiency.

Then, with excluding 29 students with low general proficiency level, the remaining 266 students were randomly divided into three groups, namely, c-LMOOC, x-LMOOC, and b-LMOOC. In order for this study to practice reading through the cued scenes of AR in the LMOOCs, in each group, the participants were randomly paired with their fellow students with the same academic disciplines in dyads.

## Procedure

In the online classrooms with the Robot-AR-aided LMOOCs, students practice LNP reading through the videos of reading clouds of the ARs on the robot's body from the LMOOCs while they are taught in the online classroom. That is, students switch between classrooms and the episodes of the LMOOCs. The study with a parallel design was 24 weeks long conducted in three stages as follows:

**Introductory stage:** At the start, the participants were trained for taking part in practicing ENP skills through Robot-AR-aided LMOOCs and had two online workshops on conducting Robot-AR-aided LMOOCs.

A two-point agenda was drawn up for the training session of the workshops as follows:

First, two students who have already passed the obligatory course of LNP are invited to read the written clouds of the ARs aloud and upload them on the body of the robots; simultaneously, the participants together (student-made or c-LMOOCs), or the teacher together (teacher-made or x-LMOOCs), or the participants together with the teachers (b-LMOOCs) videotape the scenes.

**Robot-AR mediated LMOOCs production stage:** To develop the episodes for the LMOOCs, (production) stage within 8 weeks was defined under a menu within the national Learning Management System of *NAVID*. Accordingly, every week, two concurrent pre-tasks were undertaken as follows:

**Pre-task I:** Following offering a reward of free membership of the language laboratory of Medical University of Isfahan, from among the 50 students of nursing, operating room, and midwifery who had passed the obligatory course of LNP with a high degree of proficiency, 12 agreed to join the study as uploaders. In the real healthcare fields, they were randomly divided into six two-member circles to read materials from a min-corpus of scenarios on their cellphones or tablets and write them up on the social robot's body through the cued scenes of the ARs. The scenarios of the mini-corpus were co-constructed by the researchers and subject-area teachers. The tailor-made English scenarios were organized in relation to the topics of the lessons. In line with the scenarios, the templates of ARs for representation on the body of the social robots were developed in partnership with *Soroush* and *Parsian* as Asian game development institutes.

**Pre-task II:** At one fell swoop, the participants (in two-member circles) and/or with English and subject-area teachers filmed the episodes of the live uploading practices by the uploader students. The episodes were made through Camtasia software suite inserted as a single menu into *NAVID*. In the ending of each session, participants and/or teachers shared their video-taped scenes of the Robot-AR-aided LMOOCs with each other and uploaded them to *NAVID*. An episode of a blended Robot-AR-aided LMOOC is shown in Fig. 1

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Fig. 1. An episode of a blended LMOOC

**LNP instruction and assessment with practice through Robot-AR-aided LMOOCs stage:** Each online LNP classroom with the Robot-AR-aided LMOOCs included three missions for participants: (1) taking part in LNP classrooms to be taught individually by the adjunct teachers, (2) (concurrently or continuously) watching the episodes of the LMOOCs, co-reading the cues of the episodes, (3) answering reading comprehension questions.

In these online classrooms, while the researchers in collaboration with the subject-area teachers co-taught the LNP reading skills to individual students, the participants were required to practice the skills through the episodes of the c-LMOOCs, x-LMOOCs, or b-LMOOCs in the two-member circles via the national *NAVID* learning management system. In each session, the co-teachers sent notifications to the participants and asked them to download the videos for collaborative reading aloud. After the students did the tasks, where the researchers examined their accuracy.

Each online classroom was closed by the assessment of the participants' reading skills through the online reading activities of textbooks. As soon as each participant answered the items of the activities, the system automatically gave +1 marks for each correct answer.

The course materials and activities were selected from English for the operating room [11], English for the students of nursing [12], and English for the students of midwifery [13].

**Interview stage:** In the qualitative phase, to answer the second research question, from among the 85 participants with the highest and lowest LNP reading scores in the academia and fields, 33 students gave their consent to have discussion with their peers on the items of the focus-group interview. Eight students were selected through systematic sampling. This way, from the groups of this study, there were at least two students (one with the highest and one with the lowest scores). Each selected participant was assigned a code. The items of the interview were adopted from the Ledger et al. (2020) semi-structured interview guide [14]. Sample interview prompts are as follows:

* Could you describe your LNP learning in the classrooms with Robot-AR-aided LMOOCs?
* What were the reasons for your current level of LNP proficiency?
* How did LNP practice through the Robot-AR-aided LMOOCs affect your participation?
* How did LNP practice through the Robot-AR-aided LMOOCs influence your participation?

## Data Analysis

This study included two questions that investigated the applicability of the Robot-AR-aided LMOOCs for LNP reading skills teaching and learning and students' perceptions of in the classrooms with Robot-AR-aided LMOOCs. While the first research questions needed quantitative analysis, the second research question required qualitative enquiry.

**Quantitative data analysis:** The gathered data from the participants' reading scores in the classrooms were analyzed descriptively and inferentially; accordingly, repeated measures ANOVA was utilized.

**Qualitative data analysis:** One of the researchers analyzed the selected participants' responses to the interview items through MAXQDA 2021. The themes of the responses were defined adopting a six-step inductive approach [15].

# Results

## Quantitative findings

To answer the first research question, as Table 1 shows, when comparing the participants' mean scores of LNP reading progress based on the group they belonged to, the participants of the third group ranked the first (mean = 14.1, SD = .86). The mean scores of the second group of participants' reading skills were the lowest (mean = 12.3, SD = .74).

1. Mean and standard Deviation of reading Scores

|  |  |  |  |
| --- | --- | --- | --- |
| Skills | Groups | Mean | SD |
| Reading  | 1 | 13.6 | .57 |
| 2 | 12.3 | .74 |
| 3 | 14.1 | .86 |

***Note.*** group 1 = c-LMOOCs; group 2 = x-LMOOCs; group 3 = b-LMOOCs

To analyze the collected data, the participants' general English proficiency score was considered as covariate and repeated measures ANOVA (viz., ANCOVA) was utilized. It was revealed that the rate of the participants' LNP reading significantly increased during the course (F11, 3124 *=* 21.843*,* *p* < .001). The interaction of time and group resulted in the participants' significant rate of progress in LNP reading (F22, 3124 *=* 1.381, *p* < .001). Likewise, the interaction of time with the participants' general English proficiency and time resulted in significant rate of progress in LNP reading during the course (F11, 3124 *=* 4.842*,* *p* < .001).

1. Tests of Within-subjects Effects for LNP Reading Comprehension Skills

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Skills | Effect | Type III Sum of Squares | df | F | *p* |
| Reading | Time\*\* | 32 | 11 | 21.843 | .000 |
| Time\*group\*\* | 853.19 | 22 | 1.381 | .000 |
| Time\*proficiency | 7.095 | 11 | 4.842 | .000 |

As can be seen from Table 3, as far as LMOOCs type was concerned, the mean scores of the participants' reading (F2,227 = 441.945, *p* > .001) were not significantly different between the three groups, hinting that the students' active role in filming the episodes of the LMOOCs cannot significantly add the applicability of the Robot-AR-aided LMOOCs for LNP reading comprehension skills teaching and learning. Regarding the proficiency level of the participants, the mean scores of the participants' LNP reading (F4,284 = 6.940, *p* < .05) in the groups were significantly different, indicating that higher general English proficiency levels paves the way for easy reading of the episodes of the Robot-AR-aided LMOOCs (F1,284 = 2.784, *p* < .05).

1. Tests of Between-subjects Effects for Reading Skills

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Skills | Effect | Type III Sum of Squares | df | F | *p* |
| Reading | LMOOCs | .491 | 1 | 441.945 | .742 |
| Proficiency Score | 6.940 | 1 | 10009.967 | .001 |

## Qualitative findings

The analysis of the selected responses in the interview showed four major themes as follows:

**Cooperation**

The students' responses highlighted the point that collaboration in doing LNP reading was the main feature of the Robot-AR-aided LMOOCs. Answers underscored that the students' reading could be put down to the collaboration between students for understanding the LMOOCs scenes.

"… as soon as I talked with my peers, I realized the potentials of the LMOOCs for language learning." (S3)

The case of increased cooperation was that of the students from the c-LMOOCs and b-LMOOCs groups. Responses gave the idea that students' cooperation for understanding the episodes of the LMOOCs led to easy comprehension of the content. Conversely, from the participants' view, x-LMOOC did not capture the students' experience at the time of the tasks.

The participants highlighted the potentials of LMOOCs episodes as an ambience for being informed about the content of the materials.

"… the best part of practicing through in the classroom [with LMOOCs] was sharing thought with my peers." (S1)

The students' responses indicated their active participation in doing EMP skills through the c-LMOOCs and b-LMOOCs, which led to understanding of the content in relation to the reading materials.

**Evidence**

Robot-AR-aided LMOOCs were the potential bases of tangible evidence. The potentiality can be represented through putting the robots amid the cued scenes of the ARs. This could be represented through two subthemes of genuine image and cues.

**Image**

True instantiation of the fields through the scenes of the ARs and human-like body of robots was highlighted in the participants' responses. A great majority of students said that the real-life episodes of the Robot-AR-aided LMOOCs could present them with fields in the online EMP classrooms and pave the way for moving the content materials to the fields to practice the skills.

"… the [real scenes] made me think more about the future [academic and professional] contexts. In this fashion, I cold update my academic and professional knowledge …" (S2)

**Cues**

The combined effect of the written cues and visual scenes on the robot's body that were embedded in the episodes of the Robot-AR-aided LMOOCs enhanced the ENP skills learning process.

"… the written materials of the clouds on the body of the robot created an immersive context of practicing which allowed me circumnavigating the academia …." (S6)

Most of the participants underscoring the reality of the scenes and the written clouds suggested that the LMOOCs episodes enhanced their engagement for collaboration with their peers.

**Continuous learning**

Students perceived the LNP classroom with Robot-AR-aided LMOOCs as a continuous learning. This theme contains two sub-themes of increased content and streamlined activities.

**Supervision**

The participants' answered indicated that the teachers' supervision facilitated their comprehension for reorganizing the content of the scenes in favor of addressing the needs. The usefulness of the teachers' supervision in doing LNP reading through the episodes of Robot-AR-aided LMOOCs was echoed in the responses of the selected participants from the blended Robot-AR-aided LMOOCs who readapted the content of the episodes to their own needs in collaboration with the teachers.

"… in the first sessions, the teacher' help to me provided me with more practical guidance and adequate support." (S4)

**Constant exposure (to content)**

Many responses showed that presenting the materials through the episodes of the Robo-Game-mediated LMOOCs increased the content during the course.

"The miscellany situations arose from the increased content established new ways for students to understand …." (S7)

**Efficient activities**

The increased effectiveness of the practice in actual-world word by understanding their scenes was seen as significant for learning.

"I felt empowered for understanding the forthcoming situations following practicing active role in doing comprehension of the efficient cues of the activities." (S8)

Capitalizing on the episodes of the Robot-AR-aided x-LMOOCs is something students found difficult in the online LNP classrooms. S3 stated:

"I couldn't establish concerted contribution to address the needs in reliance on the [teacher-made excerpts] of x-LMOOCs…"

# Discussion

In this part, the findings of the study are discussed as follows:

The findings introduced different possible reasons for the feasibility of Robot-AR-aided LMOOCs for LNP reading teaching and learning: evidence-based language learning; student participation; and teacher role.

B-LMOOCs in LSP education can balance the instructional-learning contexts with students' and teachers' collective participation. Lack of support for students undermines the feasibility of LMOOCs for LSP skills learning. Similarly, the qualitative results underlined the participants' cooperation and role of the teachers as the key determinants of the applicability of the Robot-AR-aided LMOOCs in LNP education.

The participants' success in reading LNP with Robot-AR-aided LMOOCs was consistent with Ince, et al.'s [7] results for the applicability of different generations of LMOOCs in LSP skills education. Mac Lochlainn et al. [5] reports that students' collaboration for practicing LSP reading through the LMOOCs paved the way for hand-on experiences. Factual evidence (e.g., real-life scenes of the world); teacher' availability for individual teaching and learning; and collective nature of LMOOCs led to rich opportunities for learning reading LSP.

Reasons for the feasibility of the Robot-AR-aided LMOOCs in the online LNP classrooms, in this study, supports the findings of the previous studies; these are instantiation of contexts through the robots [3]; ubiquity of teleoperated robots (John, 2008); cooperation for doing reading (John, 2008); enhanced practicing scenes [9]; and collaborative comprehension [1], 2008). The findings revealed that students' active role for developing excerpts for LMOOCs led to LNP reading skills. This showed the applicability of the Robot-AR-aided c-LMOOCs in LNP learning.

The importance of interactive real scenes in the LMOOCs for language education has been underscored in the literature, but few have investigated the augmentation of these scenes. This study revealed that clouds of the ARs on the body of the along with the coaching of students for publishing the b-LMOOCs improved the participants' reading. Despite the actual-life features of the episodes of the LMOOCs, the plainness of these episodes meant that students are underprepared for dealing with the future needs.

Students' collaboration for practicing LNP reading skills through genuine events of the world in the clouds of ARs overlaid on the body of robots added to the applicability of the Robot-AR-aided LMOOCs for teaching reading skills. This applicability can be explained by the participants' rising rate of progress in reading in the academia.

From the analysis of qualitative data, it was revealed that the scenes of the Robot-AR-aided LMOOCs from practicing LNP materials through the cued body of the robot provided students with enriched tangible evidence. Most frequently cited were evidence related to the provision of healthcare to individuals and collaboration for reading in the academic and professional contexts.

# conclusion

As regards the first question, this study explored the applicability of Robot-AR-aided LMOOCs in LNP skills teaching and learning. Results showed that students in the classrooms with the Robot-AR-aided LMOOCs are more likely to learn LNP reading skills. Findings revealed that the cued real-time scenes of the ARs and social robots can help portray the tangible constituents of the fields in LNP skills teaching and learning. The findings of this study help renovate the LMOOCs for representation of actual-life phenomena in college language teaching and learning. Because the evidence-based nature of the Robot-AR-aided LMOOCs, fabricating new ways to intermingle scenes of AR into social robots' body is suggested. Students' active participation for featuring scenes of the Robot-AR-aided LMOOCs under the support of the teachers' added to the applicability of these courses for LNP reading education.

Regarding the second question, the participants perceived the scenes of the Robot-AR-aided LMOOCs as efficient evidence for easy comprehension of the needs.

In tandem, active participation was viewed as a major element updating LMOOCs for medical college reading. Meanwhile, students endorsed the guided of teachers in the process of running games and robots for renovating LMOOCs in medical college language education.

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