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Research Article

Towards a Blended Programme for Arabic and Other Less Commonly Taught Languages (LCTLs) in the South African Higher Education Context

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Disruptive technologies are widely used in education today. They aim to develop the knowledge, skills, and competencies of students. The field of applied linguistics, in general, and foreign language teaching, in particular, have benefited immensely from the developments taking place in computer-assisted language learning (CALL) and mobile-assisted language learning (MALL). However, meaningful learning cannot be achieved by using technology indiscriminately; an understanding of educational theories and key instructional design models is urgently required. The present study argues that the adoption of established instructional design models will yield effective learning materials not only for the less commonly taught languages (LCTLs) but also for language classrooms in general. It investigates the use of ADDIE instructional design model for designing and developing a blended syllabus for teaching Arabic as a foreign language in South African institutions of higher learning. The study also deals with the attitudes of the students towards the designed blended syllabus. The proposed syllabus is based on a wide range of web-based tools and e-learning specifications such as Learning Tools Interoperability (LTI) and Shareable Content Object Reference Model (SCORM). This study serves as a guideline for developing instructional materials for teaching Arabic, as well as other languages.

1. Introduction

Developments and changes in the field of technology have greatly aided foreign language instruction. The twentieth century witnessed various attempts to employ technology in teaching foreign languages, and these attempts culminated in the emergence of computer-assisted language learning (CALL). By the same token, the advancements in telecommunications and mobile technology have resulted in the rise of mobile-assisted language learning (MALL). The latter approach has grown at a faster rate than others due to the relatively low cost of mobile devices as well as its user-friendliness.

However, according to the UNESCO, both CALL and MALL have so far failed to substantially influence education [1]. Thus, the leveraging of technology to enhance the teaching experience in the language classroom is long overdue. Technology can be used in the preparation of course materials, for facilitating the logistics of a programme, in the delivery of content, and as a source of motivation for students. Technology has made the design and delivery of fully online and hybrid or blended courses amazingly simple and interesting. Indeed, blended learning is the fruition of developments in the fields of MALL and CALL. Language specialists and syllabus designers have been

compelled to revisit and, in a sense, revive traditional instructional design models and to make them more practical in the language classroom. In this regard, the present paper investigates the use of the ADDIE model in designing a blended programme for teaching Arabic. Despite its international, political, economic, and religious significance, Arabic is still one of the less commonly taught languages in South Africa. To be more precise, this study aims to design a technology-enhanced blended syllabus for teaching Arabic in the Department of Arabic Studies at the International Peace College South Africa (IPSA). The motivation for this is to discover the extent to which such a programme can help learners improve their Arabic language skills. IPSA is one of the few institutions that offer Arabic language courses at the undergraduate level in South Africa. Furthermore, this study also investigates the attitudes of Arabic as a foreign language (AFL) students at IPSA towards the proposed syllabus. In particular, this study attempts to answer three main questions as follows:

(1) Do Arabic students at IPSA have positive attitudes towards a blended syllabus?

(2) Is there a correlation between the learners' attitudes and their study level?

(3) Is there a correlation between the learners' attitudes and their gender?

To answer the second question, a null hypothesis is formulated as "there is no statistically significant relation at $P \leq 0.05$ between the study level of participants and their attitudes towards the blended syllabus." Similarly, a null hypothesis is formulated for the third question, stating "there is no statistically significant relation at $P \leq 0.05$ between the gender of participants and their attitudes towards the syllabus."

Hence, this study does not only explore the adoption of the proposed model in designing and developing interactive online materials and websites for teaching Arabic online but also for developing a ubiquitous learning prototype that will potentially provide new learning experiences to learners of Arabic as a foreign language. The approach and format adopted in this study may serve as a guideline for the design of instructional resources for language teaching and learning in the South African context and beyond.

2. Blended Learning

Blended or hybrid learning is an emerging model of learning which includes the combination of traditional teaching methods with online learning [2, 3]. Some educators, however, argue that blended learning has a broader scope, and it may include the combination of e-learning tools to achieve the learning objectives of a lesson. Blended learning also has the potential to incorporate various pedagogical approaches such as behaviorism and constructivism to produce an optimal learning outcome. In the latter case, the use of instructional technology may not be mandatory [4].

It should be noted that the combination of self-paced online education and face-to-face training can be beneficial, but if it is not wisely applied, it can become counterproductive. It should not be expected that all students and teachers will be passionate about this paradigm shift in teaching and learning. Some of the challenges that hinder successful implementation of blended learning can be the lack of essential infrastructure, the high cost of software and hardware technology, IT literacy, and the implications of blended learning in terms of workload, especially in the initial phases of implementation. Additionally, the technological resources used in blended learning might not be user-friendly, and hence might not be accepted by all teachers and students. A blended programme may also increase the cognitive load on students, especially if it is poorly designed. Furthermore, a blended programme is likely to create some issues with plagiarism and cheating [5].

Blended learning can take different forms and models. Its design and implementation are likely to differ amongst teachers, programmes, and schools [6]. As suggested by Hannon and Macken [7], there are three models of blended learning: blended presentation and interaction, blended block, and fully online, as shown in Figure 1.

As its name indicates, the first model combines presentation and interaction. Classroom engagement is the primary focus in this form of blended learning. The online component, which consists of supplemental activities, serves as support. The flipped classroom is an example of this model of blended learning. A blended block or programme flow model incorporates a sequence of face-to-face sessions and online tutorials. Students might have face-to-face presentations afterwards. In contrast to the first two models, the fully online model does not include any face-to-face physical interaction. The blend takes place through the incorporation of synchronous meetings via platforms such as Zoom and asynchronous sessions or activities. These three models "provide initial frameworks for the deliberate structuring of blended learning to improve learning outcomes." [6] Hence, blended learning is not simply the adding of technology-enhanced activities to a lesson or a course. It is a sophisticated blend that combines face-to-face instruction and online learning with the aim of achieving certain pedagogical needs and overcoming time and location constraints.

3. Literature Review

The use of blended learning for language instruction, including Arabic, has been investigated in various studies. For instance, studies which investigated the outcomes of using a blended language learning environment on English as a foreign language (EFL) include learners in an Indonesian context [8], a Chinese context [9], and a French university context [10]. These studies found that a blended syllabus plays a significant role in enhancing students' motivation and learning autonomy [9]. It has also a great impact on student learning, test results, and classroom language use [10]. However, despite its benefits, blended learning also involves several problems and weaknesses. Noninteractive activities and materials, connectivity issues, and a lack of technology-literate instructors are just a few of the drawbacks [8]. In addition, some students remain hesitant to

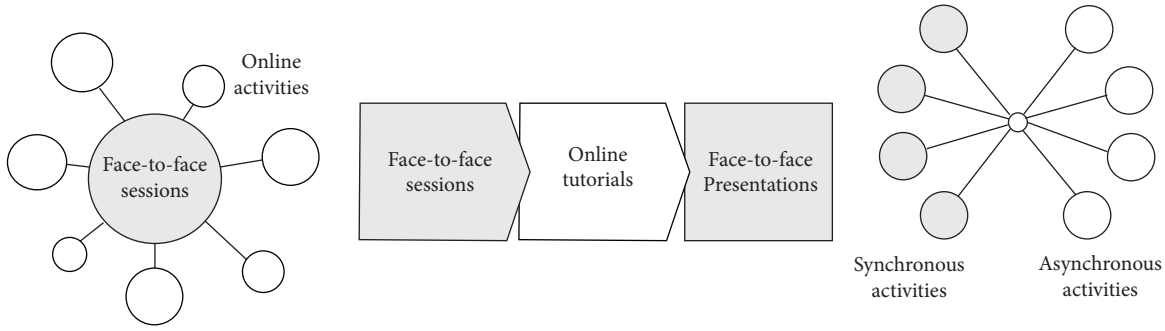

Figure 1: Models of blended learning [7].

accept blended learning despite the likelihood of receiving greater instructor input in a blended program than they would in a class of forty or fifty students [10].

The use of blended learning in an EFL class was also examined in a recent study [11]. The participants of the study were thirty-nine students, some of whom were people with physical or intellectual disabilities. The study concluded that the participants, especially those with disabilities, were satisfied with the blended course and the flipped learning model adopted in it. Web tools such as infographics, Padlet, Google Docs, and Canvas were also employed in a blended English reading course. The use of infographics, Padlet, Google Docs, and Canvas enhanced collaboration among the learners and allowed them to actively participate in reading tasks [12].

Similar studies were conducted to investigate the impact of a blended learning approach on the performance of students of Arabic at Islamic State University in Indonesia [13] and at Islamic University in Madinah, Saudi Arabia [14]. It was also used in the teaching of students of Arabic as a foreign language in a Singaporean context [15]. Blended learning was found to be more effective than traditional face-to-face instruction [14]. It improved the average scores of learners of Arabic [13], promoted problem-based learning, and was shown to result in an increased level of self-autonomy of students. It also played a key role in the development of the digital and communication skills (ICT) of the learners [15]. A blended learning course was also designed to teach the Arabic alphabet at an American elementary school. The blended materials were created and delivered via Google applications. The pronunciation of the students as well as their reading and writing skills showed notable improvement [16].

For the optimal use of blended learning in the language classroom, the adoption of instructional design models is essential. Unfortunately, very few studies have examined the use of established instructional frameworks in the design of blended syllabi in language courses. The ADDIE instructional design model was used to create a website for teaching Arabic for tourism purposes at a Malaysian university. The Grav® CMS platform was used to design the syllabus [17]. Similarly, the ASSURE model was used in the design of a blended syllabus for teaching a *ḥadīth* (i.e., the recorded traditions of the Prophet Muhammad) module for students of Arabic as part of learning about Shariah in a South African undergraduate class. The design applied the six phases of the ASSURE model. These phases are analyze the students; state the objectives of the course; select methods, media, and materials; utilize media and materials; require student participation; and evaluate and revise [18].

The e-learning industry has created a wealth of software that makes the design of blended and fully online courses easy and appealing. Learning management systems such as Moodle and Sakai enable teachers to design integrated course layouts and enriching course sites that raise the students' motivation and enhance learning. Moodle, for instance, was used to present a blended course model for teaching a Turkish course for beginners at Tel Aviv University [19].

Although the above studies report on the design of blended materials for one or more language skills, few of them explain how the materials were created. This study, however, attempts to avoid any haphazard or hasty approaches in the development of blended syllabi. This study is part of a deliberate and phased project that was conducted over three years. It is based on well-known pedagogical theories and an established instructional design model, namely, ADDIE. It was carefully implemented across three undergraduate levels (i.e., National Qualifications Framework (NQF) level 5, NQF level 6, and NQF level 7). Based on the review of the known literature, this is the first study that attempts to design a comprehensive blended Arabic programme for teaching Arabic and less commonly taught languages (LCTLs) in South Africa and perhaps globally. Most of the published studies focus on languages such as English, even in the Arab world. The above studies also employ and test limited technological tools and thus fall short when exploring potentially more effective web-, computer-, and mobile-assisted language learning tools, all of which can be used for the creation of an array of textual and multimodal language learning prototypes.

4. Research Methods and Materials

4.1. Syllabus Design. The present research aims to design a blended syllabus for teaching Arabic as a foreign language at the International Peace College South Africa (IPSA) based on the ADDIE instructional design model. This is a qualitative study which describes various phases of the model from analysis to implementation. The ADDIE instructional model is widely used for developing a variety of instructional

programs, courses, and training [20–22]. The model is composed of five phases, namely, analysis, design, development, implementation, and evaluation. Each of these five phases is composed of different procedural steps. The entire process in ADDIE's instructional design model is illustrated in Figure 2.

This study not only deals with the description of the blended syllabus but also investigates students' perceptions towards it.

4.2. Questionnaire. A cross-sectional study design is adopted in the current study to find out the perceptions of the students towards the proposed blended syllabus. The participants in this study were thirty-three undergraduate students enrolled in three Arabic language courses in the academic year 2020 at IPSA. The blended syllabus was initially designed and implemented in the first semester of the academic year 2018-2019. It was completed and fully implemented across three undergraduate levels at IPSA during the first semester of the academic year 2020-2021. Due to the small number of students at the college, all students were considered part of the sample for this study. The distribution of participants across gender and academic levels is shown in Figures 3 and 4, respectively.

4.2.1. Procedure. Prior to the data collection, permission to conduct this study and undertake research was acquired from the principal of IPSA. This study has therefore received formal ethical clearance from the postgraduate division at the International Peace College South Africa (IPSA). A close-ended structured questionnaire of twenty-five items was prepared via Google Forms. The questionnaire covered three main components: design and layout, resources and activities, and the impact of the syllabus on the students' language skills. The questionnaire clearly stated that participation in the study was voluntary, and there were no known or anticipated risks. Participants were clearly informed that they could decline to answer any of the questions and exit the questionnaire at any time. The form also stated that all data collected would be treated as confidential and the participant's anonymity protected in any reports or publications produced as a result of the questionnaire. Twenty-three participants completed questionnaires.

4.2.2. Reliability and Validity. Before using it for data collection, the questionnaire was sent to two experts for review, one of whom is an instructor in the Department of Arabic Studies at IPSA. The other teaches at the Centre of Languages and Translation at Taiz University in Yemen. Both recommended some modifications to ensure the questionnaire's validity. Cronbach's alpha was used to measure the reliability of the questionnaire items. First, a pilot study with ten students was conducted to test the questionnaire's reliability. The participants of the pilot study were excluded from the final sample. The Cronbach alpha outcome of the pilot study shows that its coefficient exceeds the standard benchmark of 70%. This indicates high reliability of the questionnaire items.

5. Description of the Instructional Design

This paper presents a blended syllabus for Arabic as a foreign language which strikes a balance between the four language skills (reading, writing, speaking, and listening) while using an aesthetically appealing and uniquely tailored course website. In the following, the designed blended syllabus is explained using the ADDIE model. Special reference is given to one of the units in the intermediate Arabic module [23].

5.1. Analysis Phase. This phase is concerned with the analysis of four key issues or factors as follows.

5.1.1. The Students. The syllabus is designed for students of Arabic as a foreign language at the undergraduate level at a South African tertiary institution. The syllabus is designed following a progression; elementary Arabic begins at level 1, intermediate Arabic at level 2, and advanced Arabic at level 3.

5.1.2. Instructional Goals. An effective instructional design cannot be produced if there are no clear instructional goals. The key goal of this project is to come up with a blended syllabus that enables undergraduate students at IPSA to learn Arabic for general purposes. To facilitate this, an interactive website must be meticulously designed with the aim of motivating learners and enhancing their language skills. Moreover, the proposed technology-enhanced syllabus should facilitate self-paced learning outside the classroom.

5.1.3. Instructional Analysis. Having identified the goals of the programme, syllabus designers require an action plan for the essential steps that must be followed to achieve instructional goals. This may include the selection of topics, materials, and websites needed for teaching, as well as the learning activities and prototypes to be embedded on the website of the proposed blended course.

5.1.4. Learning Objectives. The blended syllabus under investigation consists of several units. Each unit is divided into various lessons. Each lesson begins with a set of defined learning objectives and outcomes that contribute to the overall objectives of the course, as shown in Figure 5.

5.2. Design. The design phase focused on the conceptual construction of the blended syllabus. Special attention was paid to e-learning ecology (e.g., website and learning management system (LMS)), its features, and how it can be used in the foreign language classroom. In this phase, the syllabus designers focused on three key design elements: learning contents, assessments, and instructional strategy.

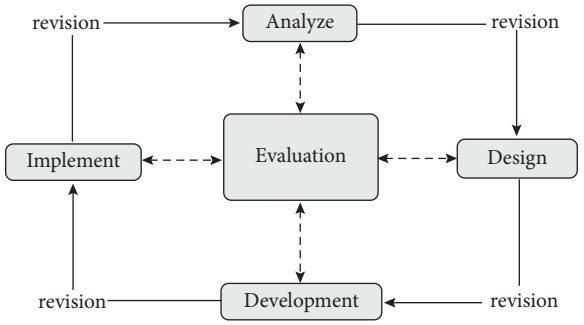

Figure 2: ADDIE's instructional design model.

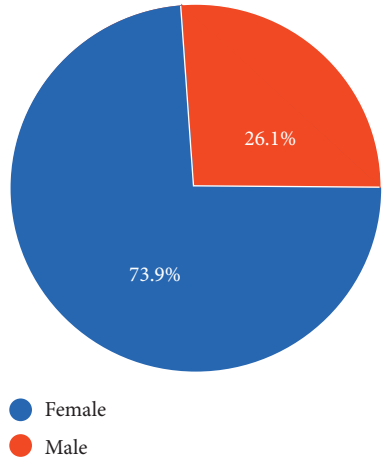

Figure 3: Gender of the participants of the study.

5.2.1. Learning Content Design. The content strikes a balance among the four language skills. The texts selected in the content are all authentic general-purpose topics. Undoubtedly, the design of a successful and balanced blended syllabus requires a vibrant learning environment with a media portal that includes a wide variety of contents, interactive videos, narrated PowerPoint videos, screencasts, podcasts, branching scenarios, dialogue simulations, and animations.

5.2.2. Assessment's Design. For the assessment to be effective, both formative and summative assessments are essential. Formative assessment takes place in various steps of the lesson or unit through interactive videos, gamified quizzes, and peer assessments, among others.

5.2.3. Designing the Instructional Strategy. The design of a website that divides the content into short segments in line with the course descriptions and the time of the lectures was initiated as part of this study. The website was divided into five main pages (i.e., units), and each page was further divided into six subpages, segments, or lessons, as shown in Figure 6.

Each unit on the syllabus consists of a reading lesson, a listening lesson, a speaking lesson, and an extensive reading or a reading-for-pleasure lesson. Writing assignments are incorporated into various components.

A Google site was then embedded into the institution's learning management system, namely, NEO LMS. This was to facilitate more effective teaching and management of the learning process, as shown in Figure 7.

Several instructional methods and techniques were employed to achieve the lesson's objectives and learning outcomes including collaborative learning, project-based learning, scenario-based learning (SBL), wikis, discussions, and presentations. A proposal for design and structure was also drafted to guide the subsequent development phase.

5.3. Development Phase. In the development phase, the content assets and methodology that were described in the design phase were created, assembled, and tested. The existing infrastructure at the host institution, including hardware and software required for the development of the blended syllabus, was considered. Although IPSA has a fully equipped multimedia lab and a high-speed, dedicated server with good bandwidth and a resident maintenance team, the aim is to design a blended syllabus that does not require a sophisticated technology such as a dedicated server and a traditional language lab. The syllabus is designed with student accessibility and learner-centredness in mind. That is, materials, including lab-based sessions, can be accessed

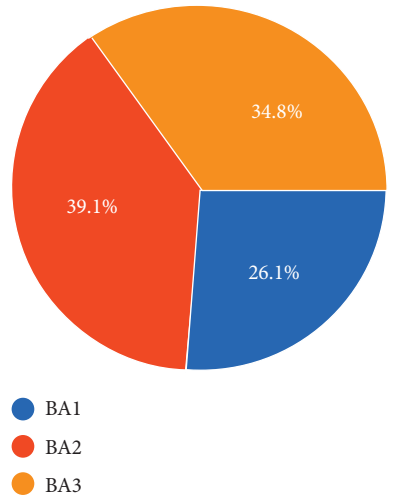

Figure 4: Academic levels of the participants.

Figure 5: Learning outcomes of a reading lesson about Nelson Mandela [22].

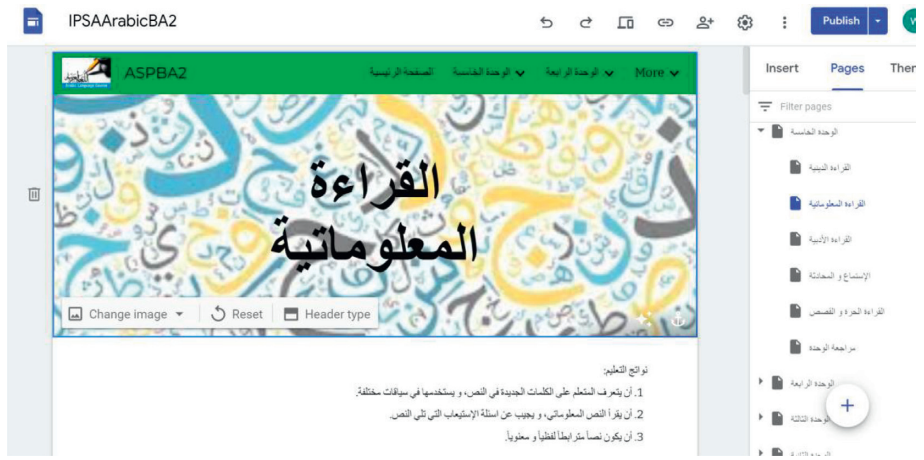

Figure 6: Interface of the blended syllabus [22].

anytime and anywhere via the mobile or PC. For this purpose, the syllabus utilizes some web 2.0 applications such as Google Sites, simulation tools, SCORM packages, and the LTI functionality available in most learning management systems. However, for the content to be SCORM or LTI compliant, the materials must be developed in specific formats in advance. Hence, storyboards and similar materials were prepared in an electronic format. Technology-enhanced activities for each unit were developed and integrated directly onto the website. Activities were prepared

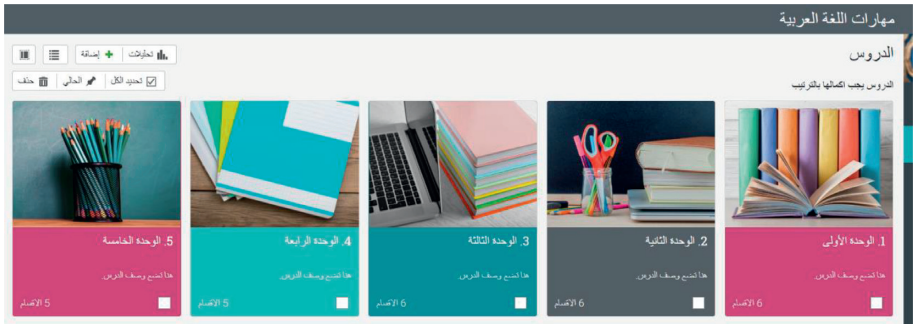

Figure 7: Interface of the blended syllabus in NEO LMS.

Table 1: Content and activities in a sample unit.

Lesson component	Activity	Offline access
Prelesson	Write two sentences about Mandela (discussion)	PowerPoint/SCORM package saved as a zip folder
Poem	Reading comprehension (https://multidict.net/cs/4875/mandela0.htm)	
Reading aloud	Watch a recording of the poem	
Dictionary work (vocabulary)	https://multidict.net/cs/4875/mandela1.htm	
Grammar (singular vs. plural)	https://multidict.net/cs/4875/Mandela2.htm	
Comprehension	https://multidict.net/cs/4875/mandela3.htm	
Creation	Wiki page about Mandela	

with various web-based tools, and they were tested. All related materials and procedures were also debugged. Table 1 provides an example of the storyboards and activities from a unit on the syllabus.

5.4. Implementation Phase. This stage is concerned with the distribution and delivery of the learning materials to students, namely, the students of Arabic across the three undergraduate levels at IPSA. Before the actual implementation, the virtual learning environment (i.e., the website and NEO LMS) was prepared, the technology and media were previewed and tested, and each lesson was examined closely and thoroughly. All materials were tested to find out whether they function properly and to what extent they are appropriate for the intended audience [24].

The proposed syllabus can be described as a blended presentation and interaction in which students participate in face-to-face sessions in a classroom. Concurrently, they are given online activities for further practice and interaction. However, the COVID-19 pandemic has compelled educators to undertake blending in the form of synchronous and asynchronous activities. There is no single method for the implementation of blended learning in the language classroom; blending may differ even from one lesson to another or from one language skill to another. The blended learning model adopted in the implementation of the proposed syllabus is outlined in Figure 8.

As shown in Figure 8, the model consists of three blocks: teacher-led instruction, online instruction, and a hybrid block for collaborative activities. The latter can be implemented either in a physical classroom or virtually. The teacher-led, face-to-face instruction can be devoted to the delivery of almost any skill. A teacher can, for instance, introduce a reading lesson in the classroom and let students read the text and complete skimming and scanning activities in the classroom. Teacher-led instruction can also be conducted online for intervention purposes. In emergency cases, teacher-led instruction can migrate fully online.

Online instruction can take the form of interactive asynchronous activities that can be completed independently by students. These activities typically target content covered in the classroom and incorporate the four language skills. Examples of these tasks are vocabulary quizzes, interactive activities and videos, gamified tasks, recordings of the reading text, a speech recognition practice, etc.

Collaborative learning can be conducted in a physical classroom for teaching various skills. It can also take place in synchronous sessions. A clear example is the use of breakout rooms in a Zoom class, in which students are divided into small groups or pairs for the purpose of completing assigned exercises. It can also be used for long-term collaborative projects such as digital storytelling, presentations, and translation projects. Table 2 summarizes the tasks and activities that are assigned across the three blocks in a listening and speaking unit.

The syllabus features several interactive activities and resources that have been created in line with e-learning standards such as SCORM and LMS LTI, as stated previously. The content can, therefore, be presented either in a brick-and-mortar classroom or virtually. The proposed syllabus incorporates a myriad of activities that enable instructors to teach all language skills with confidence. Sanako Connect, for example, is used to teach speaking and listening

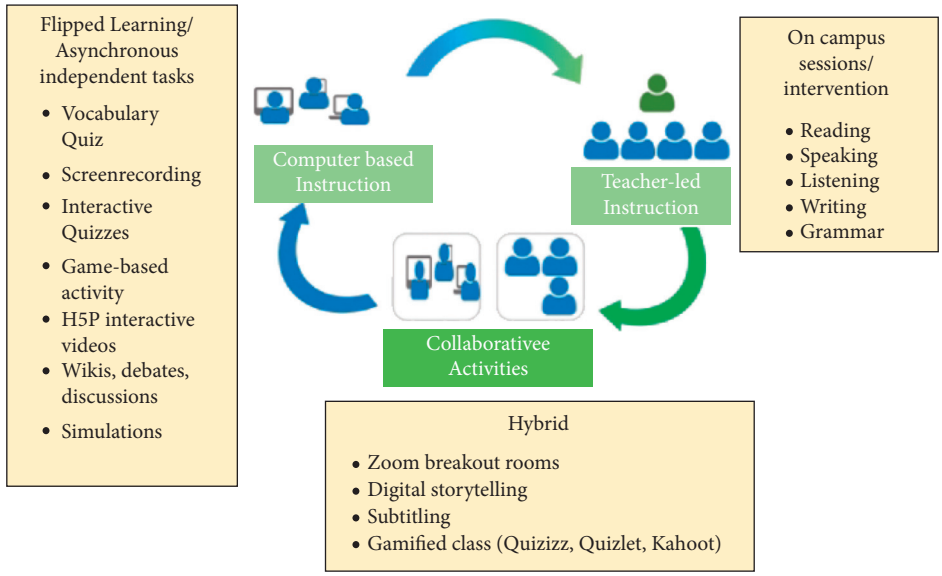

Figure 8: Description of the blended learning model.

Table 2: Application of the model in a speaking and listening unit.

	Teacher-led instruction	Computer-based instruction	Collaborative activities
Listening	Prelistening Listen to/watch a two-minute report Learn the meaning of new vocabulary Listening comprehension Use new vocabulary in similar contexts	Brainstorming (Padlet) Vocabulary game "collocations" Interactive activities "multiple-choice, fill in the blanks" Word link quiz	Online review game Subtitling/closed caption of a video
Speaking	Dialogue Role-play Pronunciation/spelling practice	Interactive tasks Dialogue simulation Interactive board/discussion via Sanako Connect Interactive video	Digital storytelling Online review game

skills in a similar way to how they are taught in a physical language lab. Synchronous sessions via web conferencing tools should be learner-centred to a great extent. Students can complete simple activities, such as spelling practice, by using a collaborative whiteboard or more advanced activities such as a debate via Sanako Connect.

5.5. Evaluation Phase. Evaluation is the final phase in the ADDIE model. Evaluation ensures that the proposed blended syllabus achieves the intended outcome. This phase evaluates materials, media, technological tools, and teaching strategies. Feedback from students and instructors constitutes part and parcel of the evaluation process. Student feedback, in particular, provides an indication about attitudes towards various components of the programme and the challenges students encountered during its implementation. In technology-enhanced blended programmes, learner input is always essential for improving and recalibrating the learning prototype, if necessary.

The evaluation phase also explores and tracks the performance of students in the course. The LMS can, for example, keep track of students who have completed their quizzes and assignments and those who have not yet submitted. A user's log activity can also indicate whether a learner has navigated the content. Statistical tools available in most LMSs enable authorised users such as instructors, tutors, or site owners to view user activity. Figure 9 provides an example of the site usage statistics by one of the students.

6. Findings from the Questionnaire

To investigate the attitudes of the AFL students at IPSA towards the proposed blended syllabus, descriptive statistics including the mean and standard deviations of each item of the questionnaire were calculated. Table 3 shows the students' responses to the items of the first component (i.e., the design and layout).

As the data in Table 3 show, the average for items in the relevant section of the questionnaire ranges from 1.87 to 2.87. This indicates a medium to high level of agreement on all items. The statistics reveal that the participants of this study are satisfied with the design and layout of the blended Arabic language course.

Figure 9: Snapshot of a student's logs and hits.

Table 3: Descriptive statistics for students' perceptions towards the syllabus design and layout.

Item	*N*	SA	*A*	*N*	*D*	SD	Mean	Std. dev
The designed blended course is well organized	23	26.09	52.17	21.74			1.96	0.71
The course layout is attractive	23	26.09	39.13	30.43	4.35		2.13	0.87
The course is motivating and interesting	23	30.43	43.48	26.09			1.96	0.77
The course enhances the interaction between teachers and learners	23	39.13	34.78	26.09			1.87	0.81
The course gives me enough time to do tasks	23		78.26	13.04	8.70		2.30	0.63
The course considers issues such as slow internet connectivity and access to data	23	8.70	26.09	43.48	13.04	8.70	2.87	1.06
I fully support blended learning but not fully online learning	23	21.74	34.78	34.78	4.35	4.35	2.35	1.03

For the second component of the questionnaire, seven items were created to explore the impact of the proposed syllabus on the enhancement of students' language skills. The results are provided in Table 4.

The data in Table 4 show that the average for items in the relevant section of the questionnaire ranges from 1.87 to 2.26. This also indicates a medium to high level of agreement on all items. This shows that the participants in this study believe that the blended syllabus has enhanced their language skills and linguistic competence.

The third section of the questionnaire deals with the attitudes of the students towards the activities and resources in the blended syllabus. This component includes ten items. Table 5 provides details of the perceptions of students towards the activities and resources of the blended syllabus.

As the data in Table 5 show, the average of items in the relevant section of the questionnaire ranges from 1.57 to 2.35. This also indicates a medium to high level of agreement on all items cited. Thus, the participants of this study appear to have been satisfied with the resources and activities of the blended course.

To answer the second question posed in this study, which was to discover whether there is a relationship between the attitudes of the respondents and their academic level or not, a one-way analysis of variance (ANOVA) was conducted. The results appear in Tables 6 and 7.

The results of the ANOVA test indicate that there is no statistically significant relation at $P \leq 0.05$ between the attitudes of the respondents and their study level. Thus, the null hypothesis is accepted.

Significance was found to be 0.993, which is greater than 0.05. Students at all three levels reported similarly positive attitudes towards the programme.

Similarly, an ANOVA to determine if there is a relationship between the attitudes of the respondents and their gender (i.e., male vs. female) was conducted. Tables 8 and 9 provide the results of the ANOVA test.

As the results in Table 9 show, there is a statistically significant relation between the gender of the respondents and their attitudes towards the blended syllabus. Thus, the null hypothesis, which states "there is no relation between the gender of participants and their attitudes towards the blended syllabus," is rejected. The significance was found to be 0.011, which is less than $P \leq 0.05$. The findings show that female respondents reported greater positivity in their attitudes towards the blended syllabus than male students. However, in a small-sized study like this, such a difference may be attributed to the discrepancy in the number of males and females. Out of twenty-three respondents, only seven of them are males. This is insufficient for determining whether female

Table 4: Descriptive statistics of responses towards the syllabus and language skills.

Item	*N*	SA	*A*	*N*	*D*	SD	Mean	Std. dev
The course enhances my reading skills	23	26.09	47.83	26.09			2.00	0.74
Blended learning makes me socially connected and gives me opportunity to practice my speaking and communication skills	23	21.74	34.78	43.48			2.22	0.80
Online videos provide authentic learning experience and allow me to listen to native speakers	23	34.78	43.48	21.74			1.87	0.76
I found the web-based tools useful for the improvement of my language and life skills	23	13.04	52.17	30.43	4,35		2.26	0.75
Interactive videos improve my listening and speaking skills	23	21.74	60.87	17.39			1.96	0.64
The blended course enhances my writing skills	23	26.09	39.13	34.78			2.09	0.79
The blended course enhances my active participation and learning as well as my creativity	23	17.39	69.57	13.04			1.96	0.56

Table 5: Responses towards the activities and resources of the syllabus.

Item	*N*	SA	*A*	*N*	*D*	SD	Mean	Std. dev
The course includes various collaborative activities/tasks	23	39.13	43.48	13.04	4.35		1.83	0.83
The tasks are clear	23	13.04	69.57	8.70	8.70		2.13	0.76
Live classrooms via web conferencing make up for face-to-face interactions, and they are highly beneficial	23	26.09	39.13	17.39	17.39		2.26	1.05
Blended learning helps us to think in depth about a subject and to be involved in more discussions and debating activities	23	17.39	30.43	43.48	8.70		2.43	0.90
Discussion forums, wikis, and chat groups help me in learning	23	21.74	52.17	26.09			2.04	0.71
Blended learning allows us to use different computer programs and web applications	23	26.09	73.91				1.74	0.45
Blended learning helps me to be able to apply what I have learned in the future	23	17.39	60.87	17.39	4.35		2.09	0.73
Blended learning facilitates timely support and constructive feedback from both learners and teachers	23	21.74	56.52	17.39	4.35		2.04	0.77
Gamified activities and game-based learning have made learning enjoyable	23	52.17	39.13	8.70			1.57	0.66
Peer review assignments are highly beneficial	23	21.74	39.13	26.09	8.70	4.35	2.35	1.07

Table 6: Descriptive statistics of the sample.

Descriptive statistics									
						95% confidence interval for mean			
		N	Mean	Std. deviation	Std. error	Lower bound	Upper bound	Minimum	Maximum
Sum	BA1	6	51.67	13.28	5.42	37.73	65.60	36.00	73.00
	BA2	9	52.33	8.73	2.91	45.62	59.05	32.00	62.00
	BA3	8	51.75	14.02	4.96	40.03	63.47	29.00	67.00
	Total	23	51.96	11.42	2.38	47.02	56.89	29.00	73.00

Table 7: ANOVA results for students' responses based on the study level.

ANOVA						
		Sum of squares	df	Mean square	*F*	Sig.
Sum	Between groups	2.12	2	1.06	0.01	0.993
	Within groups	2866.83	20	143.34		
	Total	2868.96	22			

students generally have more positive attitudes towards the blended syllabus than male students. More studies are needed to investigate this correlation.

7. Discussion

The results indicate that the respondents are satisfied with the layout of the designed course. Ultimately, a linear thematic layout consisting of various topics may not be appropriate for teaching Arabic and other foreign languages. The presentation of the syllabus in the form of weekly chronological units, or modules, may be more beneficial and motivating to students. The respondents reported that the blended syllabus is attractive, well designed, and motivating.

Additionally, a blended syllabus may ensure a smoother learning process and greater interaction between students and instructors and allows more time for discussion. It provides students with the opportunity to speak more and to

Table 8: Descriptive statistics of the sample.

Descriptive statistics									
						95% confidence interval for mean			
		N	Mean	Std. deviation	Std. error	Lower bound	Upper bound	Minimum	Maximum
Sum	Male	6	42.17	12.95	5.29	28.57	55.76	29.00	62.00
	Female	17	55.41	8.85	2.15	50.86	59.96	36.00	73.00
	Total	23	51.96	11.42	2.38	47.02	56.89	29.00	73.00

Table 9: ANOVA results for students' responses based on gender.

ANOVA						
		Sum of squares	df	Mean square	*F*	Sig.
Sum	Between groups	778.01	1	778.01	7.81	0.011
	Within groups	2090.95	21	99.57		
	Total	2868.96	22			

discuss topics they could not in the classroom. The respondents also agreed that the proposed syllabus considers the logistics and limitations of blended and online learning, such as slow connectivity and access to data. Most of the activities in the syllabus are designed in a manner that allows both online and offline access.

The findings of this study have also shown that the blended syllabus enhances linguistic competence and communication skills. In their view, blended learning enhances student reading skills, provides social connections with other students, and provides the opportunity to practice speaking and communication skills. Online videos provide authentic learning experiences and allow students listen to native speakers. The respondents also reported that interactive videos are beneficial for the improvement of listening and speaking skills. The blended course also ensures more time to participate in discussions, debates, and wikis, thus allowing students to practice their speaking and writing skills. The blended course also enhances active participation, learning, and creativity. Furthermore, various web-based tools used in the course not only enhance language skills but also students' digital literacy and ICT skills.

The findings of this study have also shown that students are satisfied with the activities and resources in the blended syllabus. In their view, discussion, wikis, and debate activities encourage them to work collaboratively. The synchronous meetings enrich their learning experience. Students also reported that certain activities stimulate their higher-order thinking, such as critical thinking skills in the target language. Gamified activities are especially favoured by students, who indicated that the game-based activities increase their motivation to learn the content. The blended syllabus also provides students with the opportunity to participate in the assessment process. They reported that peer assessments enhance their confidence and autonomy within the programme, as well as their learning experience. A cursory look at the peer assessments submitted via the LMS shows that students generally provided constructive feedback to their peers. The findings have also shown that the blended syllabus facilitates timely support and constructive feedback from both students and instructors. Additionally, the syllabus familiarizes students with a considerable number of computer and web tools that they can use in the future.

8. Limitations and Future Research Directions

To the best of our knowledge, this study is the first of its kind both locally and internationally that attempts to design a blended syllabus for Arabic as a less commonly taught language. The proposed model can be used as it is or with idiosyncratic modifications to design blended or fully online syllabi for teaching languages. This study mainly focuses on the development of accessible, learner-friendly, and interactive materials, as well as the perceptions of students towards blended curricula. However, further study would be required to explore the success of blended syllabi and the perceptions of other stakeholders towards these, including the instructors, tutors, administrators, and parents. In addition, this model could be applied to other less commonly taught languages including French, German, and Latin.

9. Conclusions

This study has demonstrated how instructional design frameworks such as ADDIE may be utilized to construct e-learning and blended courses. This model has been used to design a blended syllabus for teaching Arabic as a foreign language in the South African context. The adoption of this model ensures the design of effective and well-structured blended learning prototypes. The use of well-established instructional design models can help to reduce the haphazard approach in the design of many blended and remote syllabi. Even though the current study focuses on the format of an Arabic course offered in the Department of Arabic Studies at IPSA in South Africa, the proposed blended syllabus is intended to serve as a model for blended learning foreign language courses in the broader South African context and beyond. Moreover, the model can be offered and delivered to students via a user-friendly website, or it can be directly

incorporated into an institution's learning management system such as Moodle, Sakai, NEO, and Canvas.

This study has also investigated the attitudes of three cohorts of students towards a blended syllabus. Findings from the questionnaire have shown that students reported positive attitudes towards the design, activities, and resources, as well as towards its impact on various language skills. This study has also concluded that there is no statistically significant relation between the attitudes of students and their academic level. The study has, however, found that there is a statistically significant relation at $P \leq 0.05$ between the attitudes of students towards the syllabus and their gender. That is, female students were found to have more positive attitudes towards the syllabus than male students. In a small study like this, such a finding is not necessarily representative of a large trend. The fact that the female students who participated in the study outnumbered male participants further limits the possibility of a correlation.

Data Availability

The data are collected from the learners via a cloud-based online survey tool. The data are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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Research Article

Intelligent Tutoring System: Learning Math for 6th-Grade Primary School Students

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This paper proposes a web-based application designed to help elementary school students who have difficulty learning online independently and also their parents who are currently having difficulty teaching their children to study at home online, especially at this time of difficulty with a pandemic outbreak like COVID-19; this time does not allow for physical meetings for the learning process in primary schools. In this paper, we only focus on mathematics because based on several other studies, it is very difficult and important to learn mathematics at the beginning of educational activities such as at the elementary school level. In this paper, the system is modeled using the Unified Modeling Language (UML) tool in the form of a use case diagram which is used to describe the proposed business process and uses class diagrams to describe the database model diagram. In this case, the class diagram is used to describe the data in the class diagram where each class refers to a table in the database. The web-based application user interface is shown at the end to show the communication between users and applications, where this web-based application is implemented using Personal Home Pages (PHP) as server programming and using MySQL to store database model designs. Moreover, for the Intelligent Tutoring System (ITS), content was created using the Cognitive Tutor Authoring Tools (CTAT) which is an authoring tool for learning mathematics created by Carnegie Mellon University. In the end, this web-based application is expected to be used and support teachers as a complement to online mathematics learning, especially during difficult times such as during the COVID-19 pandemic.

1. Introduction

A virus outbreak called COVID-19 occurred in Indonesia in March 2020. This affected many sectors in Indonesia, and one of the clearest impacts is on Indonesia's education. The government decided to minimize educational activities across the country by changing the learning method into an online learning system or daring with the hope to prevent or diminish the spread of COVID-19 [1]. The research found that this will highly affect education institutions that are not ready to embrace the new learning system. Some problems need to be anticipated not only by education institutions but also the government while implementing the new learning system such as Internet connection, devices needed, and many more [2].

Students become one of the main victims of the new learning system. The research found that COVID-19 has hugely affected students' psychology. Some students show signs or symptoms of having an anxiety disorder. This research also shows that the learnings are not optimal without the guidance of an expert. In this situation, students' only goal is to stay present in attendance. Lack of independent learning by students is one of the biggest causes that make students demotivate in the learning process [3]. With the

necessity of students learning online, parents tend to be involved. This can result in a positive or negative effect, and the research shows that parents who have a high level of education are mostly more confident in being involved in the education of their children than parents with a low level of education [4]. According to research, students' prior knowledge, in this case, primary school, is important and should be taken into consideration because it helps dictate students' knowledge in the future and will influence students' achievement.

Especially about the mathematic story case or word problem case, research was conducted and compared a high school student who was more native in English in terms of reading or writing with a primary student who was still in the learning stage of English. Furthermore, when the English word was combined or matched with mathematic operation, students from both sides performed worse on the story case with more text [5].

In facing problems that were mentioned before, this research proposes a method of teaching which will be focused on mathematics as it is one of the hardest primary school subjects which is caused by the lack of understanding of related concepts and the use of mathematical terminology [6]. The method of teaching that is proposed by this research can be achieved by the implementation of an Intelligent Tutoring System. An alternative method of teaching should be taken into consideration as it will help in boosting students' participation and learning progress, which becomes one of the main difficulties faced by Indonesian teachers while teaching online [7]. The research was conducted to measure the effectiveness of using an intelligent tutoring system and was concluded with an astonishing result that shows students who received this method of learning can outperform the other students [8]. Teachers have also shown signs of interest in the usage of the intelligent tutoring system because not only does it help in keeping students motivated but also helps in increasing students' problem-solving skills. In addition, step-by-step problem solving made by the intelligent tutoring system can easily be monitored by both teachers and students [9].

2. Current and Previous Research

In this section, we will elaborate the papers that we have collected for our reference to complete this paper; as we know, our title is about an intelligent tutoring system for mathematics; some of the students said that it is easier to learn mathematics after trying the intelligent tutoring system because of the efficiency in material and in nowadays' terms of teaching [10], many students find that mathematics is hard to learn but all of that depend on the Working Memory (WM) from the students themselves; in this context, students' working memory was identified as the important thing in learning performance, so solving the problem in mathematics too is an essential part of the student working memory [11].

With the implementation of an online learning system, the emergence of a new method of learning is unavoidable. One of the methods of learning is by implementing an Intelligent Tutoring System, and it was proven to be more effective in helping students develop more learning methods while, at the same time, becomes an alternative solution for the problems that students faced while using traditional learning methods [12]. Implementation of an intelligent tutoring system has been on the surface for years and was surveyed to be around 55 by the end of 2017 and does not close the possibility of being more than that [13].

There are some positive psychological effects of using the ITS as a learning system. Research on the web-based intelligent tutoring system said that the ITS does not significantly affect students' retention levels on the given subject, but it does help students to get greater academic achievement [14]. Another research also states that, aside from higher academic achievement, the use of the ITS also improves students' motivation, as concluded from their survey [15].

In a paper about ITS survey from 2000 and until the end of 2018, most ITSs usually have four parts, namely, the knowledge model which is used to model knowledge, the student model which is used to model students, the pedagogic model which is used to model the pedagogy, and finally, the user interface model used to model the User Interface (UI) as an application display that is used for communication between users and applications. The knowledge model serves as a place where all the actual teaching materials are found. The student model saves and collects data about students' habits and behaviors, individual data for each student. The pedagogical model will then use the teaching materials and the data collected about each student to control teaching experience, including, but not limited to, adjusting speed, picking the right tutoring strategy, and giving feedback to students. Finally, the user interface model, or what is sometimes referred to as a communication model, functions as a liaison between students and the system [16].

Making an ITS was originally only available to programmers. However, from time to time, research emerged to ease the making of the ITS. Nonprogrammers nowadays can also create their own ITS using available authoring tools. People do not need to code for their ITS; they only need to perform a model tracing or an example tracing on the authoring tools [17]. One of the most recent studies in this year even pushed forward a way to ease ITS making, saying that people can create the ITS faster, rather than using model tracing or an example tracing, with the help of machine teaching [18].

While interests were built upon all the positive effects of using an intelligent tutoring system, negative ones seem to be undeniable too. Some of the effects are the cost of implementation by researchers, users become socially isolated, lack of communication skills by users, the exposure of users to harmful contents, and many more [19]. This is also supported by other research which stated that developing an intelligent tutoring system is not an easy task and can only be possible with lots of authoring guidelines, feedbacks, and a good team of researchers and developers surrounding the creation of an intelligent tutoring system and serves as its main resource [20].

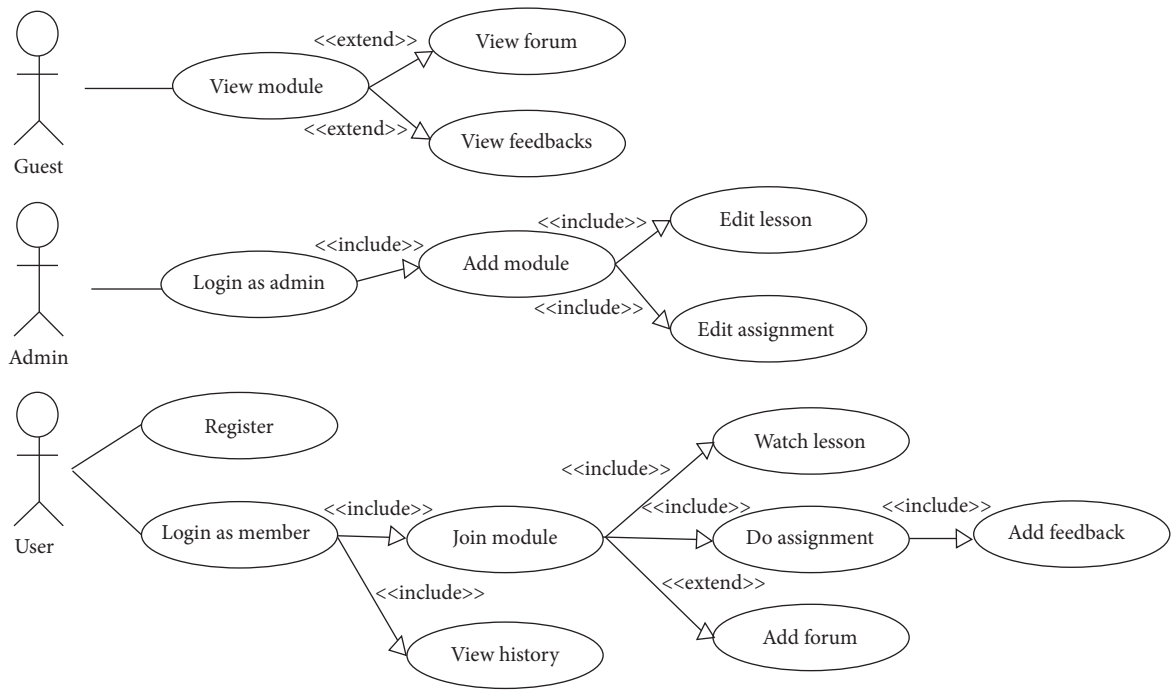


Figure 1: Use case diagram of the proposed model system.

3. Proposed Idea

3.1. Method of Creation. The idea is to create an ITS using the Cognitive Tutor Authoring Tools (CTAT) which is an authoring tool for learning mathematics in grade-6 elementary schools. The reasons are to have a faster developing time and ease of making. Also, CTAT is free to use for research and academic purposes.

The first step to build the ITS is to make an HTML for the student interface. In the beginning, this paper makes use of the drag-and-drop method to make the HTML using CTAT HTML editor available online from Carnegie Mellon University. We also specify some components as variables to make multiple similar questions with a slight difference in numbers or texts, the value which would then be specified in a spreadsheet editor (Microsoft Excel). The file should be saved in a Google Drive folder synced to one of our PCs. After that, we would like to modify the HTML by hand coding for additional aesthetics, adding some CSS and JavaScript.

Inside the authoring tools installed in our PC, we specify an example-tracing tutor as our chosen type to build the tutor. The example-tracing tutor works by defining an initial state (creating the first node in the behavior graph), and then, we use a behavior recorder to have a CTAT record our actions each as a step while demonstrating problem solving in the student interface. We can also demonstrate alternative steps to solve the problem, which is also valid but not preferred. Then, we set groups for the steps and make some steps done by the student to be ordered or unordered to be recognized as true.

After demonstrating the correct steps to solve the problem, we then demonstrate some incorrect steps. The engine defines all unrecognized input by the student as wrong answers automatically. The reason we demonstrate some incorrect steps are to place hint messages on some specific false step done by the student, which the text will prompt inside a hint widget of the CTAT HTML component. We also write some hints in the correct step.

The last thing to do inside the authoring tools is to create skill labels. We attach it to the graph, and then, it will be used by the system for knowledge tracing. The skill name or label would also be visible to the student when we put a skilled window (a CTAT HTML component) on the HTML. All things set in the authoring tools are saved as a BRD file. Since we do not use any Learning Management System (LMS), we do hardcode to connect every HTML to their respective BRD files. All project files will be saved in a folder inside the server, and we will save the HTML file path on the database.

3.2. Diagrams. We use the Unified Modeling Language (UML) tool such as use case diagram and class diagram, where the use case diagram is used to design the proposed business process while the class diagram is used to model the database model design where each class in the class diagram is represented as a table in the database. The use case diagram in Figure 1 shows the business process in the proposed ITS which includes three actors as a guest, admin, and user.

The guest could access the viewing module section and could separately view the forum and viewing feedback, the admin actor has the privilege to add the module, edit a lesson, and edit the assignment, and the admin actor must access the view module section for viewing the forum and viewing the feedback. Moreover, the third actor is the user, where the user could also access the view module section and

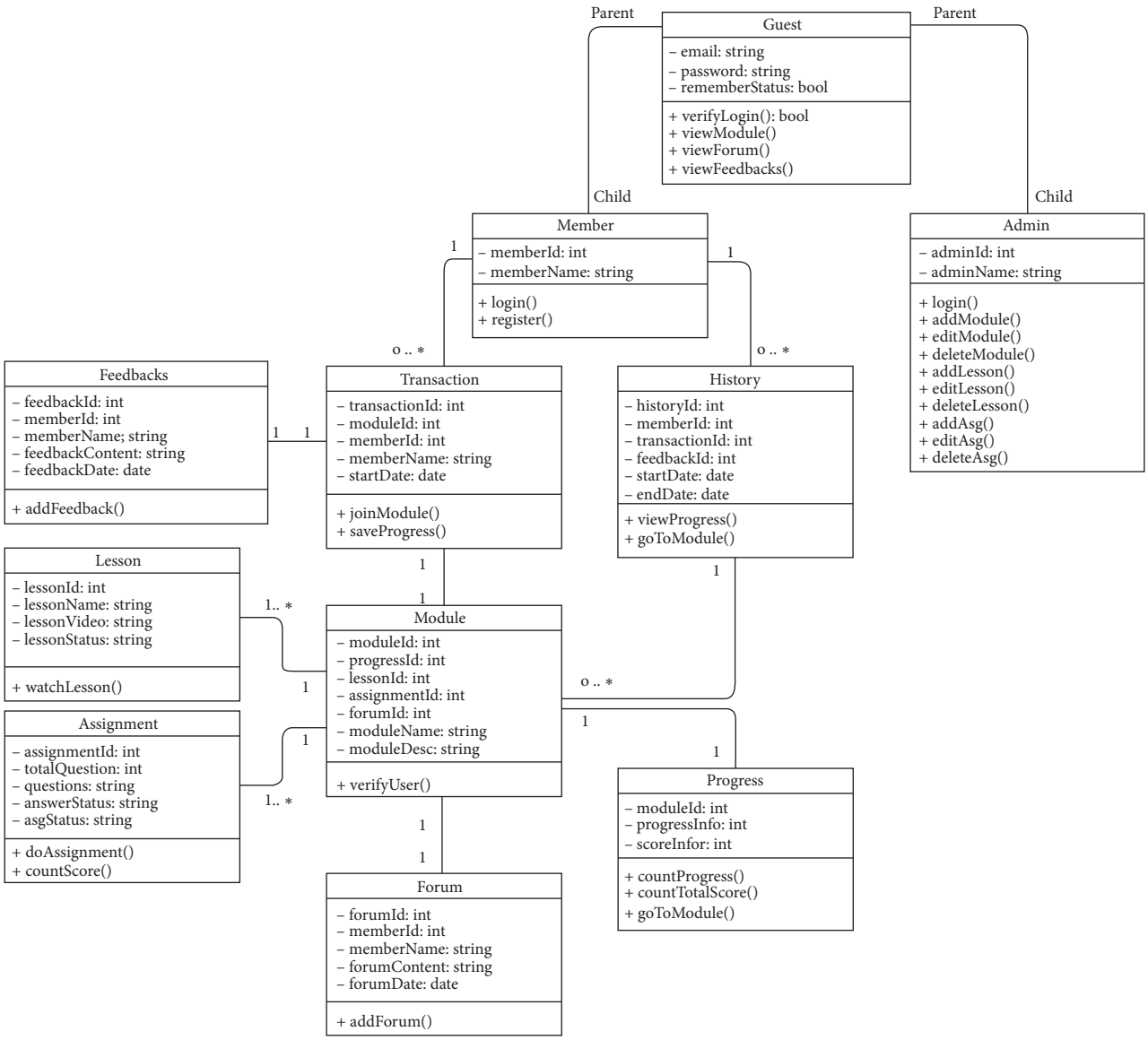


Figure 2: Class diagram.

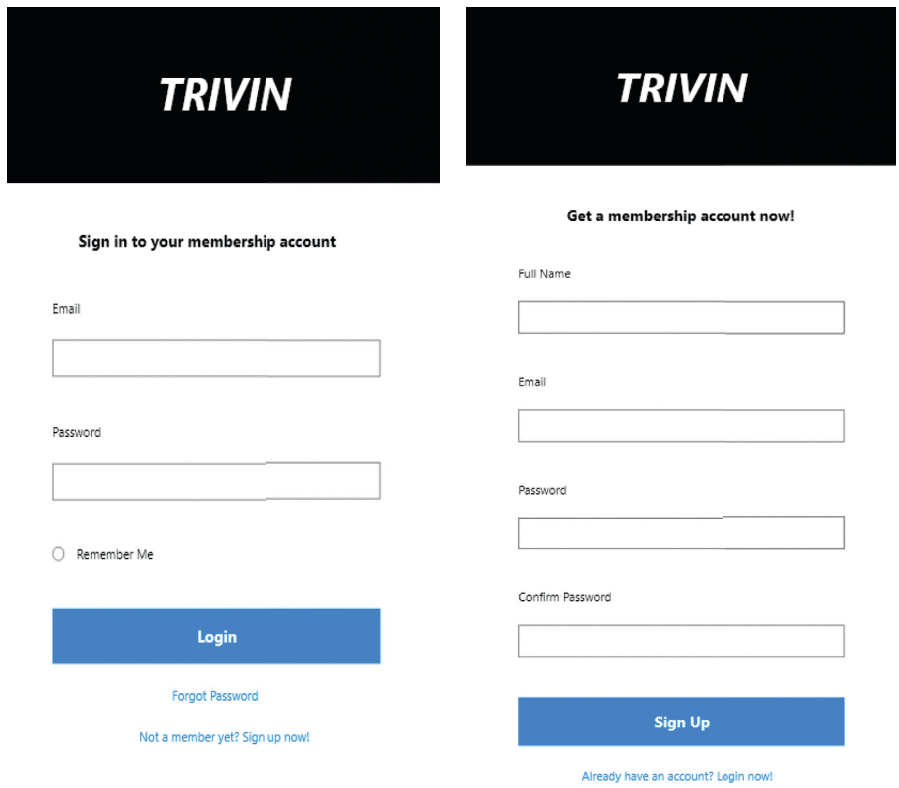
the user could freely view the forum and the feedbacks; the users could register their account and can log in as a member to have more privilege such as joining a module and viewing progress. After joining the module, the user may view the lesson, do the assignment, and add a forum; after doing the assignment, the user can add feedback to the assignment.

Figure 2 shows the class diagram for ITS math for the sixth grade. This diagram contains 11 classes that will correlate in a way with one another. The first class is the guest class, acting as a parent class that will inherit attributes such as e-mail, password, and rememberStatus. All attributes are private. This class will also have public methods such as verifyLogin() to see user status, viewModule(), viewForum(), and viewFeedbacks() which are the privileges that can be obtained by being a Guest user.

The next class is the member, which is a child of the guest class and will get all the attributes and methods available in the guest class. In this class, there are private attributes such as memberId and memberName. There are also public methods such as login() and register(). This class will contain zero or any transaction(s) and zero or many histories.

The next class is the admin class, which is a child of the guest class and will get all attributes and methods available in the guest class. In this class, there are private attributes such as adminId and adminName. There are also public methods that an admin can do which is login(), addModule(), editModule(), deleteModule(), addLesson(), editLesson(), deleteLesson(), addAsg() (Asg = assignment), editAsg(), and deleteAsg().

The next class is the transaction class which contains private attributes such as transactionId, moduleId. memberId, memberName, and startDate. In this class, there are public methods such as joinModule() and saveProgress(). This class belongs to one member class and can give one feedback for each transaction made.



(a) (b)

Figure 3: (a) Login page user interface and (b) register page user interface.

The next class is the history class which contains private attributes such as historyId, memberId, transactionId, feedbackId, startDate, and endDate. In this class, there are public methods such as viewProgress () and goToModule (). This class belongs to one member and has zero or many modules.

The next class is the feedbacks class which contains private attributes such as feedbackId, memberId, memberName, feedbackContent, and feedbackDate. In this class, there is a public method which is addFeedback (). This class belongs to one transaction.

The next class is the module class which contains private attributes such as moduleId, progressId, lessonId, assignmentId, forumId, moduleName, and moduleDesc. In this class, there is a public method which is verifyUser () to see if a user is logged in. This class has at least one lesson and one assignment. This class belongs to one history and has one progress and one forum.

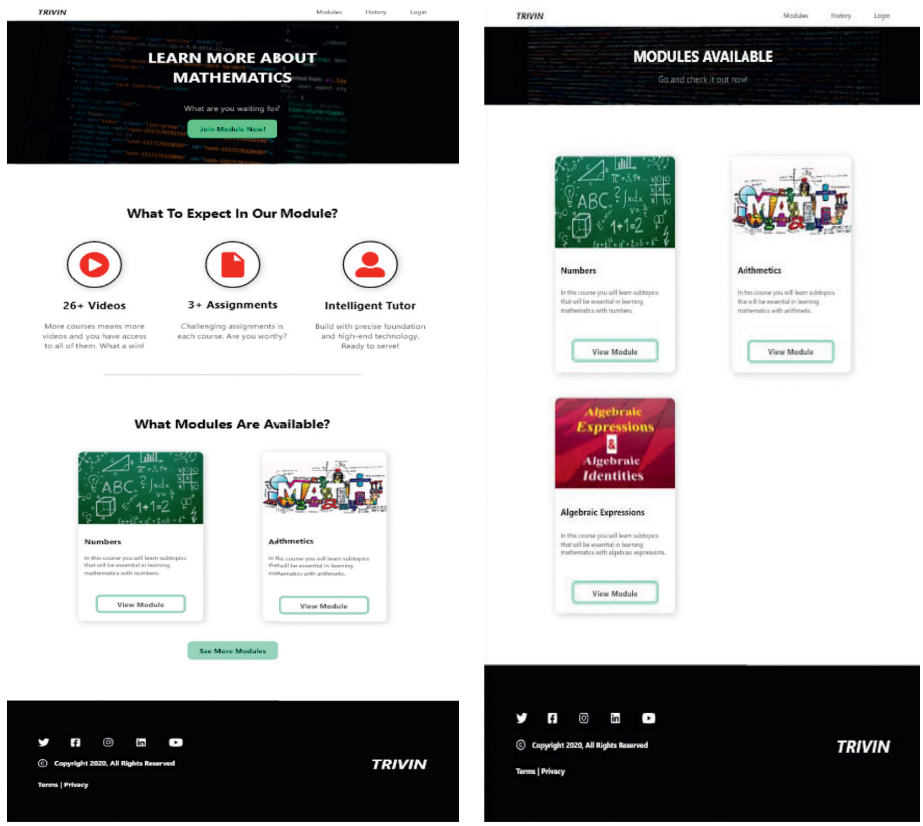
The next class is the lessons class which contains private attributes such as lessonId, lessonName, lessonVideo, and lessonStatus. In this class, there is a public method which is watchLesson (). This class belongs to one module.

The next class is the assignment class which contains private attributes such as assignmentId, totalQuestion, questions, answerStatus, and asgStatus. In this class, there are public methods which are doAssignment () and countScore (). This class belongs to one module.

The next class is the forum class which contains private attributes such as forumId, memberId, memberName, forumContent, and forumDate. In this class, there is a public method which is addForum (). This class belongs to one module.

The last class is the progress class which contains private attributes such as moduleId, progressInfo, and scoreInfo. In this class, there are public methods which are countProgress (), countTotalScore (), and goToModule (). This class belongs to one module.

3.3. User Interface. In Figure 3(a), the page shows that users can log into their perspective account. If the user logs in as an admin, then the user will be given the privilege and access of an admin. An admin account is already created in the database by developers. If the user logs in as a member, then the user will be given the privilege and access of a member. When logging in, the user must fill in some mandatory information such as e-mail and password. The user is also given an option of remember me where if the user agrees, their account will be saved in a cookie. After pressing the login button, the system will validate if the account exists in the database. Users can access forgot password to change their old password. Verification will be sent to their e-mail. If the user does not have an existing account, then the user can access the not a member yet? Sign up now! link. The user will then be redirected to the register page.



(a) (b)

Figure 4: (a) Home page user interface and (b) module page user interface.

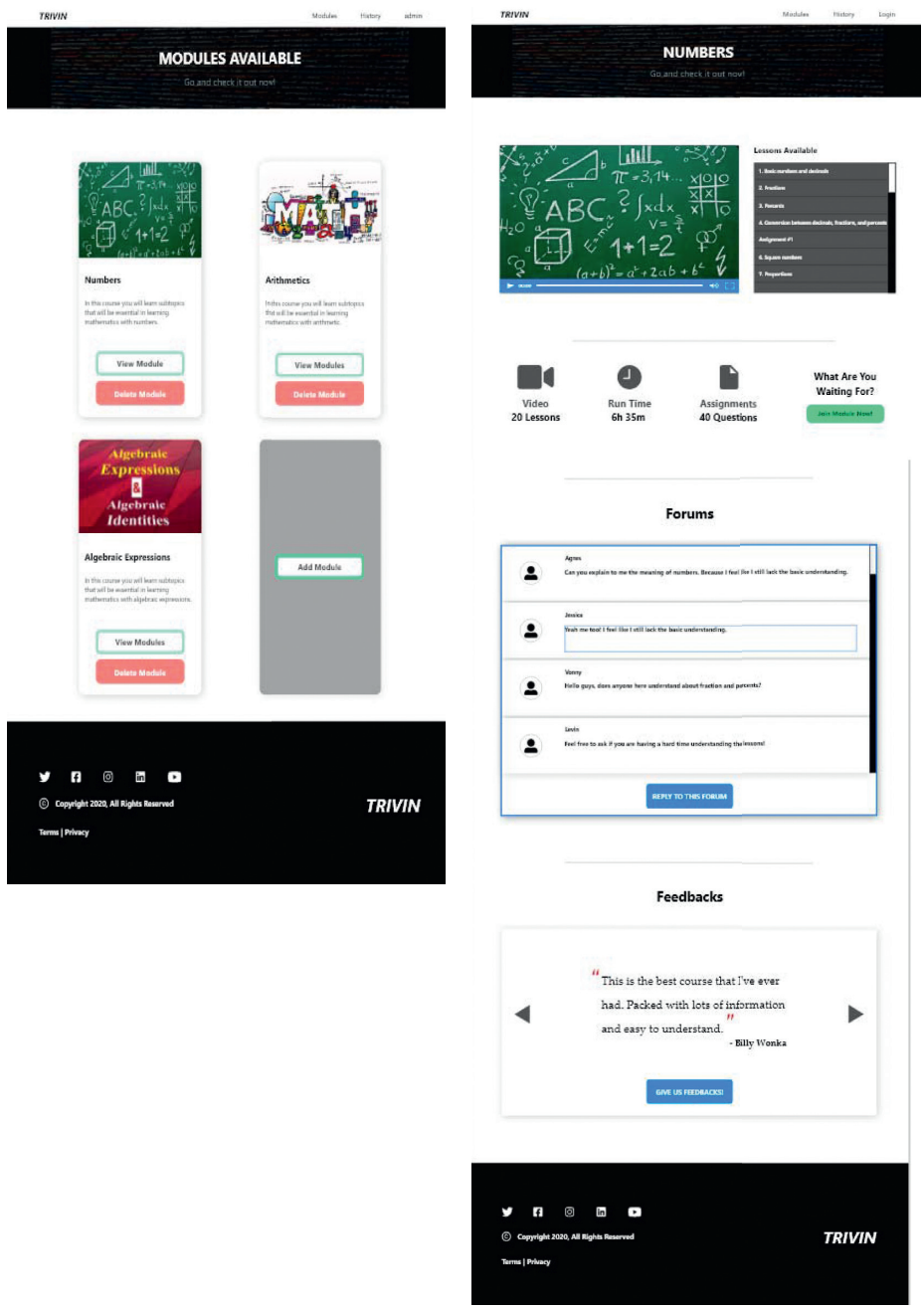
As shown in Figure 3(b), the users can create and register a new membership account. To be able to create a new account, the user must first fill in some mandatory information such as full name, e-mail, password, and confirm password. A verification link will then be sent to the user's e-mail account. After verifying the account, the user will then be redirected to the login page and can log in to their existing account. Users can also access the already have an account? Login now! link to get redirected to the login page.

When the user first accesses the website, this home page will be displayed. On this page, as shown in Figure 4(a), there are three menus that users can access. The first menu is the module, which will redirect the user to the module page. The second menu is history, which will redirect the user to the history page. The last menu, login, will redirect the user to the login page. Users can also have a preview of what to expect in our modules and what modules are available. A footer which contains information that allows user to connect with us will also be displayed throughout our website.

Figure 4(b) shows that the user will be able to view all available modules. In each module will be prescribed a title of the module and a brief description of what the module is about. If the user wants to view the full information of the module, the user can press the wiew module button and the user will then be redirected to the module's page.

Figure 5(a) will be displayed if the user is authenticated as an admin where the user has all the features a member has but with some additional privilege. An admin can delete an existing module and also add a new module. If an admin adds a module, then the admin will be redirected to the module detail page for admin. As shown in Figure 5(b), the website will be displaying a module detail page that was previously accessed by the user. The user will be able to see what and how many lessons are available in this module, what is the total run time of this module, how many questions are tasked to the user, all the discussions from the participants of this module in a forum, and all the feedback from the participants that have completed this module. Users can only join the module if they have successfully logged into their existing accounts and authenticated as a member. Features such as watch lessons, do assignments, reply the forum, and give feedbacks can only be accessed if the user has joined the module. Progress of the user that has joined the module will be saved and can be accessed in the history menu.

This page, as shown in Figure 6(a), can only be accessed by the admin when the admin wants to add a new module. There is some information needed before the admin can add a new module. First, the admin needs to upload a photo, title, and description that will be used to display the new module in the module page to enable other users other

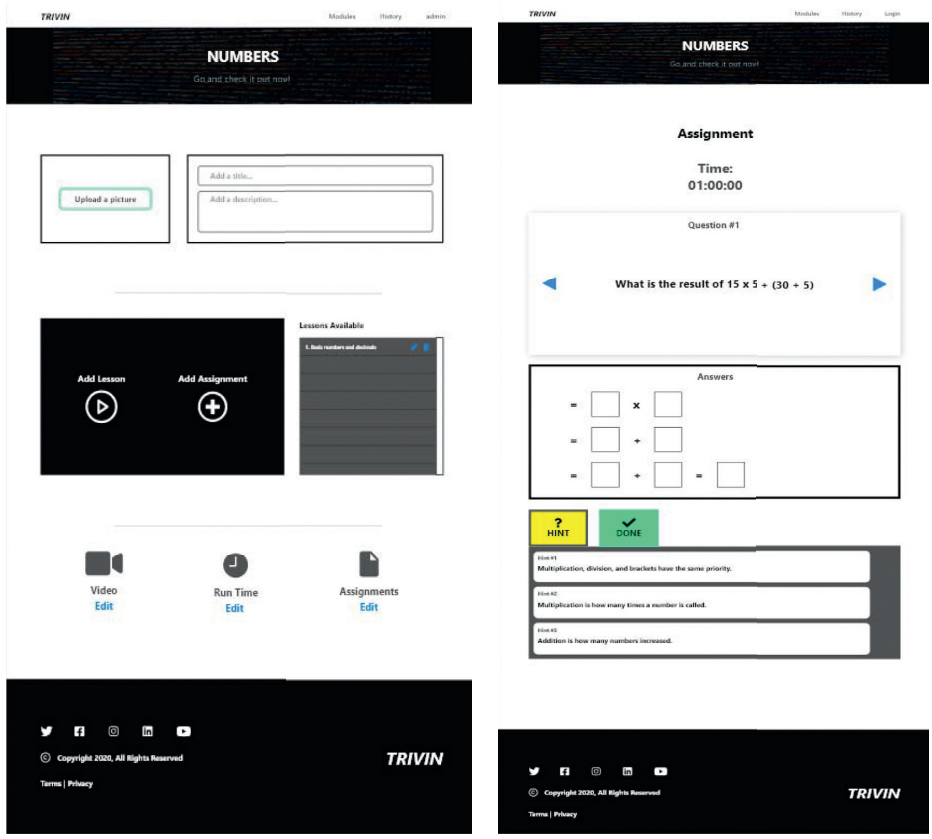


(a) (b)

Figure 5: (a) Module page for admin UI and (b) module detail page UI cont.

than the admin to view or join the module. Next, the admin can add lessons that users will learn upon joining this module. The lessons can also be edited or removed depending on the admin's desire. The admin can also add assignments where the admin will be redirected to CTAT and start building questions with an intelligent tutoring system. Additional pieces of information of the module detail can also be edited by the admin such as the number of videos available, overall run time, and amount of questions the user will have to do.

Moreover, after the user joined the module and has reached the assignment section, this page, as shown in Figure 6(b), will be displayed. Users will be given a limited time to do all the available questions. For this feature, an intelligent tutoring system is applied to help the users learn while doing their assignment. The time and number of questions vary based on the module. After finishing the assignment, the user will be redirected to the history page and the result will be saved and can be accessed on this page for future reference.



(a) (b)

Figure 6: (a) Module detail page for admin UI and (b) module detail assignment page UI.

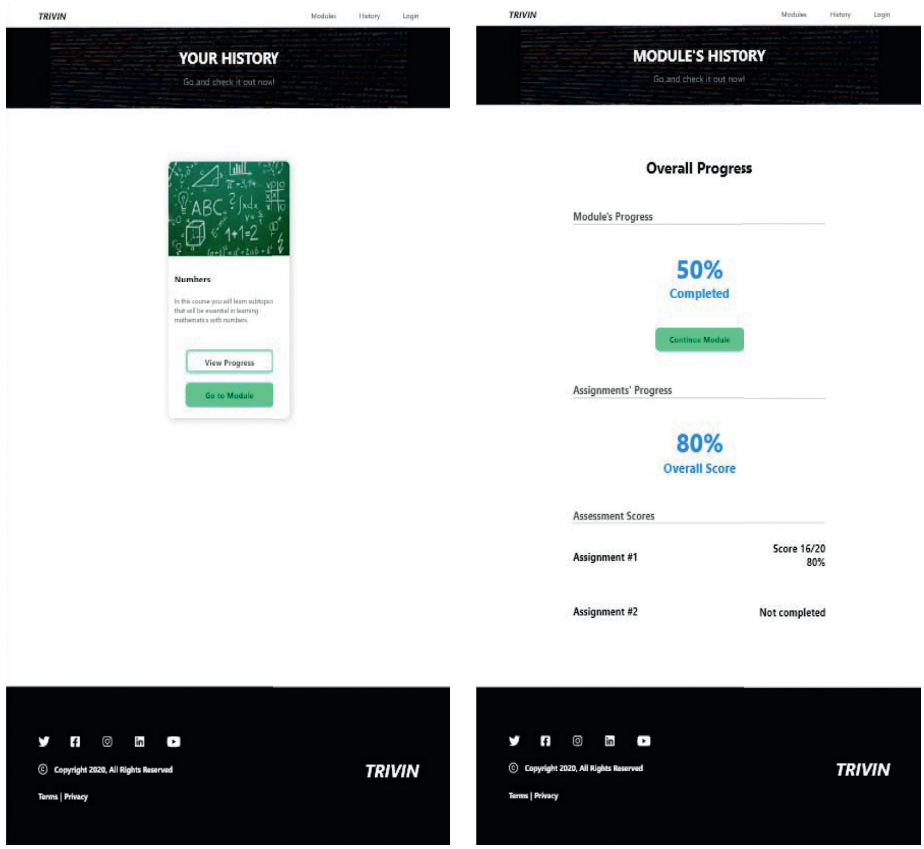
On this page, as shown in Figure 7(a), the users will be able to see all of the modules that they have joined. In every module, there are two buttons available. The first is view progress, where the user will be redirected to the view progress page. The second is go to module, where the user will be redirected to the module detail page.

On this page, as shown in Figure 7(b), the user will be able to see all the progress of the module that the user is currently on. The module's progress will display the percentage of lessons that the user has done. If it is not 100%, then a button will be available for the user to immediately get redirected to the respective module detail. The assignment's progress will show the overall score in percentage gained by the user. The users can also view their scores in each assignment.

We did not perform a full experiment on the writing of this paper. We tried some aspects of CTAT (using CTAT HTML Editor) and concepts to write this paper. No implemented function was tried. In this paper, we only apply the analysis, design, and implementation process where one more stage in the software development stage, namely, the testing phase, is not carried out considering that the ITS application built is still in the refinement stage. It is hoped that ITS implementation will not stop here but will be expanded by applying Artificial Intelligence (AI) technology such as the Recommender System (RS) where the RS can help actors such as tutors or teachers including students and their parents to get recommendations from the system according to their needs.

Meanwhile, other extension implementations will be implemented to, for example, handle forum data as unstructured communication data between actors that can be used to apply other AI technologies such as sentiment analysis or opinion mining including topic classification or topic mining. Sentiment analysis or opinion mining is applied to capture the sentiments or emotions of the actors which can be extracted from the communication of the actors involved in the forum facilities in their application and classify sentiments as positive, neutral, or negative.

Meanwhile, for now, the student assessment process still uses multiple-choice questions because it is very easy and automatic to assess student answers, but it is different from essay questions as unstructured data where it is necessary to assess essay questions that are done by students which are done manually. In overcoming the problem of assessing this test, an automatic essay assessment can be applied where the system will automatically assess the essay questions done by students. In addition, to complete the ITS application, a dialogue system or chat agent or chatbots will be implemented where the system will automatically handle user



(a) (b)

Figure 7: (a) History page UI and (b) view progress page UI.

problems by machine and the system will continue to learn when there are new questions and the labeling process will be carried out for these new questions.

We will apply all of these AI implementations for testing purposes where we will test all ITS applications that have been completed, and the testing process will be carried out by implementing user acceptance tests as an example. This testing process is a valuable stage where the shortcomings of the ITS being built can be seen, and it is hoped that by capturing signals from users, ITS application users will be fulfilled and to successfully apply the concept of software engineering in successfully building the software according to the wishes of the user. In the future, a separate research paper will be created that explains what approach was used to carry out the test and displays data and graphs from the results of the testing phase.

4. Conclusions

After all the research, this paper has come up with the conclusion that the COVID-19 pandemic hugely affected education. Students find it hard to learn and understand using this new online learning method. Alongside this new online learning method, the presence and guidance of parents are necessary, which can have both positive and negative effects.

In solving this problem, researchers have come up with an idea and have successfully designed a web-based online learning course that focuses on sixth-grade primary school mathematics with the implementation of an intelligent tutoring system made using Cognitive Tutor Authoring Tools (CTAT), which speeded up and simplified the making of an ITS. Also, the usage of an ITS is proven to improve students' self-learning and understanding experience according to the previous and current research. With the realization of this paper, researchers hope to bring a huge and positive impact globally.

This paper does not close the possibility of further research and improvement in the future. There are many possibilities yet to be researched from this topic. Research can be conducted to further enhance the user experience from the standpoint of the students, impact the relationship between the school's teachers and the students, and more.

Data Availability

The data are included in this paper.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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Research Article

Gadgets and Messenger Applications as an Instrument for Secondary School Administration

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This research is intended to study the influence that gadgets and messenger applications have on the management process in institutions of general secondary education (IGSE) in Ukraine. The relevance thereof is conditioned by the fact that this subject matter has never been previously in the focus of any specific research in either Ukraine or the world. It relies on the data collected through an online questionnaire distributed among the IGSE administrators of Ukraine. The findings reveal that the use of gadgets and messenger applications in IGSEs is becoming new normal in the management activity of the IGSE administrators while raising a number of ethical questions related to violation of the subordinates' rights to privacy and personal time and space.

1. Introduction

Computation intelligence technologies are being extensively integrated into all aspects of people's lives producing new and ever more advanced products, such as computers, smart devices, mobile phones, and all kinds of gadgets equipped to serve all kinds of purposes. Accelerated development of IT technologies in the late XX–early XXI centuries has been pushing the population of the planet to mass use of such devices and gadgets. Their appearance on the market has fundamentally changed the approaches to solving a number of tasks, inter alia, in information sharing and communication. The management processes, in particular in education, are no exception in this context. The use of these devices significantly impacts and changes performance of management functions in the education system, especially those of organization, control, communication, etc. At the same time, as yet, there has been no systematic research conducted in the education system of Ukraine to study the impact of gadgets and messenger applications on management processes, or the view of representatives of certain professional groups as to the use of gadgets in communication processes, etc. Therefore, this study is one of the first attempts undertaken in this direction.

1.1. Analysis of Research and Publications. In preparation for this research, we have analyzed the open-access materials available today on the use of modern gadgets in education management. This enabled us to conclude that the majority of works in this subject are related to the support of the academic process in institutions of education. As for the use of gadgets in education management, this is significantly underresearched, with only sparse publications on the matter. For instance, there is a paper by Golenko on the use of gadgets in the education process as a tool of education quality management. Based on the results of an online poll, the author made a conclusion about the active penetration of gadgets into the sphere of education and their transformation into an instrument of education quality management emphasizing that the youth, being the most creative part of the society that positively accepts change, is today's major consumer of educational services [1]. At the same time, this study focuses on the issues of the education process

organization rather than on pure management activity of administrators of educational institutions, and the emphasis is on higher education. Similar issues are addressed by Golovyashkina in her studies of use of gadgets in the education process of a university at different stages. The author explicitly stresses the positive impact thereof on the education quality [2].

It is worth mentioning that a vast majority of the national sources study the influence of gadgets on students' health and the problems related to their use in the educational process. Most of such works are publicistic rather than scientific in nature.

The analysis conducted enables us to state the fact that the research presented below is the first such attempt not only in Ukraine, but also in the post-Soviet countries, an attempt to analyze the impact of the modern gadgets on management processes in the general secondary education system.

The same situation is observed in the international scientific community. While there are numerous and multifaceted studies of use of gadgets in the classroom, its effect on the students' academic performance and health, there seems too to be no significant research of their use by secondary school administrators in their management activity.

Occasionally, there would emerge studies under the title of "School Management in 21st Century Using ICT: Challenges and the Way Forward," for example, which suggests that the subject matter would cover the ICT in the management activity of school administrators. However, upon thorough examination, it becomes clear that it primarily deals with the ability of school leaders to select and implement "the tools teachers will use to engage students and improve learning" [3].

Similarly, Serhan's research on school principals' attitudes towards the use of technology reveals a positive attitude of school principles to ICT use in teaching viewing it as "an enhancement to the classroom" ([4], p. 46).

The doctoral thesis in educational management "The management challenges of using information communication technology for administration at secondary schools in Kirinyaga county, Kenya" by Muriithi Stephen Njoka, with reference to Krishnaveni and Meenakumari ([5], p. 282), indicates general administration among the main areas for ICT use in educational management, the others on the list being payroll and financial accounting, student data administration, inventory management, personnel records maintenance, etc. ([6], p. 10). Although it is worth mentioning that Krishnaveni and Meenakumari [5] deal with the higher education environment, similar to the study by Kupoluyi [7], the MS degree paper by Said Gedwar titled "Use of ICT for Administration and Management: Case Study, EMU" provides an interesting insight into the use of ICT in the daily work of university administrators [8].

With reference to Maki (2008), Njoka maintains that ICTs among other things enable education administrators "to communicate data, that is exchange messages and data between school staff and other schools or organizations" ([6], p. 9).

Hoque et al. in their research conducted on ICT use by teachers and principals in Malaysia point out that "principals or headmasters have to understand that the function of ICT in schools does not serve primarily to promote computer literacy" and mention "daily administrative functions of the school," although without specifying what the latter include [9].

A study conducted at education schools of Nigerian universities in 2018 investigated the availability and use of ICT gadgets to conclude that these should be available and used in teaching and learning [10]. Another Nigerian study indicates that ICT integration in secondary schools significantly underperforms due to the lack of the relevant funding, facilities, and ICT literacy of the staff, which negatively affects the quality of the educational process provided to students [11].

Studies emphatically confirm that ICT in secondary school are particularly important not only for teaching and learning, but also for record keeping and inter- and intra-communication [12].

The job performance of school administrators can significantly improve if they effectively use such ICT as email, database management systems, Internet, and word processing tools in exercise of their functional duties [13].

Another study of the use of modern electronic gadgets in the university setting conducted at the Russian State Social University in 2018 confirmed the important role that modern gadgets play in the educational process in terms of students' communication and learning [14].

Researchers from Kenya looked into the secondary school principals' attitude to computer use in school administration to reveal that ICT use by Kenyan school principals is almost nonexistent despite the growing popularity of mobile phones and that an awareness-raising campaign is long overdue among the school administrators to improve the situation [15].

A survey conducted among college principals also confirms that it is becoming more and more essential for the educational administrators to use ICT technologies for "educational assessment, support and management, ethical, social and legal issues for supporting and enriching instructional environment" [16].

The findings of the study by Antonio and Lorenzo indicate that the scope of training received by the school administrators, the family members' influence, own personal beliefs and attitudes to ICT have a significant impact on the decisions of the school administrators to adopt and use ICT in the performance of their managerial functions [17].

In 2019, there was a Doctor of Education dissertation defended in the field of education leadership that investigated the correlation between school administrators' technology leadership preparation and technology integration in the schools [18]. It concludes that "school leaders must become the primary visionaries and promoters of educational technology" in the students' learning [Ibid, p. 100].

Similar findings were received in Sweden where a survey revealed school principals' willingness to participate in digitalization trainings and satisfaction with their content, which enabled them to learn and better understand the

digitalization process and how it can be applied in their schools [19].

The secondary school administrators' opinions on the use of mobile technologies for educational purposes have been screened in a study conducted by İra et al. whose findings indicate positive changes in the teaching and learning activities that employ mobile technologies [20].

Internet tools can be an effective aid in school management, too. Studies show that school principals favour using such Internet tools as "search engines, eail services, online storage systems, social media, Google docs, e-records management tools, online security apps, open office and e-timetable apps" in their management of the school [21].

An interesting study is one analysing the use of social media in school management in Ukraine and USA. It reveals the biased attitude towards the social media among the school administration in Ukraine who majorly regard them as entertainment and therefore a priori refute the idea of using those for educational purposes, while their American colleagues perceive them as valuable didactic resource that can help successfully arrange the educational process [22].

As for the students' expectations from and perceptions of school administration quality, recent studies reveal a significant gap between those and the actual state of affairs as the use of ICT tools for communication is highly expected but not as commonly practised [23].

In the times of the COVID-19 pandemic, the issue of educational administrators' competence in use of ICT, gadgets and messenger applications, is gaining more and more momentum and relevance. Of course, it primarily applies to the distance learning organization, which can only be effectively and efficiently integrated in an education institution with a digitally savvy administrator. One of the most recent studies to confirm this idea is that by Asio and Bayucca [24].

In addition to that, it is important to point out that the government support must be an integral part of any process if we want it to make a visible change and lasting tangible results on the national scale and in the long run. Education is not an exception to this rule. Therefore, a well-envisioned and consistent policy for ICT integration in the educational administration is required [25].

It is evident that the use of gadgets and messenger applications in the secondary school administrators' activity as managers is a blind spot in the scientific research and has never been a subject matter of specific studies. And while there is no doubt that ICT and gadgets in teaching and learning activities are important, this issue has been receiving the spotlight in the scientific and educational communities for years now, of which there are numerous indications in articles, conference proceedings, and other publications, including most of the cited above. However, teaching and learning are not the only aspects of effective school operation. How well organized and efficient is the communication between the administration and the staff of the educational institution is no less important and deserves a dedicated study as this communication is key to ensuring smooth running of any school as well-balanced mechanism.

1.2. Purpose Statement. This research is intended to study the influence that gadgets and messenger applications have on the management process in institutions of general secondary education (IGSE) in Ukraine.

2. Materials and Methods

By the information from the Ministry of Education and Science of Ukraine in 2020, there were 15,200 institutions of general secondary education in the country [26]. The survey conducted within this research covered 1,791 IGSE administration representatives, particularly, 1,186 IGSE directors (principals) (66.2%), and 605 deputy directors (principals) (33.8%). The polling was undertaken using the Google Form instrument in the form of a questionnaire available to the participants by link. Since the survey no longer accepts responses to the questionnaire, how the original form of the questionnaire appeared to the respondents is available at http://www.t.ly/Vsw1. All the answers collected for this questionnaire within this survey are available at http://www.t.ly/g9H3.

The selection was random within the homogeneous general population of IGSE administrators of Ukraine who participated in the survey on a voluntary basis. The polling took place in December 2020 and was anonymous for the participants to ensure more truthful answers. The use of the results obtained hereby is only provided for in a generalized form. The survey was conducted by the Department of Creative Pedagogy and Intellectual Property of the Ukrainian Engineering Pedagogics Academy according to the scientific research plan of the Department.

2.1. Findings and Discussion. The surveyed consisted of 1,448 women (80.8%) and 343 men (19.2%). This shows that the men–women ratio in the IGSE management system in Ukraine is 1 : 4.

There were 1,787 respondents who indicated their age. The distribution by age is presented in Table 1.

The indicators presented indicate an ageing tendency among the IGSE administrators as the majority (51.6%) are 50 years old and older. This is particularly evident in the analysis of individual oblasts; for example, Lvivska oblast in the west of Ukraine has this indicator at the level of 61.8% (Table 2).

As an example of age groups presentation by one oblast situated in the east of Ukraine, Table 3 provides answers for Kharkivska oblast. The data demonstrate that the age of IGSE administrators is closest to normal.

There were no territorial limitations for participation in the survey. At the same time, IGSE administrators' zeal varied significantly across Ukraine (Table 4).

What is a positive sign is that the majority of oblasts of Ukraine participated in the survey, which enables identifying specific features of different regions: western (Lvivska, Rivnenska, Ivano-Frankivska, and other oblasts), eastern (Luhanska, Kharkivska, and other oblasts), central (Kyivska, Poltavska oblast, and the city of Kyiv), northern (Sumska, Chernihivska, and other oblasts), and southern (Odeska and other oblasts).

Table 1: IGSE administrators by age groups.

Age group	Number of responses	%
20–30 years old	40	2.2
30–40 years old	198	11.1
40–50 years old	627	35.1
50–60 years old	643	36
>60 years old	279	15.6

Table 2: IGSE administrators by age groups in Lvivska oblast.

Age group	Number of responses	%
20–30 years old	4	0.9
30–40 years old	43	9.9
40–50 years old	119	27.4
50–60 years old	169	38.9
>60 years old	99	22.9

Table 3: IGSE administrators of Kharkivska oblast by age groups.

Age group	Number of responses	%
20–30 years old	11	3.5
30–40 years old	36	11.3
40–50 years old	128	40.1
50–60 years old	115	36.1
>60 years old	29	9.1

Table 4: IGSE administrators by oblasts of Ukraine.

Oblast	No. of persons	%
Vinnytska oblast	—	—
Volynska oblast	—	—
Dniprovska oblast	5	0.3
Donetska oblast	2	0.1
Zhytomyrska oblast	1	0.1
Zakarpatska oblast	5	0.3
Zaporizka oblast	3	0.2
Ivano-Frankivska	23	1.3
Kyivska oblast	49	2.7
Kirovohradska oblast	—	—
Luhanska oblast	85	4.7
Lvivska oblast	436	24.3
Mykolaivska oblast	—	—
Odeska oblast	86	4.8
Poltavska oblast	76	4.2
Rivnenska oblast	124	6.9
Sumska oblast	89	5
Ternopilska oblast	—	—
Kharkivska oblast	319	17.8
Khersonska oblast	1	0.1
Khmelnytskyi oblast	—	—
Cherkaska oblast	—	—
Chernivetska oblast	—	—
Chernihivska oblast	130	7.3
Autonomous Republic of Crimea	—	—
City of Kyiv	356	19.9
Total	1791	100

The survey results revealed that the majority of IGSE administrators use modern gadgets in their management activity—1,710 people (95.5%), of which 1,106 (61.8%) use them as a means of information sharing with their subordinates and 889 (49.6%)—for setting tasks for individual staff members. At the same time, the absolute majority of administrators (1,580, or 88.2%) communicate via groups created for specific topics or issues.

The survey also showed that the vast majority of IGSE administrators (1,570, or 87.7%) prefer Viber. Table 5 presents the choices of messenger applications in more detail. It is worth mentioning though that there are no significant deviations in the answers to this question by oblasts across Ukraine.

The survey results indicate that the use of gadgets in IGSE management in Ukraine has somewhat negative tendencies in the administrators' attitude to respect of personal space of their subordinates during their nonworking hours: 996 respondents (55.6%) use gadgets for dissemination of administrative information on a round-the-clock basis, and only 795 (44.4%) do that within the working hours. This tendency is stable today and we believe is likely to increase. It is worth pointing out that this issue should require urgent regulation both at the normative and ethical levels. The situation we are witnessing today considerably affects the personal lives of the staff employed in secondary education and may cause conflicts between family members, professional burnout, and depressive disorders. Moreover, analysis within individual oblasts showed that Dniprovska oblast's indicator of round-the-clock dissemination of administrative information was 100% and that of Sumska oblast was –73%. Having received this data, we are now considering further studies in this area to develop propositions as to regulations for the relevant activity in terms of professional activity of particular professional groups.

The question if use of gadgets in the management activity impacts the personal space of the staff and their personal time received only 40.8% (731 respondents) of positive answers, while every fourth (451) IGSE administrator is of the opposite opinion, and 609 respondents (34%) could not give a definite answer to the question. At the same time, more categorical in their response were the representatives of larger administrative-territorial units, such as Kharkivska oblast, where the significant influence of gadget use for the work purposes on the staff's personal time and life is acknowledged by as many as 76.8%, or Odeska oblast with the indicator being 59.3%, or Kyivska oblast with 46.1%.

The survey revealed that every third IGSE administrator (564 answers, 31.5%) was concerned and unhappy when their subordinates ignored their requests to send something via messenger applications; about as many (584) respondents (32.6%) claimed to be okay with this attitude; the rest (643 respondents, or 35.9%) hesitated in their response. The distribution of answers by oblasts did not show any significant deviations, which suggests the situation is similar across the entire country and is not inherent to any particular territory. These answers suggest that there is still no well-established attitude or line of conduct in relation to superior-subordinate communication via messenger applications that is acknowledged and accepted by both sides of this communication.

Table 5: Messenger applications used by Ukrainian IGSE administrators in their management activity.

Messenger application	No. of persons	%
Viber	1570	87.7
Skype	12	0.7
Facebook Messenger	119	6.6
Telegram	62	3.5
WhatsApp	28	1.6

Table 6: IGSE administrators' view on improvement of management quality through use of modern gadgets and messenger applications.

Score	1	2	3	4	5	6	7	8	9	10
No. of persons	1	4	17	34	192	125	308	495	220	260
%	0.1	0.2	1	2.1	11.6	7.5	18.6	29.9	13.3	15.7

At the same time, whenever IGSE administrators conduct meetings, the majority of them emphasize to their subordinates that the latter should read instructions and requests received via gadgets: 1,105 (61.7%) do that regularly and 513 (28.6%) occasionally. No such requests would come from IGSE administrators in only 173 responses (9.7%). However, when it comes to using gadgets and messenger applications to disseminate orders related to the main professional activity, about half of the respondents (811 answers, or 45.3%) believe this to be inexpedient, while 19.9%, or 356, IGSE administrators do this regularly and 624 (34.8%) from time to time. In general, across Ukraine, this indicator for administrators who emphasize the need to read their instructions and requests sent via gadgets is above average for Kyivska oblast (65.7%) and Lvivska oblast (65.4%), which indicates the attitude to gadgets in management is more tech-savvy in the capital and in the most western region of Ukraine.

Most respondents believe that gadgets can significantly improve the management activity. This is the opinion of 1409 survey participants (78.7%). However, about every fifth IGSE administrator (372 participants, or 20.8%) is actually hesitant to answer this question and 10 respondents (0.6%) gave a negative answer. Analyzed by oblasts, the data received from different oblasts vary insignificantly. This suggests that there exists positive experience of gadgets use in the management practices in IGSEs across Ukraine, and its effect on quality and convenience of the process is regarded by the majority as positive and welcomed.

IGSE administrators also evaluated by a 10-point scale the degree to which the management processes improved with the use of gadgets and messenger applications therein. The answers to this question were given by 1656 survey participants (Table 6) and illustrate an overall positive trend with the overwhelming majority confirming the noticeably positive effect from the use of gadgets on the management process.

As for IGSEs having a particular system using gadgets and messenger applications in improvement of management processes, 615 administrators of such IGSEs (34.3%) indicated having such systems, while the majority, 1176 administrators (65.7%) admitted to having none.

Those exploiting the benefits of the gadget/messenger application system were also to indicate the main principles thereof, the algorithms of its use, etc. The 382 detailed answers given can be grouped as addressing the following issues:

(i) Handling urgent matters: providing additional information during distance learning; distributing news from the Ministry of Education and Science of Ukraine and the Ministry of Health of Ukraine; creating topic-related and temporary groups by particular subject matter (a constantly operating group of tutors; an administration group; a group for provision of information on students' attendance of academic classes; a temporary group to prepare for the pedagogical council session, and the like).

(ii) Providing information on materials uploaded to Google Drive, including orders related to the main activity: creating a virtual teaching staff room; providing a space for a depository of relaxation materials; providing a space for communication with the parents' community; providing a space for communication with IGSE graduates; conducting urgent polls; providing photo reports, etc.

These answers clearly illustrate the diversity of uses that-gadgets and messenger applications have in IGSE management as well as in communication and collaboration between various participants of the educational process. The respondents were to evaluate on a 1-to-10 scale how less frequent their face-to-face meetings in their IGSEs became thanks to the use of gadgets and messenger applications (Table 7).

In some oblasts of Ukraine, these indicators are more significant. The results for the capital city of Kyiv are presented in Table 8. The results indicate a positive tendency, which enables IGSE administrators to free up a significant share of working hours for other work and activities.

The IGSE administrators also answered the question if the education governing bodies use gadgets to work with them as IGSE administrators. The overwhelming majority answered positively (84.4%) and regard this as a positive practice (94.3%), which confirms that gadgets in administration routine are an important and effective tool of work and communication.

As for the means of information provision by the education governing bodies, most IGSE administrators (1,326 respondents, 74.3%) give preference to it being emailed to them, 20.9% (372 respondents) prefer messenger applications, and only 4% (71 respondents) are for traditional means of information transfer and 0.8% (15 respondents) hesitated.

At the end of the survey, IGSE administrators were to rate the overall impact of modern gadgets on the management quality in institutions of general secondary education on a 1-to-10 scale (where 1 means the impact is insignificant and 10 stands for such impact being significant) (Table 9). The results reveal that the overwhelming majority attribute more-than-average significance to the impact of gadgets on management quality.

Table 7: IGSE administrators' view on cut-down in face-to-face meetings thanks to the use of modern gadgets and messenger applications.

Rating scale	1	2	3	4	5	6	7	8	9	10
No. of persons	149	139	218	174	541	136	138	172	103	28
%	7.9	7.8	12.2	9.7	30.2	7.6	7.7	9.6	5.8	1.6

Table 8: Kyiv IGSE administrators' view on cut-down in face-to-face meetings in favour of those with modern gadgets and messenger applications.

Rating scale	1	2	3	4	5	6	7	8	9	10
No. of answers	9	11	18	16	95	21	37	77	57	15
%	2.5	3.1	5.1	4.5	26.7	5.9	10.4	21.6	16.0	1.4

Table 9: IGSE administrators' view on overall impact of modern gadgets on IGSE management quality.

Rating scale	1	2	3	4	5	6	7	8	9	10
No. of answers	3	17	39	52	229	154	288	473	261	262
%	0.2	1	2.2	2.9	12.9	8.7	16.2	26.6	14.7	14.7

It should be noted that, analyzed through the prism of each oblast of Ukraine participating in the survey separately, this indicator demonstrates no significant deviations in the results, which further strengthens the representativeness of these results.

3. Conclusions

Considering the above, the following conclusions can be made:

(1) The scientific sources addressing the use of modern gadgets in education management are scarce and limited indicating the lack of attention of the scientific community to the new realia of today.

(2) Gadgets and messenger applications in education management have actually created a new reality that is still little understood by the educational community. This is conditioned not only by the changes in communication between the subjects and objects of education management, but also by communication within the teaching staff, with parents and other stakeholders and participants in the educational process. This means special studies are needed in order to provide theoretical, methodological, technological, and regulatory justification of these processes.

(3) Active use of gadgets and messenger applications in education management has put on the agenda the quality of such devices and their provision to subjects and objects of management by the state or local education authorities. Today, the most common practice is participants using their own devices in the process of communication, which often affects their personal interests, sometimes hampering receipt of information in full.

(4) Particular emphasis should be placed on observance of ethical rules by subjects of education management without violating their subordinates' right to privacy. Round-the-clock communication is inadmissible between subjects and objects of management unless it is an emergency. The findings presented in this study show that most of the interviewed administrators of institutions of secondary education fail to consider it when performing their professional duties.

(5) Use of gadgets and messenger applications in the professional activity also brings scientific and communicative activities to the agenda, which will enable developing and discussing particular algorithms of work in this direction, elaborating to account for ethical norms, exchanging experience, and systematizing the existing achievements and developments.

Therefore, it is expedient to conduct and focus on further studies exploring the use of gadgets to improve communication processes within and between teaching staff communities, as well as with parents and other stakeholders and participants in the educational process.

Data Availability

The answers collected within the survey for this study are available at http://www.t.ly/g9H3.

Disclosure

The polling was undertaken using the Google Form instrument in the form of a questionnaire available to the participants by link. The analysis of the results was carried out by the authors of this research themselves without any funding involved.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Supplementary Materials

The annex to this paper contains the questionnaire form as it was presented for the participants. (*Supplementary Materials*)

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Research Article

Implementation of Online Teaching in Medical Education: Lessons Learned from Students' Perspectives during the Health Crisis in Marrakesh, Morocco

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Background. On the announcement of the COVID-19 health emergency, the Marrakesh School of Medicine accelerated the digitization and the establishment of courses available to students through the faculty platform. We aimed to describe the students' perspectives toward the online educational approach implemented during the COVID-19 pandemic and to investigate the factors that might affect the implementation of online teaching in the future. *Methods*. This was a cross-sectional study among medical students in Marrakesh during June-July 2020. Data collection was based on a self-administered electronic questionnaire distributed via the student platform. We studied the knowledge and previous practices of virtual technologies and students' appreciation of distance learning during the lockdown. Univariate and multivariate analyses were performed using SPSS16.0 software. *Results*. A total of 111 students participated. The female-to-male sex ratio was 2.2 with an average age of 20.6 ± 1.8. The majority of students felt that they had a good knowledge of virtual technologies (on a scale of 1 to 10, 81% ≥ 5/10), and two-thirds reported using them in medical studies. Before the COVID-19 lockdown, 16.2% of the students used the platform and 39.6% did not attend in-person courses (16.0% in 1st cycle versus 49.2% in 2nd cycle, $p = 0.01$). During the pandemic, 79% of the students appreciated the virtual learning (54.0% in 1st cycle versus 89.0% in 2nd cycle, $p < 0.001$) and 80.2% thought that the online courses were understandable. Regarding to student's preferences, 41.4% preferred blended education and 68.5% of the students would recommend continuing distance learning after the pandemic. Regarding satisfaction, previous use of the educational platform (OR = 66.3, CI 95% [1.9; $2.2*10^3$]), improvement of learning during distance learning (OR = 22.6, IC 95% [4.1, 123.7]), and professor support (OR = 7, IC95% [1.3, 38]) seemed to be the most powerful factors in the multivariate analysis. *Conclusion*. Our results will contribute to the implementation of actions by taking advantage of the experience during the health crisis. The institutionalization of virtual learning with more interaction in addition to the in-person courses is the main recommendation of this study.

1. Introduction

With the advent of the COVID-19 pandemic with the new coronavirus, the Faculty of Medicine and Pharmacy of Marrakesh (FMPM) was called upon, like all training institutions, to quickly adapt to the circumstances imposed by the epidemic in Morocco following the ministerial decision to suspend, until further order, the classes in all schools and

universities from Monday March 16, 2020 [1, 2]. In order to ensure the continuity of education and in accordance with the directives of the Ministry of Higher Education, the FMPM has accelerated the digitization, recording, and the establishment of courses available to students through the educational platform (Theia) of the faculty. This platform was adopted at the institution level for distance education before the pandemic. However it was until then underused. The orientation of the FMPM was having a smooth transition to active pedagogy to anchor a learning paradigm through several pedagogical innovation projects such as the competency-based approach, the flipped classroom, tutoring, or simulation. Before this period, distance learning—defined as "using computer technology to deliver training, including technology-supported learning either online, offline, or both" [3]—was not considered in Moroccan universities as a modality for education. The literature suggests that this is effective, and in some contexts, more effective than in-person learning [4]. While this health crisis presents major challenges for medical education, it also gives an opportunity for innovation for countries still in the phase of exploring these solutions [5]. Other countries that encountered health crises in the past have experienced a disruption in medical education that requires learning lessons and anticipating public health crises [6]. During the COVID-19 pandemic, the lack of visibility on the evolution of this epidemic means that we now have to draw on online solutions in Moroccan medical education. Innovations in e-learning technologies indicate a revolution in education, making it possible to individualize learning (adaptive learning), improve learner' interactions with others (collaborative learning), and transform the role of the teacher [4].

Indeed, these innovative solutions in health science education are a necessity nowadays in the digital age and in the face of a new generation of hyper-connected "Y" students known as the millennial generation which refers to individuals born between 1982 and 2005 [7]. Generation Y does not highly value reading and listening to lectures as it has been traditionally in medical education. They want their education to be creative, interactive, and fun with technology [8]. Medical educators need to stay abreast of new technologies and incorporate them into teaching during and after the pandemic. So better preparation of our teaching teams, our students, and the system stands out as an essential alternative during and posterior to the pandemic. The literature suggests that key barriers which affect the development and implementation of online learning in medical education include time constraints, poor technical skills, inadequate infrastructure, absence of institutional strategies and support, and negative attitudes [9].

The description of the current approach of the experience from the user's point of view will therefore make it possible to improve it and to draw from it extremely constructive lessons for the life after the pandemic. The entire teaching team—the majority of the double-hatted persons are teachers and doctors—has been put to the test during this health crisis because they are called upon to manage the health and educational challenge of COVID-19.

An assessment of student satisfaction with the system deployed (courses, questionnaires, forums, etc.) in achieving learning objectives is also useful and must be understood in order to highlight the achievements and gaps and target possible levers of action.

This study aimed to explore the situation of distance institutional e-learning among medical students during the pandemic and to identify possible challenges, limitations, and satisfaction as well as perspectives for this approach of learning and to investigate the factors that might affect students' preference for virtual learning in the future. Through an action research project at the FMPM, we aim to develop practical recommendations to promote institutional projects in educational innovation in our faculty.

2. Methods

We carried out a cross-sectional observational study based on the experience of the Faculty of Medicine and Pharmacy of Marrakesh following the declaration of the COVID-19 pandemic in Morocco in March 2020. The period of the study was the end of the academic year 2019–2020 (months of June and July 2020). All students in grades 1 through 5 were included in an online self-administered survey. Students enrolled in the 6th or 7th year have been excluded due to the absence of a course schedule for these students under normal circumstances. The questionnaire was distributed via the FMPM educational platform inviting students to participate on a voluntary and anonymous basis.

The data collected included (1) age, sex, and year of study; (2) knowledge and practices of Information and Communication Technology in education (ICT) and outside training for personal use; (3) overall assessment of teaching remotely during the lockdown; (4) any difficulties experienced; and (5) suggestions for improvement through an open-ended question to the participants. The questions were open-ended, single or multiple choice, and we had evaluation questions on a scale of 0 to 10. The data were extracted by Excel and then analyzed by SPSS version 16 fr. Statistical analyzes were descriptive, univariate and multivariate. Qualitative variables were presented by numbers (n) and percentages (%), and quantitative variables by means (m) and standard deviations SD ($\pm$). The answers to the open-ended questions were analyzed separately according to a content analysis guide then regarding the quantitative results.

The comparison of responses between year of study was made between the 1st cycle (students enrolled in 1st or 2nd year of medicine) and the 2nd cycle (students in 3rd or 4th or 5th year). Fisher's exact test compared two proportions of two independent samples. The comparison of means used the Student's t-test. The study of the factors associated with the satisfaction was carried out in two stages: (1) in univariate analysis by the Fisher Exact test, Khi square test, and Student's t-test and (2) in multivariate analysis utilizing a binary logistic regression to estimate the impact of the explanatory variables (gender, student's

year of study, previous use of virtual tools for medical studies, having followed in-person courses before, previous use of the educational platform, having a laptop or computer to follow the courses, access quality Internet, understanding and assimilation of courses, interactivity of courses, improvement of learning, technical difficulties encountered, support in learning by the faculty/teachers) on the students' satisfaction for distance learning during the COVID-19 outbreak. The Forward Stepwise method was used with 5% entry and 20% exit thresholds. The Hosmer and Lemshow test made it possible to test the final model retained after adjustment for the different significant factors in a multivariate analysis. The significance level for all statistical analyzes was 5%.

Ethically, confidentiality and anonymity were respected during data collection and analysis. Participation was voluntary. Participants were previously given an information note on the purpose of the study and the possibility of refusing to participate without any consequences or harm. This study was safe for the participants, and its results may lead to the improvement and promotion of active and digital pedagogy.

3. Results

3.1. Students' Description. A total of 111 students responded to the questionnaire. The average age was 20.6 ± 1.8 years and the female/male sex ratio was 2.2. More than half were enrolled in the 2nd cycle (3rd to 5th year of initial medical studies), and one-third resided outside the city of Marrakech during the survey (Table 1).

3.2. The Students' Use of the Virtual Technologies. During the lockdown, 82% had a computer for distance learning (DL) and 74% had a good Internet connection to attend classes. Participants had a good knowledge of information and communication technology (ICT) with a score $\geq 5/10$ (median 7) in 82% with very frequent use in 91%. 66% responses reported their current use for medical studies (researching information, preparing or reviewing courses) (Figure 1). The proportions of ICT use were similar whether they were used for or outside medical studies for the two cycles of study. However, the utilization of the teaching platform was more reported by the 2nd-cycle students (77.8% versus 22.2, $p = 0.029$).

3.3. Students' Perceptions and Satisfaction toward the Virtual Learning. For 79.3% of the students, it was the first experience in virtual learning. During the lockdown, 79% of the students appreciated the DL (54.0% in 1st cycle against 89.0% in 2nd cycle, $p < 0.001$). They followed more than half of the courses provided via the platform in two-thirds of the responses. They were satisfied with the online education. The notable difference between the two cycles concerns the follow-up of the courses, the satisfaction, and the comprehension of the lectures which were higher among the students of the 2nd cycle (Table 2). Of those surveyed, 83% experienced difficulties with distance learning (Table 3).

3.4. Factors Associated with the Students Satisfaction

3.4.1. Bivariate Analysis. Satisfaction with distance learning was significantly different between the 2 education cycles, and between men and women. Factors associated with higher satisfaction were the previous use of ICT for medical studies, the availability of technological means during lockdown, the absence of technical difficulties, the feeling of improvement in learning, and the presence of support and when the interactivity considered important. It was inversely associated with the in-person follow-up of previous courses (Table 4).

3.4.2. In Multivariate Analysis. In multivariate analysis, previous use of the educational platform (OR = 66.3), improved assimilation during distance learning (OR = 22.6), and being supported by teachers (OR = 7) seemed to be the most powerful factors in the model compared to the other studied factors (Table 5).

3.5. Students' Preferences and Recommendations for Virtual Leaning after the Pandemic. A total of 41.4% of students responded that they prefer the hybrid form (26.1 were for the face-to-face form and 29% for online only) and 68.7% of the students recommended continuing DL after the pandemic. By analyzing the verbatim according to an analysis grid, the results were as follows.

3.5.1. Distance Learning: A New Education That Has Won over Medical Students. The medical students rated their experience positively during the health crisis as most of them perceived an improvement in their learning. In particular, they highlighted ease of access to courses and the advantages in terms of saving money and energy. Also, they saw their psychosocial health improved: reduction of stress and fatigue and increase in free time. The DL also made it possible to follow quality lessons in a more comfortable way (less arduousness, less stressors) by being more concentrated.

"Before lockdown, I had a problem with the time to attend class so a little fatigue after the clinical training, so less concentration. But with distance education, we attend our course with a relaxed head at home and much more concentrated."

In addition, interactions were greatly favored, especially for students who had difficulty asking questions in lecture halls. We can therefore say that self-study has represented a source of autonomy appreciated by students in view of the many advantages it provides them.

"There is much more interactivity, the teachers are more available than in lecture halls, and for those who have difficulty speaking in lecture halls they were lucky enough to be able to participate in writing during the discussion. There is the possibility of reviewing the recorded session, and having an online course saves us time compared to the commute to the faculty."

Table 1: Participants' sociodemographic characteristics.

Variables		Participants ($N = 111$)	
		Number (n)	Percentage (%)
Gender	Male	35	31.5
	Female	76	68.5
Age (in years)	≤22	94	84.7
	[22–25]	17	15.3
Year of the medial study	1st	24	21.6
	2d	26	23.4
	3d	12	10.8
	4th	26	23.4
	5th	23	20.7
Cycle of the medical study	First	50	45.0
	Second	61	55.0
Nationality	Moroccan	105	94.6
	Foreigner	06	05.4
Residency during the COVID-19 lockdown	Marrakesh	76	68.5
	Outside Marrakesh	35	31.5

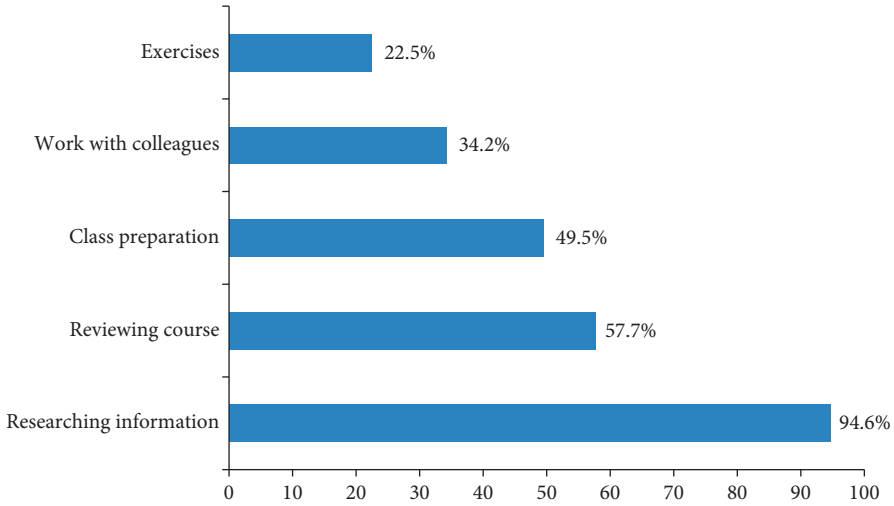

Figure 1: Description of the students' use of the virtual technologies during their medical studies.

3.5.2. Distance Learning: A Challenge for Other Students. A minority of the students surveyed did not appreciate distance learning. According to them, socioeconomic and environmental inequalities represent a brake on DL since not all students have the material means or adequate living conditions that are required for e-learning sessions to go well.

"This type of education is not good for all students, especially for those students who are poor and who cannot always have Internet connection in addition to housing in geographic areas where there is little network. . ..."

Also, the lack of interaction between teachers and students was highlighted with difficulties in assimilating self-study courses. In addition, there were numerous logistical and informatics technical problems (unavailability of the platform, impossibility of connection, sound problem, etc.).

"There are classes that do no't even work and it's not interactive."

3.5.3. Students' Suggestions and Recommendations. According to participants, this could be a form of teaching that would strengthen the face-to-face part and would be particularly useful in the event of another health emergency, for example. For a student, it would be nice to "just use distance learning as a supplement and have revision sessions with teachers after they have completed lessons in the amphitheater."

On the other hand, the current lack of training for students and teachers in connection with distance teaching and learning represents a brake on the final implementation of learning at the FMPM for the moment. Moreover, it was pointed out that DL is a favorable method but the socio-economic disparities between the students would be a source of unequal chances of success.

One student believes that "you need training for students and teachers to use these platforms well. We must help students who do not have the means to follow the courses."

Table 2: The students 'perceptions of the distance learning during the lockdown and their utilization of the educational platform.

Variables		All participants n (%)	Study cycle		p
			1st cycle	2d cycle	
Utilization of the education platform before lockdown	Never-sometimes	93 (83.7)	46 (49.5)	47 (50.5)	0.029
	Often-always	18 (16.3)	04 (22.2)	14 (77.8)	
Utilization of the ICT** for medical education	Never-sometimes	38 (34.2)	18 (47.4)	20 (52.6)	0.438
	Often-always	73 (65.8)	32 (43.8)	41 (56.2)	
Attending face-to-face class before the pandemic	Never	16 (14.4)	04 (25.0)	12 (75.0)	0.001*
	Sometimes	22 (19.8)	04 (18.2)	18 (81.8)	
	Often	42 (37.8)	21 (50.0)	21 (50.0)	
	Always	31 (27.9)	21 (67.7)	10 (32.3)	
First experience with e-learning	Yes	88 (79.3)	39 (44.3)	49 (55.7)	0.472
	No	23 (20.7)	11 (47.8)	12 (52.2)	
DL satisfaction during the pandemic	Not satisfied	12 (10.8)	10 (83.3)	02 (16.7)	<0.0001
	Not very satisfied	18 (16.2)	13 (72.2)	05 (27.8)	
	Satisfied	58 (52.3)	17 (29.3)	41 (70.7)	
	Very satisfied	23 (20.7)	10 (43.5)	13 (56.5)	
Quantity of online courses followed	Less than the half	35 (31.5)	21 (60.0)	14 (40.0)	0.026
	More than the half	76 (68.5)	29 (38.2)	47 (61.8)	
Comprehensibility of the courses regarding the expectations	Not to not very comprehensible	21 (18.9)	18 (81.8)	04 (18.2)	<0.0001
	Comprehensible to very comprehensible	89 (80.1)	32 (36.0)	57 (64.0)	
Degree of improvement through the DL***	Absent	20 (18)	13 (65.0)	07 (35.0)	0.022*
	Low	17 (15.3)	11 (64.7)	06 (35.3)	
	Average	49 (44.1)	19 (38.8)	30 (61.2)	
	Important	25 (22.5)	07 (28.0)	18 (72.0)	
	None–little use	23 (20.7)	30 (47.6)	33 (52.4)	0.333
Utility of the forum set by the school (FMPM)	Useful to very useful	88 (79.3)	20 (41.7)	28 (58.3)	<0.0001
	Not satisfied	38 (34.2)	26 (68.4)	12 (31.6)	
Support from teachers/institution	Somehow satisfied Satisfied-very satisfied	73 (65.8)	24 (32.9)	49 (67.1)	—
Encountering difficulties	Yes	92 (82.9)	15 (45.5)	18 (54.5)	0.559
	No	19 (17.1)	35 (44.9)	43 (55.1)	
Recommendation of DL after the pandemic	Yes	76 (68.5)	30 (39.5)	46 (60.5)	0.211*
	No	13 (11.7)	07 (53.8)	06 (46.2)	
	I do not know	22 (19.8)	13 (59.1)	09 (40.9)	
Courses' interactivity degree (scale from 1 to 10)		6.5 ± 2.5	5.7 ± 2.5	7.2 ± 2.4	<0.0001
Number of hours per week for DL (On10) mean ± standard deviation (SD)		10.8 ± 8.9	11.4 ± 10.4	10.4 ± 7.6	0.389
Self-perception of learning level (scale from 1 to 10)		6.3 ± 2.2	5.6 ± 2.3	6.8 ± 1.9	0.001
Probability in % of following DL in the future ($N = 84$)		71.8 ± 31	63.1 ± 34.1	78.0 ± 27.3	0.040

*Fisher exact test, **ICT: Information and Communication Technology, ***DL: Distance Learning.

Finally, improvements should be considered if we want to strengthen the quality of DL (planning and running of courses, reduction of technical problems of access to teaching).

4. Discussion

4.1. Distance Learning at the Marrakesh Medical School. With the increasing use of technology in education, online learning has become a common teaching method. Compared to offline learning, online learning has advantages to enhance undergraduates' knowledge and skills; therefore, it can be considered as a potential method in undergraduate medical education [10]. During the COVID-19 pandemic, this has become an obligation for medical schools around the world and it is time for newbie institutions to align with this new requirement in terms of online education. All the more so as it has many advantages and has helped to preserve the physical and mental health of the students and ensure satisfaction according to previous literature [11–13], although the distance and virtual learning must have the characteristics of accessibility, contextualization, flexibility, interaction, and collaborative work and will need to continue to improve during and after this pandemic [14]. Also, it is imperative to take into consideration the difficulties and challenges of a transition to online education in medical studies. It requires a balance between learning, development of skills, and some clinical and practical skills. Furhter, it is important not to change the habits of the students and teachers who do not master the use of software and teaching platforms [15]. Students with financial difficulties and special needs may not have equal opportunities to access

Table 3: The difficulties encountered by the students during the distance learning in the time of the lockdown.

Types of difficulties encountered	Effective sample size (n)	Percentage (%)
Difficulties related the learning environment change	51	55.4
Work organization	51	55.4
Work overload	44	47.8
Courses expectations nondiscussed	43	46.7
Decrease of the interaction and collaborative work (student/student and student/teacher. Group work ...)	40	43.5
Communication difficulties with the teachers	28	30.4
Learning difficulties and difficulties to achieve courses' goals	28	30.4
Difficulties in using digital media	21	22.8
Communication difficulties with the administration	18	19.6

technology. It is therefore necessary to take into account the nature of a health emergency and its possible impact on inequalities in access to education and to adapt solutions to both students and educators [16, 17]. In this sense, FMPM is questioning how to provide a quick solution in accordance with the instructions of the National Ministries of Education and Health and thinking about the smooth transition by adapting to the needs of students and teachers. Training sessions and tutorials on accessing and using the platform were disseminated through the faculty website. Teachers were invited to add sound to their lessons and to foster discussion with students during synchronous interactive online lessons. Also technical support was offered at the request of users [18].

Like several authors from different parts of the world [3, 12, 19–22], we were interested in exploring student's perspectives on online medical education as an alternative to traditional education. The majority of students felt they had a good knowledge of ICT and two-thirds reported use in medical studies mainly for information retrieval and course review. However, the educational platform was underutilized before the lockdown since most of the students attended the lectures. During this closure period, 79% of the students appreciated the DL (54.0% in 1st cycle vs. 89.0% in 2nd cycle, $p < 0.001$) and 80.2% thought that the online courses were understandable. The difficulties were related to the organization of work, to the change in the learning environment. The hybrid form was recommended by students even after the pandemic. The benefits of digital pedagogy were felt by our participants, like in previous studies, namely, the flexibility and the ability to learn at their own pace and reduce travel costs [23].

4.2. Students' Perspectives and Associated Factors. Across the world, students 'perspectives on distance learning have been disparate between pros and cons. The positive perspective is fostered by a previous e-learning experience. In Nepal, for example, 76.5% had never attended online courses and therefore the same proportion (77.8%) preferred traditional classroom instruction in the future. Medical students did not find online classes as effective as the traditional classroom teaching; it could be made more interactive and productive by introducing interactive and brainstorming sessions complementing the conventional face-to-face education [20]. The same observation was made according to a study in Jordan with 488 medical and dental students (1 to 3 year) [24]. Gender, level of study, and study material were not associated with this preference according to the authors [24]. The low involvement in these countries can be linked to the quality of training in interactive pedagogy and digital technologies of teachers. It justifies the subsequent recommendation that the training of trainers is a real lever for the development of DL.

Unlike in Israel, the online experience for the students was positive. A high level of overall satisfaction and a low rate of technical problems during electronic learning were significantly correlated with the desire to continue online learning [12]. Our students favored the hybrid form of teaching, and the perspective was different between the two cycles of study. Indeed, satisfaction with distance education was higher among undergraduate students despite being used to traditional lecture-based education. The 1st- and 2nd-year students probably encountered more difficulties in assimilating the theoretical contents which are essentially fundamental sciences during these two years of medical studies. Satisfaction was higher in case of previous use of virtual techniques for medical studies, availability of technological means during the lockdown, absence of technical difficulties, having a feeling of improvement in the learning process, and having a support system to facilitate the interactivity. It was inversely associated with the in-person follow-up of previous courses. These results were confirmed by the verbatim of the students in response to the open-ended questions. The difficulties observed in distance higher education in Morocco during the lockdown period are shared and can be summed up in the lack of familiarization with ICT in education and the lack of technological means and increased workload [8]. Some teachers have also encountered problems with new technologies, such as scheduling videoconferences or using interactive methods through web services [13]. This could result from the need for training both students and teachers in this essential educational innovation.

4.3. Recommendations. Online education lacks specific quantitative standards to measure the quality of the teaching process. This affects the learning effectiveness of medical students and needs to be addressed further [15]. In the

Table 4: Factors associated with the distance learning satisfaction among the students.

	Satisfaction		p
	Not very satisfied or not satisfied n (%)	Satisfied to very satisfied n (%)	
Gender			
Woman	16 (21.1)	60 (78.9)	0.037
Man	14 (40.0)	21 (60.0)	
Study cycle			
1st cycle	23 (46.0)	27 (54.0)	<0.0001
2nd cycle	07 (11.5)	54 (88.5)	
Utilization of the ICT for medical education before			
Yes	13 (17.8)	60 (82.2)	0.002
No	17 (44.7)	21 (55.3)	
Attending face-to-face class before			
Yes	25 (34.2)	48 (65.8)	0.018
No	05 (13.2)	33 (86.8)	
Use of the platform before			
Yes	01 (05.6)	17 (94.4)	0.039*
No	29 (31.2)	64 (68.8)	
Having a computer or a laptop to attend the class			
Yes	16 (17.6)	75 (82.4)	<0.0001
No	14 (70.0)	06 (30.0)	
Good quality Internet access			
Yes	12 (14.6)	70 (85.4)	<0.0001
No	18 (62.1)	11 (37.9)	
First e-learning experience			
Yes	23 (26.1)	65 (73.9)	0.679
No	07 (30.4)	16 (69.6)	
Lectures' comprehension and assimilation			
Yes	08 (09.0)	81 (91.0)	<0.0001
No	22 (100.0)	00 (00.0)	
Courses' interactivity (means ± SD)			
	3.0 ± 3.9	8.1 ± 7.4	<0.0001
Education improvement			
Yes	03 (04.1)	71 (95.9)	<0.0001
No	27 (73.0)	10 (27.0)	
Encountering difficulties			
Yes	30 (32.6)	62 (67.4)	0.004
No	00 (00.0)	19 (100.0)	
Technical difficulties			
Yes	14 (42.4)	19 (57.6)	0.018
No	16 (20.5)	62 (79.5)	
Support and technical assistance			
Yes	14 (17.1)	68 (82.9)	0.0001
No	16 (55.2)	13 (44.8)	
Learning support by the faculty/teachers			
Yes	04 (05.5)	69 (94.5)	<0.0001
No	26 (68.4)	12 (31.6)	

SD: Standard Deviation. *Fisher's exact test. **T-test.

Table 5: Factors associated to the satisfaction of distance learning in the multivariate model analysis by binary logistic regression.

Factors	Odds ratio	IC 95%		p
		Lower	Upper	
Use of the platform before lockdown	66.3	1.9	$2.2*10^3$	0.019
Improvement in learning during the lockdown	22.6	4.1	123.7	<0.0001
Learning support by the teachers	7.0	1.3	38	0.023
Distance learning courses interactivity	1.8	1.1	2.8	0.007
Constant in the equation (multivariate model) ($B = -5.346$)	0.005	—	—	<0.0001

Hosmer et Lemeshow: Khi square = 6.7. $p = 0.566$.

literature, students' experiences are context dependent. In Germany, for example, medical students recommended digital adoption for education after the pandemic [21]. On the other hand, in other countries, the opinion was in favor of in-person education as in Nepal. Our recommendations join those of other authors such as in Saudi Arabia or Jordan on the hybrid form. The authors suggest that medical students moderately accepted e-learning during the COVID-19 Pandemic closure time. More training of the students and tutors, better designing of e-courses, more interaction, motivation, and blended learning are recommended [19]. Technical and infrastructural resources were reported as a major challenge for implementing distance learning, hence understanding technological, financial, institutional, educators, and student barriers is essential for the successful implementation of distance learning in medical education [3].

At the Marrakesh Medical School (FMPM), it is necessary to institutionalize online education which must be complementary and not a substitute for the usual classes. Having a more holistic approach to the students' training must be adopted in postpandemic period taking into account the mental impact of COVID-19 on students as well as improving the security and technology of virtual platforms [14, 25]. We recommend the following.

(i) Institutionalize online education.
(ii) Encourage mentorship at the FMPM.
(iii) Continue training faculty and students.
(iv) Promote hybrid online and face-to-face teaching.
(v) Improve the educational platform for more flexibility and technical operationalization.
(vi) Encourage interactivity through case discussion modules, chat, and discussion forums.
(vii) Take into consideration the new learning/teaching methods during the assessment of learning acquisition.
(viii) Manage the student work time for better adaptation and profitability.

4.4. Limits and Advantages. The investigation took place during the closure time as part of the response in Morocco against the epidemic which coincided with the end of the 2nd semester of the 2019–2020 academic year (July, 2020). This period was particularly stressful for the students which may impact their response regarding the assessment and perception of distance learning. Despite several reminders, we were only able to get 111 responses (1700 students enrolled so an estimated response rate of 6%). This could induce a nonresponse bias (students who refuse to participate or who did not have access to the platform to answer the questionnaire). But the number of participants could also testify to the low access to the platform during this period for connection problem or lack of technology.

This survey is part of an action research project whose results with students will be supplemented by a second survey at the end of the 1st semester of the 2020–2021 academic years, and by interviews with the faculty and the technical team in order to set up actions to support and improve the educational system and promote digital pedagogy at FMPM in the medium and long term.

5. Conclusion

Despite the emergency to start distance learning imposed by the COVID-19 health crisis, it appears that students were generally satisfied (52.3% satisfied and 20.7% very satisfied) and had a positive experience. This satisfaction was felt more among students of the 2nd cycle of initial medical studies (88.5% versus 54%, $p < 0.0001$) and was influenced by factors such as the interactivity of teaching and the improvement of learning.

These results and the students' recommendations encourage a reflection on the institutionalization of distance education by taking advantage from the experience during the COVID-19 epidemic to succeed in the transition to digital pedagogy in hybrid form by further promoting learning and interaction with our students in undergraduate training after the pandemic.

Data Availability

All relevant data are included in the manuscript. The corresponding author can be reached for raw data.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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