

# Effectiveness of WhatsApp as a Part of a Hybrid Learning Environment: An Opportunity for Post-COVID-19 Pandemic Pedagogy

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## ABSTRACT

**Aim and objective:** This study sought to examine the effectiveness of hybrid learning utilizing WhatsApp as an adjunct to traditional learning in delivering knowledge to and supporting the learning of undergraduate dental students and investigate learner perceptions of WhatsApp use in educational contexts.

**Materials and methods:** The 3-month prospective analytical interventional study sampled 85 undergraduate students from the Department of Preventive Dental Sciences. A WhatsApp group was created, information was sent to the male and female groups, and a written assignment was used as a performance benchmark of knowledge acquisition and application. Perceptions of e-learning through WhatsApp were assessed using a previously validated and published questionnaire. Collected data underwent descriptive and bivariate analyses (unpaired t-test).

**Results:** The average assignment scores of the 85 hybrid learners were statistically significantly higher than those of traditional learners from the previous academic year ( $34 \pm 1$  vs  $26 \pm 3$ ;  $p < 0.05$ , respectively). Meanwhile, 57 hybrid learners completed the survey, and 73% agreed/strongly agreed that introducing a new method of teaching via WhatsApp was useful, 70% reported that a professional and comfortable learning environment was created, and 70% felt that group distractions were handled appropriately. The top advantages of learning through WhatsApp were availability/immediacy (94.7%) and being simple to operate (91.2%). Males (40.4%) were significantly more likely to report a sense of belonging to the group than females (33.3%,  $p = 0.01$ ). Respondents agreed that high expectations of teacher availability (71.9%) and some students making no effort (52.6%) were challenges. Message flooding (45.6%) and time-consuming nature of WhatsApp (36.8%) were identified as technical challenges.

**Conclusion:** The findings showed significant improvements in student performance using the hybrid learning tool, as reflected in assignment scores. Positive perceptions of hybrid learning and improved academic performance indicate that WhatsApp is a convenient new teaching tool.

**Clinical significance:** The results of this study may be applicable to other clinical dental disciplines.

**Keywords:** Dental Epidemiology, Education, Hybrid Learning, Interventional Study, WhatsApp.

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## INTRODUCTION

Over time, researchers have demonstrated the benefits of integrating social networking and mobile technologies into learning contexts compared to only using face-to-face learning in the classroom.<sup>1-3</sup> There is emerging evidence that free messenger applications have significant potential to support the learning process, such as enabling direct access to an abundance of online resources, which has major implications for pedagogies.<sup>4,5</sup> The high degree of infiltration of smartphones into the market initiated the growing use of WhatsApp as a communication platform for various student groups, and more recently, for groups of teachers to communicate with their students. WhatsApp is a cross-platform smartphone messenger application that utilizes instant messaging and employs users' existing Internet data plans to help them engage in social networking in real time.<sup>6</sup> Over the last few years, WhatsApp has gained popularity and has over 350 million users in 127 countries.<sup>7</sup>

Integrating WhatsApp into higher education has received much attention in the past few years. Research studies suggested that this integration may yield desired learning or communication objectives or have positive social impacts and emotional

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benefits.<sup>1,8–10</sup> Moreover, although WhatsApp is a relatively new tool in education, it has shown great potential for sharing knowledge, interacting, and developing skills.<sup>11,12</sup> In health sciences, a recent review revealed that previous works have been limited to student use of WhatsApp in medical education.<sup>13</sup> The review concluded that, in medical education, WhatsApp is an excellent supplement to traditional face-to-face learning in terms of its collaborative learning potential and ubiquitous availability, providing an effective and motivational space that promotes higher-order thinking abilities in students. Another experimental study showed that students in a blended learning strategy group (using WhatsApp) demonstrated better academic performance than students using only traditional face-to-face learning.<sup>10</sup> Meanwhile, gender-based variability in terms of using WhatsApp as a learning tool has been a matter of controversy.<sup>1,14</sup>

In the era of coronavirus disease (COVID-19), constructive changes to the education system have become inevitable, and learning is no longer bound by traditional face-to-face methods. Therefore, using WhatsApp is likely to become an important component in higher education, including dental education, which involves teaching a multitude of scientific facts and concepts. Hence, a thorough examination of the effectiveness of the WhatsApp application in education has become imperative. As such, it was worth launching a practical exploration into this new terrain through the present small-scale study, which offers insights about introducing WhatsApp in an undergraduate hybrid classroom in a Saudi setting.

The dental epidemiology course was designed to explain the principles of oral epidemiology and measure oral health in order to support evidence-based decision-making related to oral health issues. One of the course's learning outcomes was to provide students with learning experiences that help them develop and apply relevant knowledge and skills through group work assignments on an oral health-related issue. Consequently, students get lower grades over the time of the course. Since this course was only given as a weekly 1-hour lecture, thoroughly explaining the purpose of the epidemiological essay—which was a required assignment in the course—and how to search for and interpret epidemiological studies was inadequate within this limited time frame. The assessment of the traditional method of face to face teaching with hybrid method worth further investigation.

Therefore, improvement of students' acquisition, retention, and exchange of knowledge in a team environment using the benefits of social media (particularly WhatsApp) was crucial for effective learning in order to ameliorate their performance in their epidemiological essay assignment.

This study aimed to assess the effectiveness of WhatsApp as a medium of teaching that complements traditional learning in delivering knowledge to and supporting the learning of undergraduate dental students as well as to investigate learners' perceptions of the use of WhatsApp in educational contexts. The study hypothesis empirically tested whether a hybrid learning environment (using WhatsApp) improved academic performance in terms of higher-order thinking compared to the traditional learning environment.

## MATERIALS AND METHODS

### Study Design, Setting, and Sample

This prospective analytical interventional study was conducted in the Department of Preventive Dental Science (within the dental

epidemiology course) at Taibah University Dental College and Hospital between March 5 and May 30, 2017, on third-year dental students. A convenience sample of all 85 students (43 females and 42 males) was invited to participate in the hybrid learning environment, and their results were compared with the 2015/2016 cohort, which used a traditional learning environment.

### Study Intervention

This study used WhatsApp to send multimedia messages, such as photos, videos, and audio recordings, as well as simple text messages. Messages were sent at different times, as agreed upon with the students, outside of the official lecture hours. The messages were saved automatically, even when a student's device was off. No charges were involved, and WhatsApp supports unlimited multimedia interactions. Since Saudis are mostly familiar with the use of WhatsApp, no training was required for the participants.<sup>15</sup>

The students were divided into two WhatsApp groups based on gender, as dictated by the culture. None of the students had prior knowledge about the topics taught in the course. Similar information was sent to each group throughout the term, including information on how to search for relevant studies, select supporting evidence, analyze key features, and describe the results of an epidemiological study. Materials also addressed academic writing, referencing, citation generator software, plagiarism, and plagiarism detection software.

### Data Collection

A written course assignment was used as a performance benchmark for knowledge acquisition and application. The assignment grades of the students from the previous year (traditional education cohort) and the study sample (hybrid learning cohort) were compared. In both academic years, the assignments were assessed by the same course coordinator based on identical marking criteria.

Perceptions of e-learning through WhatsApp were assessed using a previously validated and published questionnaire.<sup>10</sup> To ease data gathering, the questionnaire was distributed to all third-year dental students through a Web-based online survey (Google Forms) after the course was successfully completed. Upon submission of the form, the data were transferred to a Microsoft Excel spreadsheet for storage and later retrieved for analysis.

The questionnaire included a cover page that explained the purpose of the study, the confidentiality of the obtained data, and the institutional review board approval; information about the researchers was also provided in case of further queries. The first section of the questionnaire asked questions about the perceived technical, educational, and instructional advantages of using WhatsApp as a learning tool using five-point Likert scale (1 = strongly disagree; 5 = strongly agree). The second section asked questions related to perceived challenges of introducing the hybrid learning method, including challenges related to students having no smartphones, message flooding, the time-consuming nature of WhatsApp, appropriateness of the language used, teacher availability, and efforts made by students.

The responses for the second section were on a five-point Likert scale (1 = strongly disagree; 5 = strongly agree).<sup>10</sup> The responses were then collated into "agree and strongly agree," "neutral," and "disagree and strongly disagree" to have meaningful analysis. The questionnaire took between 3 and 8 minutes to complete.

Approval was obtained from the Taibah University Dental College and Hospital Research Ethics Committee before the initiation of the study (TUCDREC20171019Alsharif).

Data were imported from Microsoft Excel to the Statistical Package for Social Sciences (SPSS) software for Windows version 24 (IBM Corp, Armonk, New York, USA) for analysis. The statistical analysis plan was based on previous relevant study.<sup>10</sup> The descriptive statistical analysis (frequency and percentages) was performed to report the students' perceptions of the advantages and challenges of introducing WhatsApp teaching and learning in the dental undergraduate course. The unpaired students' *t*-test was conducted to compare the mean value of the assignment scores of the two cohorts (traditional formal learning vs. hybrid learning) and determine whether there was a significant difference in knowledge acquisition and performance between the groups. The significance level was set at  $p \leq 0.05$ . The internal consistency and reliability of the questionnaire was assessed using Cronbach's alpha; the estimated values were interpreted according to Kline: acceptable (0.60–0.69), good (0.70–0.89), and excellent ( $>0.90$ ).<sup>16</sup>

**RESULTS**

**Traditional vs Hybrid Classroom Student Performance**

The study involved the performance-based assessment of 97 students from the traditional learning cohort and 85 students from the hybrid learning cohort. As can be seen in Table 1, the hybrid learning cohort's average assignment scores ( $34 \pm 1$ ) were statistically significantly higher than that of the traditional learning cohort ( $26 \pm 3$ ) ( $p < 0.05$ ) (Table 1). In the hybrid learning cohort,

higher average assignment scores were found in the male group than in the female group ( $p = 0.001$ ).

**Perception of e-Learning through WhatsApp**

Of the 85 questionnaires sent, 57 (male = 30, female = 27) were completed (response rate = 68%). The Cronbach's alpha of the questionnaire was good (0.79).

In total, 86% of the respondents agreed/strongly agreed that the objectives of the course were clearly communicated, 77% agreed/strongly agreed that the content of the trainings supported the objectives, and 58% agreed/strongly agreed that the topics were well-organized (Fig. 1A). Furthermore, 74% of respondents agreed/strongly agreed that the introduction of a new method of teaching via WhatsApp was useful, 70% agreed/strongly agreed that a professional and comfortable learning environment was created, and 70% agreed/strongly agreed that group distractions were handled appropriately (Fig. 1B).

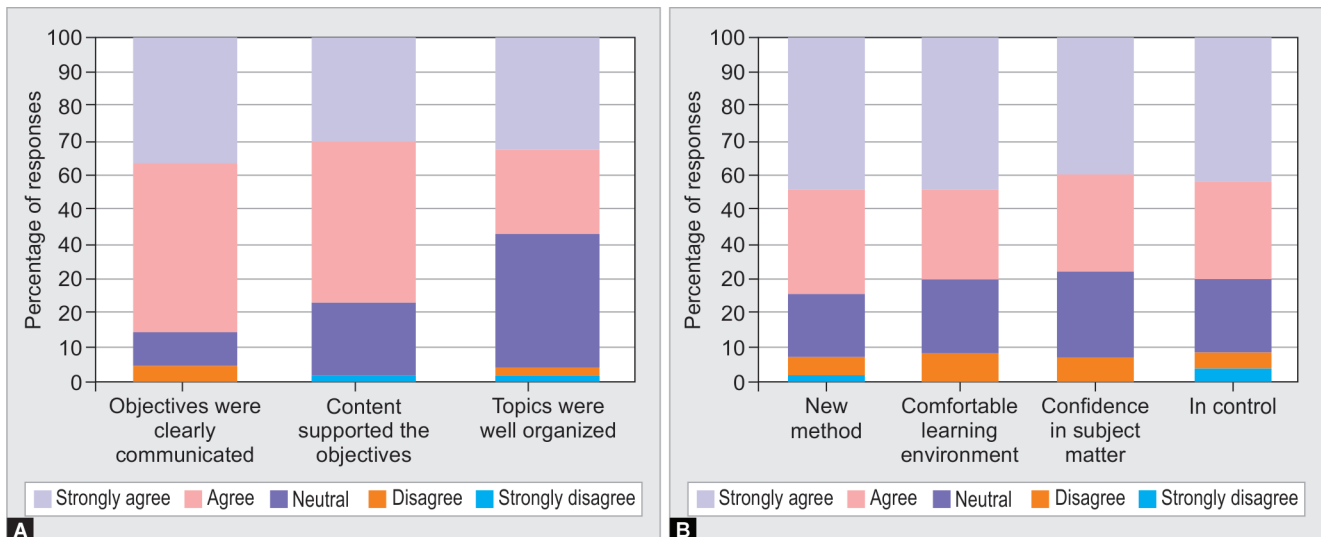
**Advantages of Learning through WhatsApp**

Table 2 describes the perceptions of the respondents on the advantages of e-learning via WhatsApp (blended cohort,  $N = 57$ ). Availability/immediacy of content and being simple to operate were the two top-rated advantages of learning through WhatsApp among 94.7% and 91.2% of students, respectively. Meanwhile, 89.5% of respondents agreed that the advantages offered by WhatsApp were that it is free of charge and that it offers the ability to learn anytime/anywhere. Meanwhile, 84% of the respondents agreed/

**Table 1:** Bivariate results of comparison assignment scores for traditional and hybrid teaching and within groups (gender) of hybrid teaching

Learning environment	Batch		Average marks (out of 35) Mean $\pm$ SD	<i>p</i> value
Traditional	2015/2016 (N = 97)		26.2 $\pm$ 3.2	0.001*
Hybrid	2016/2017 (N = 85)		34 $\pm$ 1	
Learning environment	Gender		Average marks (out of 35) Mean $\pm$ SD	<i>p</i> value
Traditional	2015/2016 (N = 97)	Females (n = 52)	26.5 $\pm$ 1.5	0.027**
		Males (n = 45)	25.8 $\pm$ 2.8	
Hybrid	2016/2017 (N = 85)	Females (n = 43)	33.5 $\pm$ 1.5	0.001**
		Males (n = 42)	34.6 $\pm$ 0.4	

\*Unpaired student's *t*-test was significant at  $p < 0.001$ ; \*\*independent *t*-test



**Figs 1A and B:** Stacked bar chart of Likert question regarding learners' perception on (A) WhatsApp learning environment and (B) facilitator during WhatsApp learning environment ( $N = 57$ )

**Table 2:** Learners' perception on the advantages of e-learning via WhatsApp (Hybrid cohort,  $N = 57$ )

<i>Advantages of using WhatsApp</i>		<i>Participants responses n (%)</i>		
		<i>Disagree</i>	<i>Neutral</i>	<i>Agree</i>
Technical	Simple to use	1 (1.8)	4 (7.0)	52 (91.2)
	Free of charge	1 (1.8)	5 (8.8)	51 (89.5)
	Availability and immediacy	1 (1.8)	2 (3.5)	54 (94.7)
	Privacy	1 (1.8)	7 (12.3)	49 (86.0)
Educational	Conductive atmosphere	6 (10.6)	23 (40.4)	28 (49.1)
	Sense of belonging to the group	4 (7.1)	11 (19.3)	42 (73.7)
	Students help each other and share learning material, more interactions	4 (7.1)	8 (14.0)	45 (78.9)
	Interaction with facilitator	3 (5.3)	6 (10.5)	48 (84.2)
	Learners can clear their doubts without disturbing the facilitator immediately	4 (7.0)	11 (19.3)	42 (73.7)
Instructional	Accessibility to learning materials	3 (5.3)	10 (17.5)	44 (77.2)
	Teacher's availability	1 (1.8)	9 (15.8)	47 (82.5)
	Learning anytime, anywhere	1 (1.8)	3 (5.3)	51 (89.5)
	Provide secure environment	1 (1.8)	10 (17.5)	44 (77.2)

**Table 3:** Learners' perception on the advantages of e-learning via WhatsApp (Hybrid cohort,  $N = 57$ ) by gender

<i>Advantages of using WhatsApp</i>		<i>Participants responses</i>						<i>p value</i>
		<i>Males n (%)</i>			<i>Females n (%)</i>			
		<i>Disagree</i>	<i>Neutral</i>	<i>Agree</i>	<i>Disagree</i>	<i>Neutral</i>	<i>Agree</i>	
Technical	Simple to use	–	3 (5.3)	27 (47.4)	1 (1.8)	1 (1.8)	25 (43.9)	0.31
	Free of charge	–	3 (5.3)	27 (47.4)	1 (1.8)	2 (3.5)	24 (42.1)	0.45
	Availability and immediacy	–	1 (1.8)	29 (50.9)	1 (1.8)	1 (1.8)	25 (43.9)	0.47
	Privacy	–	3 (5.3)	27 (47.4)	1 (1.8)	4 (7)	22 (38.6)	0.39
Educational	Conductive atmosphere	3 (5.3)	12 (21.1)	15 (26.3)	3 (5.3)	11 (19.3)	13 (22.8)	0.99
	Sense of belonging to the group	4 (7)	3 (5.3)	23 (40.4)	–	8 (14)	19 (33.3)	0.01
	Students help each other and share learning material, more interactions	3 (5.3)	3 (5.3)	24 (42.1)	1 (1.8)	5 (8.8)	21 (36.8)	0.45
	Interaction with facilitator	1 (1.8)	5 (8.8)	24 (42.1)	2 (3.5)	1 (1.8)	24 (42.1)	0.21
	Learner can clear their doubts without disturbing the facilitator immediately	3 (5.3)	6 (10.5)	21 (36.8)	1 (1.8)	5 (8.8)	21 (36.8)	0.61
Instructional	Accessibility to learning materials	1 (1.8)	4 (7)	25 (43.9)	2 (3.5)	6 (10.5)	19 (33.3)	0.49
	Teacher's availability	–	6 (10.5)	24 (42.1)	1 (1.8)	3 (5.3)	23 (40.4)	0.32
	Learning anytime, anywhere	2 (3.5)	1 (1.8)	27 (47.4)	1 (1.8)	2 (3.5)	24 (42.1)	0.71
	Provide secure environment	–	4 (7)	26 (45.6)	3 (5.3)	6 (10.5)	18 (31.6)	0.05

strongly agreed that they were interactive with the facilitator, and 45% agreed/strongly agreed that WhatsApp provided more accessibility to learning materials than traditional learning. Seventy-four percent of students agreed that the WhatsApp learning environment cultivated a sense of belonging to the group. Male students (40.4%) were significantly more likely to report a sense of belonging than female students (33.3%,  $p = 0.01$ ; Table 3).

### Challenges of Learning through WhatsApp

Using WhatsApp as a teaching and learning tool raised many challenges (Table 4), with 71.9% of respondents agreeing that the main challenge was having high expectations of the teacher's availability and 52.6% agreeing that the main challenge was that some students made no effort. Meanwhile, 45.6% of learners agreed that technical challenges included message flooding or found the process to be time-consuming (36.8%). A series of Chi-square tests

found no significant differences ( $p > 0.05$ ) between males and females for each item related to challenges in learning through WhatsApp (Table 5).

### DISCUSSION

This study aimed to assess the effectiveness of WhatsApp as a medium of teaching that complements the traditional educational model in delivering knowledge to and supporting the learning of undergraduate dental students as well as to investigate learners' perceptions regarding the use of WhatsApp in educational contexts. The study findings revealed that the hybrid learning environment (using WhatsApp) probably improved the academic performance of third-year dental students compared to the traditional learning environment, which was consistent with the study hypothesis.

One of the major benefits of WhatsApp is that instructors can incorporate a variety of tools into courses to facilitate effective

**Table 4:** Learners' perception on the challenges of e-learning via WhatsApp (Hybrid cohort,  $N = 57$ )

<i>Challenges in using WhatsApp</i>		<i>Participants responses n (%)</i>		
		<i>Disagree</i>	<i>Neutral</i>	<i>Agree</i>
Technical	Students with no smartphone	34 (59.6)	15 (26.3)	8 (14)
	Message flooding	10 (17.5)	21 (26.8)	26 (45.6)
	Time-consuming	15 (26.3)	21 (36.8)	21 (36.8)
Educational	High expectation of teacher's availability	7 (12.3)	9 (15.8)	41 (71.9)
	Use of inappropriate language	32 (56.1)	8 (14.0)	17 (29.8)
Instructional	Some students do not make any efforts	6 (10.5)	21 (36.8)	30 (52.6)
	Some students may not share material to impress facilitator without learning about it	11 (19.3)	20 (35.1)	26 (45.6)

**Table 5:** Learners' perception on the challenges of e-learning via WhatsApp (Hybrid cohort,  $N = 57$ ) by gender

<i>Challenges in using WhatsApp</i>		<i>Participants responses</i>						
		<i>Males n (%)</i>			<i>Females n (%)</i>			<i>p value</i>
		<i>Disagree</i>	<i>Neutral</i>	<i>Agree</i>	<i>Disagree</i>	<i>Neutral</i>	<i>Agree</i>	
Technical	Students with no smartphone	17 (29.8)	10 (17.5)	3 (5.3)	17 (29.8)	5 (8.8)	5 (8.8)	0.36
	Message flooding	5 (8.8)	12 (21.1)	13 (22.8)	5 (8.8)	9 (15.8)	13 (22.8)	0.87
	Time-consuming	8 (14)	11 (19.3)	11 (19.3)	7 (12.3)	10 (17.5)	10 (17.5)	0.99
Educational	High expectation of teacher's availability	4 (7)	6 (10.5)	20 (35.1)	3 (5.3)	3 (5.3)	21 (36.8)	0.59
	Use of inappropriate language	20 (35.1)	2 (3.5)	8 (14)	12 (21.1)	6 (10.5)	9 (15.8)	0.13
Instructional	Some students do not make any efforts	2 (3.5)	9 (15.8)	19 (33.3)	4 (7)	12 (21.1)	11 (19.3)	0.21
	Some students may not share material to impress facilitator without learning about it	5 (8.8)	12 (21.1)	13 (22.8)	6 (10.5)	8 (14)	13 (22.8)	0.69

learner-centered interactions. Learning through WhatsApp allows the sharing of a greater variety of materials (e.g., texts, photos, videos, and voice notes) to better accommodate diverse learning styles. In the hybrid learning cohort in the present study, higher average assignment scores were observed among the males than their female counterparts. This result suggests that hybrid learning directly contributes to student learning outcomes, particularly male students. Chuang et al.<sup>17</sup> found that males have a better ability to cope with Web-based learning than females. This matches well with our earlier findings from this study.

It was observed in our study that hybrid learning using WhatsApp offers a nonrestrictive environment by facilitating meaningful interactions with instructors anywhere and anytime and providing easy access to course materials. Furthermore, it has been reported that teaching is deeply rooted in interactions between students and instructors, students and their peers, and students and course content.<sup>9,18</sup> Studies have also emphasized that students desire personal interaction with their instructors, and new technology that allows this interaction has been directly related to students' course satisfaction.<sup>17,18</sup> Meanwhile, it has also been found that most students' daily social media activities occur in vehicles and public places and while walking; therefore, WhatsApp groups provide an opportunity for synchronous learning.<sup>1</sup>

According to the present study, the major benefits of using WhatsApp for learning beyond classroom borders were that it was available at any time, enabled immediate responses from the facilitator, and was simple to operate. These findings are consistent with those of Gon and Rawekar.<sup>10</sup> Furthermore, in the present study, male students were significantly more likely than female students to feel a strong sense of belonging to the group. In fact, a study

has found that male students were more interactive and preferred to participate in group discussions and provide feedback in a Web-based learning environment.<sup>18</sup> Providing feedback, sharing their thoughts, and expressing their viewpoints helped reinforce the learning material for the students (especially male students) in the present study and motivated them to become more active in the learning process. This finding is clearly reflected in the fact that the males outperformed the females in the epidemiological essay assignment.

Meanwhile, learning via WhatsApp was found to pose several challenges, such as message flooding and occasional disruptiveness. This might be attributed to the fact that WhatsApp discussions are not time bounded. No significant statistical differences were found based on gender.

### Implications

The spread of COVID-19 is potentially one of the greatest threats to global education in our lifetime, leading to a gigantic educational crisis. During the COVID-19 pandemic, all lectures and in-person classes were ceased, and millions of students were sent home in an attempt to limit interpersonal interactions and thereby flatten the infection curve. Conventional education was suspended, and emergency e-learning protocols were activated. In response to this sudden demand, educators and students began to use various online learning channels. Although some believed that the unplanned and rapid move to online learning—with no training, insufficient bandwidth, and little preparation—would result in poor user experiences that would be un conducive to sustained growth, the study findings indicate that a new hybrid model of education has emerged and has significant benefits. Since online or hybrid

learning will continue after the pandemic, the implementation of robust educational plans will be required.

### Limitations and Strengths

The absence of a stable Wi-Fi connection—which occurred for a limited period in a few cases—was one constraint of this study. However, although students might miss the interactive conversations with their colleagues, they can still catch up with the group once their Internet connection resumes. Another limitation was the small sample size, since the total number of third-year students was small. Furthermore, the findings might not be generalizable as the study was conducted in the context of only one learning course (i.e., dental epidemiology) in a single institution. However, the strengths of the study include the use of a validated questionnaire and the autonomy of the students' responses; since students were surveyed after completion of the module, response bias was minimal.

### CONCLUSION

Students have demonstrated positive perceptions and high levels of motivation, enthusiasm, and responsibility when using the WhatsApp application in a hybrid learning setting. Using WhatsApp as a medium for teaching/learning is significantly linked to improvements in students' academic performance in terms of higher-order learning. The significant improvements in the students' assignment performances were clearly reflected in their high grades using the hybrid learning tool. Students' acquisition, retention, and exchange of knowledge also improved in a team environment. Due to the ability to learn anytime and anywhere as well as the constant availability and immediacy of responses, WhatsApp has emerged as a convenient tool for teaching and learning. It is hoped that the present study sheds light on and provides valuable evidence for designing strategies and maximizing the potential of WhatsApp as a platform for enhancing interactions, collaborations, and engagement in hybrid learning environments.

### AVAILABILITY OF DATA AND MATERIAL

The datasets generated and/or analyzed during the current study are not publicly available due there was not a part of the informed consent. However, the data were available from the corresponding author on reasonable request.

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