The Relationship between Teachers' ICT Knowledge and Students' Motivation in Online Learning

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Abstract—**Knowing that the teaching-learning experience has recently shifted to online platforms, researchers are concerned about enhancing students' motivation. This study aims at finding the relationship between teachers' ICT knowledge and students' motivation in online learning. A sample of 169 students enrolled at a private university in Jeddah, KSA, answered a survey of eight questions explicitly constructed for this research. Structured interviews with sixteen students and four teachers of different majors were conducted to triangulate the data. Descriptive statistics for each variable were then calculated. The results indicated that the factor that motivates the students most is the teacher's skillful use of online tools such as Announcements, Journal, Discussion Board, and Wiki. On the other hand, the factor that has the lowest effect on students' motivation is the teacher's ability to solve technical problems that emerge in online classes. Teachers' ICT knowledge is found to be directly related to students' motivation in online classes. It is, therefore, recommended that teachers have an adequate practice of using ICT in their online classes.**

Index Terms—**ICT, TPACK, Online learning, Motivation**

I. INTRODUCTION

The last decade has witnessed frequent integration of Information Technology (IT) into education. Information and Communication Technologies (ICTs) have smoothed online learning development, specifically for higher education [1]. On the other hand, the pervasive COVID 19 pandemic forced educational institutions and universities worldwide to build academic networks to facilitate distance learning. Several platforms are available to provide e-learning methods and to expedite the teaching-learning process. Because of this sudden change, various studies about students' motivation in online learning were recently conducted [2]-[8]. Minda Nasution [3], in her research study about the effect of online education on students' motivation, found that online learning and students' motivation are weakly

correlated. Similarly, in their research study about students' online learning perspective during the COVID 19, Adnan and Anwar [6] found that online learning did not yield the desired results. Bearing this in mind, the purpose of this study is to identify the relationship between teachers' ICT knowledge and students' motivation in online learning.

A. Statement of the Problem

Recently, teachers worldwide had to shift from teaching in traditional classrooms to teaching in virtual classes. The transition was sudden and swift as a result of the spread of COVID19. However, many teachers were unprepared to use digital resources and platforms, which are the core of online teaching. Many difficulties have arisen in the teaching and learning processes, coinciding with teachers' and students' frustration. Therefore, the researchers are interested in exploring the relationship between teachers' ICT knowledge and students' motivation.

B. Significance of the Study

Because the learning process improves if the students are highly motivated [9], teachers must educate themselves on how to increase their students' motivation. Moreover, the inevitable shift to online teaching requires being equipped with sufficient knowledge of ICT. There is a lack of adequate literature about the relationship between teachers' ICT knowledge and students' motivation; hence, this study is intended to fill in this gap and encourage more research to be done in this education area.

C. Research Question

What is the relationship between teachers' ICT knowledge and students' motivation in online classes?

II. LITERATURE REVIEW

A. The Importance of Using ICT in the Classroom

In a digital era, ICT plays a significant role in almost every aspect of life, including education. This role makes

it essential for teachers to integrate ICT into their teaching environments to provide their students with 21st-century skills [10], [11]. First, with an increasing tendency toward learner-centered classes, ICT could be the proper support in the learning environment. Utilizing ICT in education makes the learning experience more differentiated and individualized [12]. Furthermore, using ICT in education targets different learning styles and the intelligence of learners. ICT increases learning efficiency because it provides opportunities for multimodal presentations that include tests, images, graphics, and sounds, enhancing students' motivation [12]. Recently, researchers have shown more interest in improving students' motivation and its effect on the latter's performance, which has paved the way for more interest in looking into the impact of using ICT, among other factors, on learners' motivation. In their experimental study on 27 fifth graders, Eliyanti and Dodi [13] collected their data from questionnaires and concluded that students' motivation increased after the application of ICT-based learning.

B. Motivation and Online Learning

Motivation constitutes a vital factor in the success of online learning [4]. Simultaneously, a lack of motivation is considered one of the significant obstacles to learning [5]. Ryan and Deci [14] argue that motivation is a crucial factor in the learning process, especially in an online learning environment, where learners sit behind screens instead of having a face-to-face human interaction. The value of motivation lies in its ability to produce; in teaching, motivation is expected to deliver active and successful learning experiences. Learners could be extrinsically motivated by seeking high grades, teachers' praise, or peers' applause. They could also be intrinsically motivated by seeking out challenges, knowledge, or a sense of achievement.

However, the teacher-student relationship is less friendly in a virtual class than in a conventional classroom, which explains the need for a more understanding of students' motivation if teachers want to maintain a healthy learning environment [15]. A study conducted at a private university in Malaysia concluded that students' self-motivation predicted students' online learning satisfaction and that there was a direct relationship between the two variables [16]. Teachers could use several approaches to improve students' motivation, one of which is gamification [5].

C. Importance and Examples of Games

Gamification means employing game-like methods to engage people in non-game environments, increasing people's inclination to compete, achieve, and collaborate [17]. Integrating games in the teaching process can eliminate many students' distracting behaviors, which often persist in traditional classes [18]. Some research studies have investigated the effect of employing games in teaching on the learners' academic performance, attitudes, behavior, and motivation. For example, to know if e-learning applications such as Kahoot! and Quizizz effectively motivate university students in the fourth semester, Lestari [18] conducted a qualitative research study. The researcher collected data in the form of field observation and close-ended questionnaires. The study results showed that Kahoot! and Quizizz effectively increase students' motivation and that Quizizz is even more effective than Kahoot! because it has more fair results and is more engaging. Similarly, in her research study, Muhsin [5] concluded that gamification played a positive role in improving university students' descriptive writing.

D. ICT and Teacher Training

TPACK framework is the interplay of three primary forms of knowledge: Technology (TK), Pedagogy (PK), and Content (CK) [19]. TPACK can fill in significant gaps in education when teachers are trained and given the basic ICT knowledge regardless of the subjects they teach [20]. To integrate ICT effectively in the classroom, teachers need to develop their knowledge of technology [21]. With the increasing emphasis in higher education to provide opportunities for students to work and collaborate in groups, enhancing problem-solving and critical-thinking skills, instructors are looking beyond traditional course management tools to emerging technologies. One technology that supports group collaboration is a wiki. However, many instructors either do not know about wikis or how to apply best practices to increase their potential for learning [22].

In a research study, a group of school teachers was given training on using ICT-based interactive games. The training was found to be effective in increasing teachers' knowledge of technology and improving their lesson planning and teaching skills [23]. Similarly, in their research study on 287 Indonesian subjects, Habibi et al. [24] reported that TPACK directly resulted in teachers' use of ICT in their teaching practices. Furthermore, Rahmi [25] studied how Indonesian ELT teachers applied TPACK and used ICT resources in their classes. The author concluded that enrolling teachers in TPACK workshops could enhance teaching and learning experiences.

III. RESEARCH METHODOLOGY

The present study was designed to examine the relationship between teachers' ICT knowledge and students' motivation in online learning. For the broad purpose of triangulating the data, this research study implemented the mixed-method research design that combines elements of quantitative and qualitative research approaches.

A. Participants

The participants in the current research study were 167 students enrolled at one private university in Jeddah. The participants were of various majors attending online courses during the fall semester of the academic year 2020-2021. Besides, sixteen students and four teachers of different majors were interviewed to triangulate the data.

B. Instruments

Quantitative data were collected using a Google Form survey devised by the researchers specifically for this study. Student and teacher protocols for structured interviews were also constructed to collect qualitative data.

The survey consists of eight questions with the corresponding 3-point Likert-scale response options: Neutral, Motivated, and Highly Motivated. The questions are:

How motivated are you by the following?

1. Teacher's ability to solve technical problems during online classes
2. Teacher's skillful use of online games such as Kahoot!, Quizizz, Edpuzzle, Jeopardy, etc.
3. Teacher's skillful use of all the features of online teaching platforms such as breakout rooms, polls, whiteboard, screen sharing, chat, etc.
4. Teacher's skillful use of online tools such as Announcements, Journal, Discussion Board, Wiki, etc.
5. Teacher's skillful use of the technological ICT tools suitable for the subject, the teaching strategies, and the learning objectives
6. Teacher's use of technology to address different learning styles (visual, auditory, kinesthetic)
7. Teacher's use of a variety of online assessment tools (Google forms, Socrative, Blackboard assignments)
8. Teacher's use of programs and software like PowerPoint, Microsoft Word, Microsoft Excel, Google Drive, YouTube, Adobe, etc.

It should be noted that the questionnaire administered in this study was pilot-tested to measure the reliability and internal consistency of the items. The participants in the pilot study were students who did not take part later in the main study.

To measure the questionnaire's reliability, the researchers used Cronbach's Alpha, which is commonly used as a measure of the internal consistency or reliability of a psychometric test score for a sample of examinees. The indicator should be greater than 0.7 to consider the internal consistency between items as strong. The results indicated that the Cronbach's Alpha indicator of all the items was .805, which means that there is high consistency between the items and that the questionnaire is reliable.

Students' Interview Protocol was constructed by the researchers and reviewed by three experts in education. The experts consulted by the researchers were known for their educational background and professional experience. They gave their comments regarding the phrasing of some questions to avoid misunderstanding and to ensure that the questions serve the study's purpose. Their recommendations were taken into consideration by the researchers.

To ensure the structured interview's validity, the researchers examined the internal, construct, and external validity. The internal validity was guaranteed by the "permissive" nature of the social interchange and reinforced by the researchers by guiding without stifling free expression. Furthermore, construct validity was ensured when the researchers checked whether the interview protocol measured the skills it should measure. This was done when experts in the field of the study reviewed the protocol items. Finally comes external validity, which refers to the ability to generalize the results from the study sample to the Saudi population. The researchers' choice to use the interviews achieved the purpose of acquiring in-depth information about the quantitative and qualitative data collected via other research tools.

The purpose of the interviews with the students is to obtain additional information about the participants' motivation for online learning and its relationship to their instructors' ICT knowledge. The questions asked during the students' interviews were:

1. Do you prefer online classes or face-to-face classes? Why?
2. Which is the most interesting part of an online class?
3. How can the students tell if the teacher in online classes is skillful in Information and communications technology (ICT)?
4. How do you feel when the teacher demonstrates skillful usage of online tools?
5. What is the importance of using games on students' engagement in online classes?

Instructors' Interview Protocol

The researchers also conducted interviews with five instructors teaching online courses during the Fall semester of the academic year 2020-2021. The interview protocol was constructed by the researchers and revised by three experts. These judges were Ph.D. holders in Education and taught in university settings. The judges gave detailed comments about the interview questions that were taken into consideration by the researchers.

To help maintain the interviews' validity and reliability, the researchers avoided posing questions that might influence the interviewees' answers. Besides, they took notes manually for better and thorough interpretations of the interviewees' ideas communicated physically and verbally. Finally, they gave the interviewees the required time to clarify and summarize their ideas to ensure that they expressed sincere opinions.

There are two purposes for the instructors' interviews. First, get information about the instructors' views of online teaching tools and platforms and their usefulness. Second, to know about the instructors' ICT knowledge and their readiness to apply it in online classes. The questions in the Instructor Interview Protocol were:

1. What could teachers do in online classes to engage students?
2. How can a teacher know that the students are motivated while taking an online class?
3. Does knowledge of ICT help teachers in engaging students while giving online classes? How?

Data Collection Procedures

The researchers obtained permission from the research center at the university to conduct the study, distribute the survey, and interview volunteering students and instructors. In the introductory part of the survey, the

researchers explained the purpose of the research study to the students and sought their approval in participating in the study.

Data Analysis Procedures

To find answers for the research question about the relationship between the students' motivation and their instructors' ICT knowledge, the researchers 1) used the Statistical Package for Social Science (SPSS) to compute the Descriptive Statistics that included means and standard deviation for the whole sample, and 2) analyzed the data acquired from the students' and instructors' interviews.

IV. RESULTS AND ANALYSIS

A. Descriptive Statistics

Descriptive statistics were used in this research study to present the general results of the items. For continuous data such as the score of components, the researchers calculated the Mean and the Standard Deviation. Data were summarized and organized to highlight the potential relationships among the variables to be examined in the current research study. Table I below shows that the means of the research items ranged between 1.00 (teacher's ability to solve technical problems during online classes) and 2.35 (Teacher's skillful use of online tools such as Announcements, Journal, Discussion Board, Wiki, etc.).

TABLE I. DESCRIPTIVE STATISTICS

Descriptive Statistics

	N	Mean	Std. Deviation
Technical	169	1.00	.000
Games	169	2.09	.858
Features	169	2.31	.733
Tools	169	2.35	.734
ICT TPACK	169	2.14	.739
Learning Styles	169	2.01	.816
Assessment	169	2.07	.749
Programs and Software	169	2.23	.756
Valid N (listwise)	169		

B. Analysis of Survey Items/Questions

Technical: Students were asked about their motivation when the teacher can solve technical problems during online classes. As displayed in Fig. 1, around half the respondents (45.6%) assured that they feel motivated. In contrast, fewer than one-third of the respondents (28.4%) stated that they feel highly motivated, and a similar percentage of the respondents (26%) assured that they felt neutral, which means that the teacher's skills in solving technical problems during online classes did not contribute to their motivation.
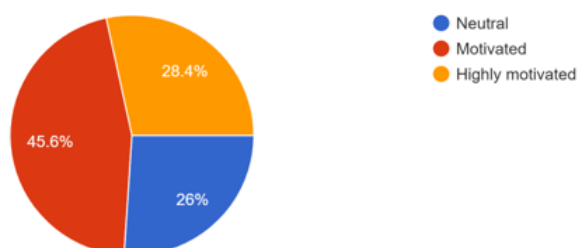

Figure 1. Teacher's ability to solve technical problems during online classes

Games: The second question in the survey was about the students' motivation when their teacher integrates online games such as Kahoot, Quizizz, Edpuzzle, and Jeopardy during online classes. More than one-third of the respondents (41.4%) stated that they feel highly motivated. Around one-third of the respondents (32.5%) had neutral feelings; that is, they do not care for online games, and if integrated into an online session, it will not increase their motivation for online classes. On the other hand, only (26%) stated that they feel pretty motivated when their teachers use online games during the session (see Fig. 2).
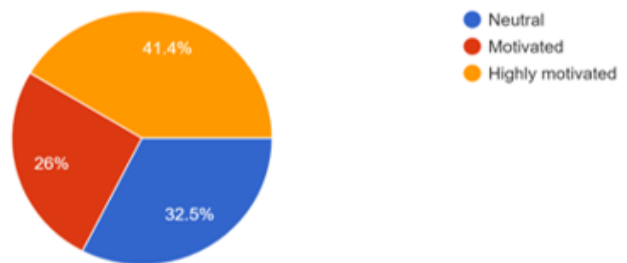

Figure 2. Teacher's skillful use of online games such as Kahoot! Quizizz, Edpuzzle, Jeopardy, etc.

Features: The third question in the survey was about whether or not the students feel motivated by their teacher's skillful use of the features of online teaching platforms such as breakout rooms, polls, whiteboard, screen share, and chat. As displayed in Fig. 3, the online survey results showed that around half the respondents (47.3%) feel highly motivated when their teacher displays skillfulness in the use of the features of online platforms. More than one-third (36.7 %) mentioned that they feel pretty motivated, whereas only (16%) of the respondents had neutral feelings towards their teacher's use of online platforms' features.
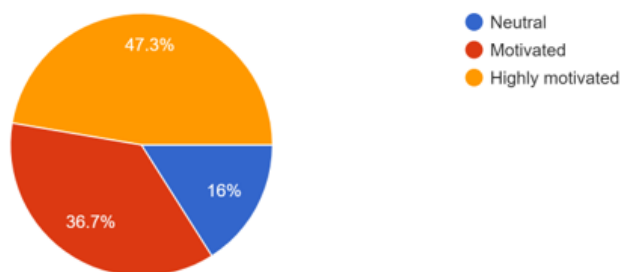

Figure 3. Teacher's skillful use of all the features of online teaching platforms such as breakout rooms, polls, whiteboard, screen-sharing, chat, etc.

Tools: The fourth research question was about the students' level of motivation when the teacher displays skillful use of online tools such as Announcements, Journal, Discussion Board, and Wiki. The results in Fig. 4 show the highest percentage of students in the whole survey, where half the respondents (50.3%) responded as highly motivated when their teacher displays skillfulness in the use of online tools, and one-third (34.3%) feel quite motivated. On the other hand, just a small percentage of the respondents (15.4%) had neutral feelings towards this case.
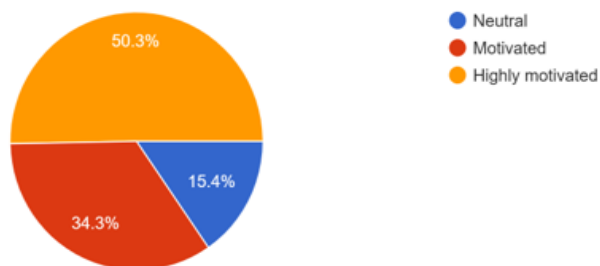
Figure 4. Teacher's skillful use of online tools such as Announcements, Journal, Discussion Board, Wiki, etc.

ICT TPACK: The fifth question in the survey was about whether or not students feel motivated when their teachers display skillfulness in using ICT tools suitable for the subject, the teaching strategies, and the learning objectives. Fewer than half the respondents (43.8%) said that they feel motivated, and around one-third (34.9%) said that they feel highly motivated, whereas just one-fifth of the respondents (21.3%) had neutral feelings (see Fig. 5).
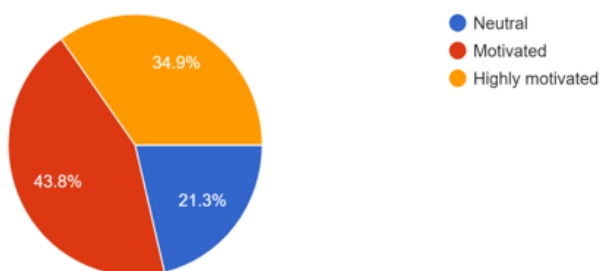

Figure 5. Teacher's skillful use of the technological ICT tools suitable for the subject, the teaching strategies, and the learning objectives

Learning Styles: The responses to the sixth question in the current survey, which are displayed in Fig. 6, had similar percentages. One-third of the respondents (33.7%) said that they feel motivated when their teachers display skillfulness in using technology to address different learning styles, and the same percentage (33.7%) said that they feel highly motivated. Simultaneously, around one-third of the respondents (32.5%) said that they had neutral feelings about whether or not their teachers used technology to address different learning styles.
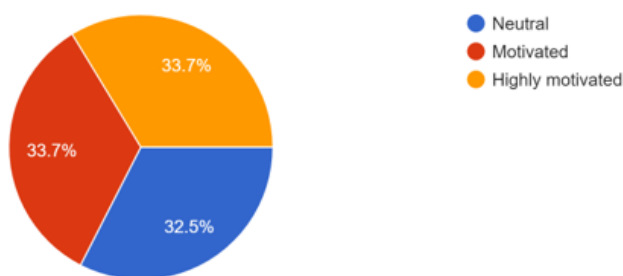

Figure 6. Teacher's use of technology to address different learning styles (visual, auditory, kinesthetic)

Assessment: Regarding the teacher's ability to use online assessment tools, 43.8% said that they feel motivated, and 31.4% said that they feel highly motivated, and around one-quarter (24.9%) of the respondents said that they have neutral feelings (see Fig. 7).
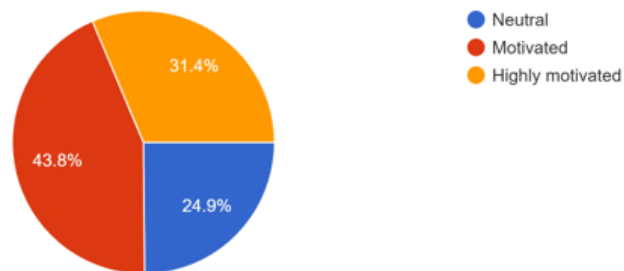

Figure 7. Teacher's use of a variety of online assessment tools (Google forms, Socrative, Blackboard assignments)

Programs and Software: The final question in the survey inquired about the students' motivation when their teachers use programs and software like PowerPoint, Microsoft Word, Microsoft Excel, Google Drive, YouTube, and Adobe in online classes. A little fewer than half of the respondents (42.6%) said that they feel highly motivated. Around a third of the respondents (37.9%) said they feel motivated, while only one-fifth (19.5%) of respondents said they felt neutral (see figure 8).
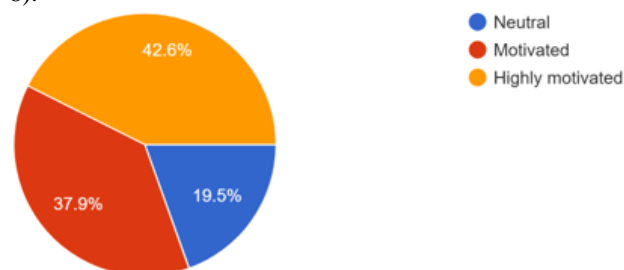

Figure 8. Teacher's use of programs and software like PowerPoint, Microsoft Word, Microsoft Excel, Google Drive, YouTube, Adobe, etc.

C. Qualitative Data

Out of the 169 students participating in the current research study's quantitative phase, the researchers interviewed 17 students, who make up around 10 % of the sample. The following section summarizes the interviews with the students.

Results of Students' Interviews

1. Do you prefer online classes or face-to-face classes? Why?

Around 60 percent of the interviewees reported that they prefer FT classes, all of whom explained their reason to be the ability to communicate more freely with teachers and classmates than they can in online classes. On the other hand, 30 % of the interviewees said it depends on the subject; if the subject is complex, they prefer FTF classes to understand the content better. Finally, 10 % of the interviewees said it is the same for them.

2. Which is the most interesting part of an online class?

The majority of the interviewees (90%) said that the most interesting part of the online class is working in groups in the breakout rooms. They referred the reason for this preference to the fact that they can communicate directly with classmates and get to know new friends. Another reason they mentioned is that group work makes the task less difficult than when doing it individually. In

addition to the breakout rooms as an engaging tool, all the interviewees expressed that online games and activities such as Kahoot and Quizizz make the lesson more exciting and help them review the material they learned. Just 10 % of the interviewees added that doing graded online activities, especially the low-stake assessments, makes her focus fully in online classes.

3. How can the students tell if the teacher in online classes is skillful in Information and communications technology (ICT)?

While only 20 % of the interviewees said they could not tell if the teacher is skillful or not in ICT, 80% assured that they can tell from teachers' confidence and frequency of using online tools and that teachers who are not skillful seem to struggle when they share screens or files. All interviewees mentioned that proficient teachers usually are capable of fixing technical issues.

4. How do you feel when the teacher demonstrates skillful usage of online tools?

All the interviewees explained that teachers who are skillful in online tools engage them more than other teachers and that the teachers' employment of online tools makes them understand the subject content more easily and makes them feel more confident and "in good hands." One interviewee expressed this engagement in the word, "we feel connected with the teacher when she uses online tools."

5. How important is using games for students' engagement in online classes?

All the interviewees responded in the same way to this question. They believe that they are motivated most when teachers use online games, whether for assessment or explaining concepts.

6. How do you feel when the teacher faces a technical issue during online classes and does not know how to solve it? (audio did not work; the teacher did not open responses in google form assessments)

All the students showed their understanding of teachers' inability to solve technical issues in online games. Just 10 % of the students said teachers resort to IT for technical issues, so there should be no problem, whereas 90 % of the interviewees said that despite their understanding of the issue and their compassion with the teachers, they still feel sorry for losing time in class.

Results of Teachers' Interviews

Engaging Students: All the interviewed teachers stated that asking students questions was their primary strategy in engaging students in online classes. The methods of asking questions could differ. The most common way is to call students' names and ask the student directly. Another way is to select from students who raise their hands, but in this case, one teacher adds, only students who are interested and who know the answers will participate actively. A third method of asking questions is suggested by an AI teacher, who uses polls several times in a class without even writing the question; she asks the question orally and immediately launches the poll. Last, a teacher suggested using the wheel of names, a website used to select students' names randomly, and which students find amusing because it makes the selection in

the "wheel of fortune" design. In addition to asking questions, all the interviewees stated that they use online games and quizzes to engage students.

Teacher's Awareness of Students' Motivation: When asked about ways to know if students are motivated in online classes, all interviewees reported that when students answer questions, they show their motivation. Also, all the interviewees stated that a good indicator of students' motivation is when students ask questions. Additionally, the student's participation in the chat messages reflects their engagement, so those who feel shy to speak can still reveal their motivation by participating through writing. One interviewee noted that some highly motivated students write emojis and not just words.

Teachers' Knowledge of ICT: All the interviewees commented that teachers' knowledge of ICT helps them avoid losing time and, consequently, losing students' attention. One interviewee referred to teachers' lack of ICT knowledge as a kind of creativity barrier because instead of creating innovative activities, unskillful teachers will have to spend their time managing the basics of technology in their online classes. The more teachers are capable and knowledgeable of ICT, the better their students will be engaged in exciting class activities.

V. DISCUSSION

Research Question: What is the relationship between teachers' ICT knowledge and students' motivation in online classes?

To answer the research question of the current study, the researchers collected quantitative and qualitative data. The researchers calculated the descriptive statistics; for the qualitative data, they transcribed and categorized the respondents' answers to the interview questions.

The results displayed in the previous section reveal that the factor that motivates the students most (50.3% highly motivated) is when the teacher demonstrates skillful use of online tools such as Announcements, Journal, Discussion Board, and Wiki. This might be because this skill facilitates explicitly clear communication between the teacher and the students. This result is congruent with the replies of 60% of the student interviewees to research question 1, who reported that they prefer face-to-face classes and explained their reason to be the ability to communicate more freely with teachers and classmates than they can in online classes.

According to the survey, in the second place to motivate students in online classes (47.3% highly motivated) comes the teacher's skillful use of the features of online teaching platforms such as breakout rooms, polls, whiteboard, screen share, and chat. This is because the use of such features enables students to get involved in the class activities. Here, they are active learners and not just passive receivers of information.

The survey data matches with the students' interview responses, for the majority of the interviewees (90%) said that the most interesting part of the online class is when they work in groups in the breakout rooms. They referred

the reason for this preference to the fact that they can communicate directly with classmates and get to know new friends. Another reason they mentioned is that group work makes the task less difficult than when doing it individually. All the interviewees explained that teachers who are skillful in online features engage them more than other teachers and that the teachers' employment of these features makes them understand the subject content more easily and makes them feel more confident and "in good hands." One interviewee described this engagement. "We feel we are connected with the teacher when she uses online tools," she said. Moreover, 80% of the student interviewees said they could easily distinguish between confident teachers, who frequently use online tools, and those who are not skillful, for they seem to struggle when sharing screens or files.

The interviewed teachers also support the survey's data about the online platform features, for all of them stated that asking students questions was their primary strategy in engaging students in online classes. The methods of asking questions, however, could differ. The most common way is to call on the student's name and ask the student directly. Another way is to select from students who raise their hands, but in this case, one teacher adds, only students who are interested and who know the answers will participate actively. A third method of asking questions is suggested by an AI teacher, who uses polls several times in a class without even writing the question; she asks the question orally and immediately launches the poll. When asked about ways to know if students are motivated in online classes, all interviewed teachers reported that when students answer questions, they show their motivation.

In the third place (42.6% highly motivated) comes the students' motivation when their teachers use programs and software like PowerPoint, Microsoft Word, Microsoft Excel, Google Drive, YouTube, and Adobe in online classes. This is mainly because this software and programs facilitate the organization and display of information. This, in turn, helps students of different learning styles, whether visual, auditory, or kinesthetic, to view, hear, manipulate, and categorize information in the best possible ways. On the other hand, as one of the interviewed teachers stated, teachers' lack of ICT knowledge is a kind of creativity barrier because instead of creating innovative activities, unskillful teachers will have to spend their time managing the basics of technology in their online classes. The more teachers are capable and knowledgeable of ICT, the better chance there is for their students to be engaged in exciting class activities, she said.

In the fourth place (41.4% highly motivated) comes the students' motivation when their teacher integrates online games such as Kahoot, Quizizz, Edpuzzle, and Jeopardy during online classes. No matter how old the students are, they like some change from the traditional ways of answering questions. The teacher's skillfulness in using online games as part of the lesson lead-in or formative assessment motivates students to be active in online classes. This conclusion from the survey matches the data collected from the interviews with both teachers and students. All the interviewed students expressed that online games and activities such as Kahoot! and Quizizz make the lesson more engaging and help them review the material they learned. One interviewee added that doing graded online activities, especially the low-stake assessments, makes her focus fully in online classes. All the interviewed students said they are motivated most when teachers use online games, whether for assessment or explaining concepts. Similarly, all the interviewed teachers stated that they use online games and quizzes to engage students.

In the fifth place (34.9% highly motivated) comes the teacher's skillful use of the TPACK or ICT tools suitable for the subject, the teaching strategies, and the learning objectives. Integrating the teacher's content knowledge and pedagogical knowledge with technological knowledge leads to the desired outcome of reaching the learning stage in the teaching-learning process. This statistical piece of information in the survey is confirmed by the students' interviews, for all the interviewed students commented that teachers' knowledge of ICT helps them avoid losing time and, consequently, losing students' attention.

In the sixth place (33.7% highly motivated) comes the teacher's use of technology to address different learning styles (visual, auditory, kinesthetic) since in this way the teacher can reach all students no matter in what domain they are intelligent or what their preferred style to acquire knowledge is. Addressing different learning styles results in communicating the information to the vast majority of the learners effectively. The survey's answer to the question about learning styles is supported by the teachers' responses in the interviews. Two teachers confirmed that the student's participation in the chat messages reflects their engagement, so those who feel shy to speak can still indicate their motivation by participating through writing. One teacher noted that some highly motivated students write emojis and not just words.

In the seventh place (31.4% highly motivated) comes the teacher's use of various online assessment tools (Google forms, Socrative, Blackboard assignments). This is a relatively low percentage compared to the factors mentioned above that motivate students in online classes. This is because students do not care about the assessment tool as much as the assessment itself and its level of difficulty. This also explains why the interviewed students did not mention the online assessment tools as a cause of motivation and instead focused on the tools used for explaining lessons.

In the eighth place (28.4% highly motivated) comes the teacher's ability to solve technical problems during online classes. The low percentage in the students' motivation regarding this issue is that they know that if the teacher could not solve a technical problem, the IT department is always there and ready to help. All the students showed their understanding of teachers' inability to solve technical issues in online classes. One student said that teachers resort to IT for technical issues, so

there should be no problem. However, 90 % of the student interviewees noted that despite their understanding of the issue and their compassion with the teachers, they still feel sorry for losing time in class.

VI. CONCLUSION

It is crucial to shed light on the results of [26] study, which shows that using ICT at school does not positively affect students' scores in math and science than the scores in science. This means that using ICT does not necessarily affect the scores in all subjects, and this observation could be the starting point of more research in the future.

Technology is not an end in itself, of course, but teachers' ICT knowledge could be a means of their survival in an increasingly developing world that continually depends on technology. ICT has a crucial role in education, especially in a fast-developing world in digital media and information, which predicts a more powerful impact of ICT on the teaching-learning process and learning motivation [27]. ICT provides access to education independently of time and place, and it enriches the learning and teaching environments and enhances students' motivation and performance [27].

VII. RECOMMENDATIONS

It is, therefore, highly recommended to train teachers at all levels and of all subjects to use ICT in their online teaching. Such a decision will require academic institutions to organize workshops or sessions that keep teachers informed of the most recent and relevant technologies, enriching the teaching and learning experiences.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Malakeh Itani and Manal Sinno prepared the data collection instruments; Malakeh Itani collected the qualitative and quantitative data; Manal Sinno analyzed the data; Malakeh Itani and Manal Sinno wrote the paper; both authors have approved the final version.

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