



## Research article

## The application of WhatsApp to support online learning during the COVID-19 pandemic in Indonesia

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## ABSTRACT

The current study aimed to evaluate university students' technological acceptance and connectedness to online learning with WhatsApp support. A total of 202 students from three different courses at an Indonesian private university participated in an online survey. Quantitative data analyses using Rasch modelling technique were conducted to evaluate the survey data. Findings show that most students accepted social media use to support learning and felt connected to the learning. The findings also have identified several drivers that promoted the high level of acceptance and connectedness to learning, such as students' perceived usefulness, availability of learning support, motivation, and connectedness with their friends. Implications for further research and practices of WhatsApp usage to support online learning are discussed.

## 1. Introduction

Social media plays a critical role during COVID-19 pandemic times. The current literature has discussed the use of social media, particularly as a tool to obtain health-related information (Ittefaq et al., 2020; Saud et al., 2020), to remote monitoring and health care (Goel and Gupta, 2020; Saud et al., 2020), to educate people on how to respond to COVID-19 cases (Ittefaq et al., 2020), to seek social support (Saud et al., 2020), and to facilitate distance learning (Goel and Gupta, 2020; Khan, 2020). It is essential to highlight that social media in this paper is perceived as mobile digital applications that allow their users to initiate and compose contents for online social interaction (Carr and Hayes, 2015; Kaplan and Haenlein, 2010; Mulyono and Suryoputro, 2020a). The definition includes using several social platforms such as Twitter, Instagram, YouTube, Facebook, WhatsApp, etc. In Indonesia, the statistics on social media users have suggested an increase, revealing 95% of nearly 63 million internet users are social media users (Kominfo, 2013). The number increases as in 2018, social media users are reported to be 97.9% from a total of 132.7 million users (Mulyono and Suryoputro, 2020a).

In the education context, the adoption of social media such as WhatsApp to facilitate ubiquitous learning has been practised worldwide. A study by Tragant et al. (2021), for example, has shown how WhatsApp application is practised to extend the language learning of 23

English as foreign language (EFL) students during an intensive summer course. Findings from the study showed that WhatsApp allowed the students to practice the target language and engage within a real communication event. A survey of 140 undergraduate management students conducted by Klein et al. (2018) has indicated that WhatsApp possesses five educational affordances for learning in higher education, such as its ability to facilitate interaction, knowledge sharing, collaboration, ubiquity and sense of students' presence in learning. During the COVID 19 pandemic, social media can be used to bridge communication between teachers and students and among students (Dhawan, 2020). Rapanta, Botturi, Goodyear, Guàrdia, and Koole (2020) argue that the online teaching during the COVID-19 crisis could embrace a social presence domain in which teachers are expected to be open and could maintain teacher-student and student-student communication and interactions. Moreover, with support from social media, both teachers' and students' social activity and peer collaboration can be enhanced and accordingly, online learning success can be achieved (Rapanta et al., 2020). Some authors have argued that social media can be used as tools for students to understand and address real-world problems (Bozalek et al., 2013; Herrington et al., 2014; Herrington and Parker, 2013; Mulyono and Suryoputro, 2020b). In other words, social media can be viewed as the emerging mobile technology that enables teachers to create an online learning environment (Bozalek et al., 2013).

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In Indonesian higher education settings, the outbreak of the COVID-19 has forced many universities to suspend face-to-face classes and initiate online teaching and learning activities. Many universities have been using social media to facilitate their teaching activities and learning management systems (LMS) based on online learning (Febriani, 2020; Kaluge, 2020). Social media integration into online teaching and learning practices is not only because WhatsApp is easy but also accessible for teachers and students to communicate and interact (Mulyono and Suryoputro, 2020). Moreover, WhatsApp is reported to facilitate students' learning motivation and increase students' learning participation (Febriani, 2020). Although, Khan (2020) has argued in his paper that many developing countries have been using WhatsApp to facilitate online teaching and learning during COVID-19 pandemic. Several conditions have been identified for such use, including limited infrastructure, virtual education tools and setup, and insufficient trained human resources for more advanced web-based online teaching and learning practices.

In the current study, social media such as WhatsApp application was devised to support LMS-based online learning practices. Particularly, the study aimed to evaluate preservice teachers' technological acceptance and connectedness to learning within the context where social media was practised as a cognitive and technological tool to promote an authentic learning environment (Bozalek et al., 2013; Mulyono and Suryoputro, 2020). Even pre-COVID 19 pandemics, technological acceptance and connectedness to learning were often listed as contributing factors to applying new technology within a particular setting (Davis, 1989; Venkatesh et al., 2003). Thus, the current study is significant in shading lights regarding Indonesian university students' acceptance and connectedness using social media to support LMS-based online learning.

Besides, previous studies on online learning acceptance and connectedness have emphasised the use of survey method for the data collecting method (e.g. Dhume et al., 2012; Dumpit and Fernandez, 2017; Lawson-Body et al., 2018; So, 2016; Teo et al., 2008, 2009). Furthermore, the previous studies have suggested applying several quantitative data analyses (e.g. multiple regression, ANOVA and path-analysis) to reflect students' acceptance and connectedness to the online learning practices. However, little has been done concerning the Rasch modelling technique to study the technology acceptance model and learning connectedness. Therefore, the current study is significant in offering a methodological alternative of applying the Rasch modelling method to evaluate students' technological acceptance and learning connectedness of using social media to support their online learning activities.

The current study attempts to address the following research questions:

1. How do Indonesian university students accept WhatsApp to support their online learning during the COVID-19 pandemic?
2. How does the use of WhatsApp help Indonesian university students to be connected to their learning online?
3. What are the drivers that lead to students' acceptance and connectedness to learning?

## 2. Theoretical framework

### 2.1. Technological acceptance theory

The current study adopted the extended technology acceptance model and learning connectedness to investigate students' acceptance and connectedness using WhatsApp to support their online learning. The term technological acceptance model (TAM) was introduced by Davis (1989) to explain and predict the individual acceptance and adoption of particular technology usage. According to Jin (2014), TAM was initially developed by expanding and used several types of extraneous variables to predict the relationships between the variable of perceived ease of use (PE), perceived usefulness (PU) and other external variables. In the field of social media acceptance, student users are believed to perform social

media related activities when they find the social media application is less complicated (i.e. easy to use) and consider it beneficial for them (i.e. usefulness) (Dumpit and Fernandez, 2017).

Our review of literature has indicated some other external variables such as subjective norm (Dumpit and Fernandez, 2017; Jin, 2014; Taylor and Todd, 1995; Venkatesh and Davis, 2000) and perceived playfulness (Dumpit and Fernandez, 2017; Moon and Kim, 2001; Padilla-Meléndez et al., 2013) can predict TAM internal variables (i.e. perceived ease of use, perceived usefulness, satisfaction and technological acceptance). In the context of social media usage, subjective norm concerns the degree of pressure that students perceive from their surrounding community to use social media sites or applications at present or in the future (see Agudo-Peregrina et al., 2014). In a study, Dumpit and Fernandez (2017) found that subjective norm plays a significant role in promoting users' behavioural intention to use social media. They indicated that students would consider the opinion of respected people to use social media. In other words, students would incorporate social media to facilitate their learning because the faculty members require them to do so.

Besides subjective norms, perceived playfulness has been described as a primary indicator of students' use of social media (Dumpit and Fernandez, 2017). In TAM, perceived playfulness concerns the intrinsic motivation that encourages individuals to use particular technology (Venkatesh and Bala, 2008). Moon and Kim (2001) have argued that when individuals find themselves in the playfulness state, they will find their interaction with technology interesting and participate in the activity for pleasure. The current study perceives playfulness concepts as students' affection for feeling happy and motivated behaviours. Thus, perceived playfulness of social media usage refers to the extent to which students perceive that social media sites would provide them with the feeling of enjoyment and pleasure. Therefore, students will perceive the interaction with social media sites and applications as exciting and accordingly will maintain their participation for the state of enjoyment.

### 2.2. Connectedness to learning

Literature has posited connectedness to learning (CL) at two different domains within the TAM framework. Ananto and Ningsih (2020) suggest that connectedness to learning should be posited as an external variable that can predict students' acceptance of social media applications to support learning. In their study, Ananto and Ningsih examined university students' acceptance of smartphones and social media to promote mobile learning. The findings suggest that students' attitudes and connectedness to smartphones and social media significantly determined their acceptance of technology usage. Moreover, the findings revealed that students' connectedness and perceived ease of using social media and playfulness statistically influenced their attitude. Although Ananto and Ningsih (2020) have claimed the association of connectedness to learning towards students' acceptance of social media to support learning, there is still an unclear argument regarding the position of such an external variable on the TAM framework.

In a different perspective, Siritongthaworn et al. (2006) suggest that connectedness to learning variable should be treated as a subdomain of perceived usefulness scale. They argue that the perceived usefulness variable should be explained from the perspective of education quality. Taking Pajo and Wallace (2001) arguments, Siritongthaworn et al. perceived the connectedness to learning resources as a salient driver for quality learning. In their study, Siritongthaworn et al. (2006) found that students perceived the usefulness of e-learning and thought that technology enhances their learning.

In the current study, we followed the view of Ananto and Ningsih (2020) and thus posited the connectedness to the learning domain as an external variable in the TAM framework. The term 'connectedness' can simply be seen as 'the sense of belonging and acceptance'. Those who feel connected in online learning are more willing and engaged with others and participate in the learning activity (van Tryon and Bishop, 2009, p. 43). In social media acceptance, the connectedness to learning reflects

strong learning bonds that encourage students to willingly participate and engage with the online learning activities over their social media usage. In our view, the above discussed external variables (i.e. subjective norm, perceived usefulness and connectedness to learning) can be used to improve the explanatory capability of TAM corresponding to particular situations, types of users and technological characteristics (Hoi and Mu, 2020; Moon and Kim, 2001). The extended TAM theories and students' connectedness to learning were put forward to explain students' technological acceptance of incorporating WhatsApp application on their smartphones to support their online learning and connectedness to online learning.

It is important to note that the current study does not aim to examine the relationships between TAM's external and internal variables as in the previous studies. Instead, using Rasch model analysis, the current study aimed to determine the strength of students' responses (Goh et al., 2010; Mulyono et al., 2020; Ningsih et al., 2021). More importantly, Rasch model analysis allows the researcher to map and detail the students' responses to the TAM questionnaire's corresponding items. In addition, some previous studies have suggested using Rasch model analysis to examine technological acceptance among university students, such as Ismail et al. (2010) and Goh et al. (2010). Therefore, the current study is significant in adding to the current literature concerning the application of the Rasch modelling method as an alternative data analysis method to evaluate students' technological acceptance and learning connectedness of using social media to support their online learning activities.

### 3. Method

#### 3.1. The setting of the study and the participants

The current study was carried out in two faculties of a private university in Indonesia, namely faculty of teacher training and pedagogy (FTP) and faculty of Islamic studies (FIS). The local ethics committee, Lembaga Penelitian dan Pengembangan (LEMLITBANG) Universitas Muhammadiyah Prof. DR. HAMKA approved the protocol for the current study. In the protocol, students were given sufficient information about the objective and the procedure of the study; their participation was voluntary and anonymous. Students were also informed that there were no consequences due to their decision to participate or not participate in the study.

A total of 202 students from three different courses attended the study. The demography of the participants is detailed in Table 1 below:

During the COVID-19 pandemic, students attended the course online via the university Moodle LMS website. Students were required to participate in lecture activities, online discussion, individual assignments (reading, project/case study) and quizzes. Chat and message features were also available to the students, though the number of students who used such features was limited. Accordingly, social media such as WhatsApp was incorporated to support online learning. Particularly, the incorporation of social media was aimed to facilitate creating an authentic learning environment for the students. To this end, students

were encouraged to create a WhatsApp group (further written as WAG) for the course they belonged to interact, communicate, and share about the learning materials and progress. All student participants were observed to have a mobile phone and accessed the WhatsApp application using their mobile phones. One student from each class was assigned as a WAG administrator and help manage the group activity.

#### 3.2. Data collecting method

The current study adopted a survey method to collect the quantitative data related to students' technological acceptance and connectedness to online learning. To this end, a questionnaire was administered to the 202 students after a mid-term test. In the study, Ananto and Ningsih (2020) five-point Likert scale questionnaire was adapted to examine factors that contributed to preservice teachers' acceptance and connectedness to learning with social media support. The questionnaire comprises 25 items with five alternative responses ranging from strongly agree (scored by 5) to strongly disagree (scored by 1). Originally, the questionnaire was developed in reference to the modified version of the technology acceptance model (Dumpit and Fernandez, 2017; Lawson-Body et al., 2018; Venkatesh et al., 2003; Yang et al., 2019) and connected learning environment (Dwyer et al., 2004). The 25 questionnaire items were classified into seven constructs, including four items of perceived usefulness (PU), four items of perceived ease of use (PE), three items of the subjective norm (SN), three items of perceived playfulness (PP), four items of attitude (AT), three items of technological acceptance (AC), and four items of connected to learning (CL). In addition, three demography questions (i.e. course, gender and age) and a consent form were added to the questionnaire.

The questionnaire used the native language Bahasa Indonesia and was developed online using the questionnaire plugin in Moodle LMS. The native language Bahasa Indonesia was purposefully employed to help the participants comprehend the information from the instruments so that they could provide appropriate responses accordingly (Zulaiha and Mulyono, 2020). The online questionnaire was distributed after the mid-term test and remained open for a week.

#### 3.3. Data analysis

Two hundred and two student responses were recorded at the online questionnaire plugin at the university LMS. To allow the data analysis, the records were downloaded from the webserver in a txt file and were tabulated using Microsoft excel. Rasch model analyses (i.e. Infit and Outfit statistics and standardised fit statistics) using WINSTEP (version 4.5.1) was utilised to transform the raw ordinal data into log unit (logit) data. Besides, Rasch analysis was performed to screen the data for missing values and outliers. More importantly, the data screening process included removing data from the student participants who did not complete the questionnaire seriously and accordingly misfit in their responses (Goh et al., 2010). Of 202 records, 75 were misfit with the model and were thus removed as outliers (Linacre, 2010; Mulyono et al., 2020).

**Table 1.** Demography of the participants.

Course/faculty	Research method (R) FIS	Scientific writing (S) FTP	Academic reading and writing (A) FTP
Participant (N)	121	38	43
Gender			
Male	49	2	3
Female	72	36	40
Age			
<20	9	1	2
0–25	111	37	41
26–30	1	0	0
30<	0	0	0

The remaining 127 records include 103 females (81.1%) and 24 males (18.9%), 70 students from the Research Method class, 25 students from the Scientific writing class, and 32 students from Academic reading and writing class. Such 127 records still met the required sample size for the Rasch model analysis (Linacre, 1994).

In addition, Rasch model analysis was performed to evaluate the internal consistency of the instrument. Table 2 below presents the analysis result:

As shown in Table 2 above, the instrument was reported to have a very high level of reliability (Cronbach's  $\alpha > 0.9$ ). Many of the constructs, i.e. perceived usefulness, subjective norm, attitude, technological acceptance and connectedness to learning, were shown to have a high level of reliability (Cronbach's  $\alpha > 0.8$ ), and two other constructs were reliable (Cronbach's  $\alpha > 0.7$ ).

#### 4. Findings and discussion

##### 4.1. Descriptive statistics

The measured person's descriptive statistics showed the person mean 2.38 with a standard deviation of 1.60. The measure item logit value has shown the item mean .00 with a standard deviation of 1.03. In addition, person and item separations were reported at 4.04 and 6.11 consecutively. These separation values have indicated the ability of the instruments to sufficiently distinguish person abilities and item difficulties (Boone et al., 2014).

##### 4.2. Students' acceptance and connectedness to learning

The first and second research questions asked if the student participants accepted WhatsApp's incorporation to support their online learning and if such use of WhatsApp improved their connectedness to the learning activity. To answer these two research questions, the quantitative data were evaluated using Rasch model analysis. Using the WINSTEP application, a Wright map was developed to map the item and person logit values (LV) (see Figure 1) and classify the students' level of acceptance and connectedness to learning.

In Figure 1, the right side of the map distributes the level of agreements to the item, from the most agreed on the top to the most disagreed on the bottom. Table 3 summarises the classification of students' acceptance and connectedness to learning. The classification of students' level of acceptance and connectedness to learning was done by observing the tendency of the person logit data. Rusland et al. (2020) suggest the range of person logit data between Mean (M) and one standard deviation below mean (S) may reflect the moderate level, above M indicates a higher level, and the other below S describes the lower level.

As shown in Table 3, it was reported that 40% of students (N = 51) accepted WhatsApp to promote online learning and were shown to have a high level of connectedness to online learning. A total of 44.9% (N = 57) was at a moderate level, and the rest, 14.96%, was at a low level. Students who attended the Research method and Academic reading and

writing courses were shown to have higher acceptance and connectedness to learning than those participating in the Scientific writing course.

Moreover, Person-Differential Item Functioning (DIF) analysis was performed to evaluate response differences across the demography aspects (i.e. course, gender and age). Literature has suggested that an item is considered to promote DIF if its value of DIF contrast is higher than 0.5 logits and its Rasch-Welch probability value is statistically significant (Chan and Subramaniam, 2020; Mulyono et al., 2020). The following Table 4 describes the result of the DIF analysis.

From Table 4 above, it is shown that three items were considered to promote DIF in reference to the course demography (i.e. Q7, Q20, and Q23), and one item (i.e. Q15) had DIF for the gender and age demography.

The DIF analysis indicated that students from the Scientific writing class had less difficulty using WhatsApp features to support learning than those attending the Research method class (DIF S = -.24 LV, DIF R = 1.10 LV,  $p < 0.05$ ). Students from the Scientific writing class also were observed to show a high level of satisfaction with the quality of online learning with the support of WhatsApp than those in the Research method class and the Academic reading and writing class (DIF S = 2.49 LV, DIF A = 1.43 LV DIF R = 1.58 LV,  $p < 0.05$ ). In addition, students from the Research method class were reported to be happier to accept the use of social media such as WhatsApp for online learning than the Academic Reading and Writing Class group courses (DIF R = 0.47 logit, DIF A = 1.25 logit,  $p < 0.05$ ).

In reference to gender and age aspects, the result of DIF analysis showed that female students and the participants aged less than 20 years old did not feel that WhatsApp could connect with their classmates while male students and participants aged from 26 to 30 years old felt that WhatsApp as a place to connect with friends (DIF M = -0.19 logit, DIF F = -1.15 logit, DIF D = -2.63 logit, DIF B = 2.34 logit,  $p < 0.05$ ).

The findings were supported by the activity report obtained from the website, as shown in Table 5.

As shown in the above Table 5, although students from the Scientific writing class spent more days on the online learning websites, the average number of views and access to the learning activity remained lower than those in the Research method and academic reading and writing classes. In other words, students attending the Research method course and the Academic reading and writing course were shown to have more connections to their online learning compared to those in the Scientific writing course.

##### 4.3. Salient factors contributing to students' technology acceptance and connectedness to learning

In addition to students' acceptance and connectedness to learning, the current study evaluated the distribution of item difficulty on the left side of the Wright map (see Figure 1) to examine potential drivers of such acceptance and connectedness. The findings highlighted several drivers that promoted the high level of acceptance and connectedness to learning, such as students' perception of the usefulness of WhatsApp application to support learning (LV Q1 = -1.93; LV Q2 = -2.26),

Table 2. Internal consistency of the instrument.

	Items	Mean (logit value)	Cronbach's $\alpha$
<b>Global reliability</b>		<b>2.49</b>	<b>.95</b>
Perceived usefulness (PU)	Q1-4	4.68	.81
Perceived ease of use (PE)	Q5-8	.54	.79
Subjective norm (SN)	Q9-11	7.82	.86
Perceived playfulness (PP)	Q12-14	2.25	.76
Connectedness to learning (CL)	Q15-18	1.15	.81
Attitude (AT)	Q19-22	2.38	.81
Technological acceptance (AC)	Q23-25	.38	.82





Figure 1. Wright person-item map (N = 127). M: mean; S: one standard deviation of mean; T: two standard deviations of mean; Perceived usefulness (PU): Q1-4; Perceived ease of use (PE): Q5-8; Subjective norm (SN): Q9-11; Perceived playfulness (PP): Q12-14; Connected learning environment (CL): Q15-18, Attitude (AT): Q19-22; Acceptance (AC): Q23-25.

Table 3. Level of students' acceptance and connectedness to learning.

Level	N	Gender		Class		
		F	M	R	S	A
Low	19	16	3	4	12	3
Moderate	57	44	13	29	12	16
High	51	48	8	29	9	13
Total	127	108	19	62	33	32

Note R = Research method, S=Scientific writing, and A = Academic reading and writing.

availability of learning support (LV Q11 = -.90), motivation (LV Q14 = -.98) and students' connectedness with their friends (LV Q15 = -.95). It is critical to note that students' motivation to participate in the online learning activities varied among the three courses, revealing that the students attending the scientific writing course tend to be more frequent in accessing the course materials and activities (66 days), followed by those in the academic reading and writing course (52 days) and those in the research method (43 days). These findings could be interpreted that students in the scientific course had more motivation to the online learning due to the presence of positive behaviour to the online learning and more learning supports. In other words, WhatsApp had helped students obtain information related to tasks and learning activities. Still, it also enabled peer interaction pertaining to the learning task and activity,

learning support and motivation. As students perceive WhatsApp's usefulness to support their learning, they will likely continuously use such a social media application. Besides, students were very positive about using WhatsApp to obtain information related to learning and their learning activity (LV Q8 = -.63; LV Q13 = -.87). Our finding corresponds to the notion suggesting that individuals are more affected by the usefulness of certain technology applications than their ease of use (Akman and Turhan, 2017; Gefen and Straub, 2000). Furthermore, the finding is in line with an earlier study by Nyasulu and Dominic Chawinga (2019) who found that WhatsApp benefited students in information sharing, academic collaboration, and providing rooms for the students to learn beyond classroom hours.

**Table 4.** DIF analysis by course, gender and age.

Item	Demography		DIF measure	DIF Contrast	t
Q7	Course	S	-0.24	0.85	2.10*
		R	1.10		
Q20		S	2.49	0.91	2.26*
		R	1.58		
		S	2.49		
		A	1.43		
Q23		R	0.47	0.85	2.10
		A	1.25		
Q15	Gender	M	-0.19	0.96	2.35*
		F	-1.15		
Q15	Age	B	2.34	4.97	2.56**
		D	-2.63		

\*p value <.05, \*\*p value <.01.

Note: S = Scientific Writing Class, R = Research Methodology Class, A = Academic Reading and Writing Class, M = Male, F= Female, B = 26–30 years old, D= < 20 years old.

**Table 5.** Activity report for each course.

	Research Method	Scientific writing	Academic reading and writing
Average days of students' access to the learning	43	66	52
The average number of views and access to the learning activity	2960	647	1305
The average number of participants actively participate in the learning activity	111	38	43

The findings also revealed the subjective norm is critical in determining WhatsApp usage to support online learning. In the current study, students were observed to use WhatsApp because teaches, peers and other people in their social community had been using such a social media application to support their online learning (LV Q9 = .60, LV Q10 = -.34, LV Q11 = -.90). In other words, people influence plays a significant role in determining students' intention to use WhatsApp. According to Taylor and Todd (1995), subjective norms are among the other TAM variables that may understand why individuals intend to adopt particular technology. The findings of the current study confirm an earlier study by Dumpit and Fernandez (2017) whose findings revealed that subjective norm is one among other extraneous variables that promotes users' behavioural intention to use social media. Dumpit and Fernandez suggest that the opinion of respected people to use social media can be a strong driver of students' use of the media. In higher education settings, faculty members' use of social media can motivate students to incorporate social media to facilitate their learning. A similar finding was found in Nyasulu and Dominic Chawinga (2019) study suggesting that most student participants used WhatsApp because their fellow students used the technology.

However, students expressed their dissatisfaction with online learning with the support from WhatsApp (LV Q20 = 1.73). The current study showed that students did not enjoy working with particular peers in WhatsApp during the online learning (LV Q18 = 1.66) and felt it inconvenient to carry out learning using WhatsApp (LV Q3 = 1.09). Furthermore, students were shown to experience difficulty interacting with other peers during the learning (LV Q6 = 1.40). The students expressed their dissatisfaction with the WhatsApp features to support online learning and the overall quality of online learning with WhatsApp support (LV Q19 = 1.01, LV Q22 = .92). Some authors (e.g. Karapanos et al., 2016; Madge et al., 2019) have suggested that WhatsApp is a technological tool that eases communication and interactions among its users. More importantly, WhatsApp is a social tool that enables the growth of social relationships. However, Karapanos et al. (2016, p. 893) have reminded the negative consequences of WhatsApp in social exposure, embarrassment, and conflicts among the users. They argue that in many events, WhatsApp frequently misfits to the social communication

norms, which are varied in reference to the users' characteristics and social background. Such a misfit has been recognised as the source of the users' negative experiences when communicating and interacting over the WhatsApp application.

## 5. Conclusions and implication

The current study aimed to evaluate the Indonesian university students' acceptance of WhatsApp to support their online learning during COVID-19 pandemic and connected to learning. Findings show that most students accepted social media use to support learning and felt connected to the learning. In addition, the research question of the current study explored potential drivers of that leading to such acceptance and connectedness. From the quantitative data analysis, the study identified several drivers for the high level of students' WhatsApp acceptance and connectedness to online learning, such as students' perceived usefulness, availability of learning support, motivation, and students' connectedness with their friends. WhatsApp usage has enabled students to obtain learning-related information and get involved in learning discussions for the perceived usefulness aspect. As students perceive the usefulness of WhatsApp to support their learning, it is likely they will continuously use such a social media application. The study's findings have identified several contributing factors that promoted the high level of acceptance and connectedness to learning, such as students' perceived usefulness, availability of learning support, motivation, and connectedness with their friends. Despite such benefits of incorporating WhatsApp to support online learning, findings of the current study have identified two social relation issues that may interrupt students' WhatsApp usage, including students' discomfort of working with others and their difficulty in establishing learning interaction with others.

The findings of the current study draw several implications concerning WhatsApp usage to support online learning. First, WhatsApp's usage to support online learning should be carefully planned prior to online learning practices. The learning materials should be sufficiently structured, and communication and interactional activities should be designed to help students carry out informal learning activities using the technology. To these ends, the faculty members should enrich their

understanding regarding the WhatsApp characteristic and potential features for students' learning. Second, as a social media application, WhatsApp allows the students and teachers to communicate and interact across diverse contexts. Therefore, teachers should inform the students regarding the social norms applied in the virtual space over WhatsApp. This will help all parties in WhatsApp maintain good behaviour when responding to the conversation in the technology.

The current study comes with limitations. First, the student participants in the current study were assigned to a WAG in reference to the course they took rather than their individual preferences. Students' opportunity to choose who they want to communicate and work with in a particular WAG thus is limited. A further study exploring a similar topic is suggested to address this issue because students' acceptance and connectedness when incorporating WhatsApp in their online learning may be affected by how the WAG is formed. Finally, the current study was dominated by female participants with some males, and very few students aged 26–30. In addition, two different study settings where the online learning took place, i.e. the faculty of teacher training and pedagogy, and faculty of Islamic studies, may present distinct course and students characteristics and the nature of teaching and learning activities. Accordingly, the findings of the current study could not be generalised to reflect the view of the overall population. It is recommended that further research could accommodate a more balanced population in reference to the gender and age aspects from a similar setting.

## Declarations

### Author contribution statement

Herri Mulyono: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Gunawan Suryoputro: Conceived and designed the experiments; Performed the experiments; Wrote the paper.

Shafa Ramadhanya Jamil: Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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### Data availability statement

The data that has been used is confidential.

### Declaration of interests statement

The authors declare no conflict of interest.

### Additional information

No additional information is available for this paper.

## Appendix 1. Research instrument

Construct	Indicators	Item
Perceived of usefulness (PU)	Using WhatsApp helps me to obtain information related to online learning tasks and activities	Q1
	Using WhatsApp helps me to communicate with other students during online learning	Q2
	WhatsApp is an enjoyable learning media	Q3
	I find that WhatsApp is useful to support online learning	Q4
Perceived ease of use (PE)	I find it easy to use WhatsApp to support online learning	Q5
	I do not find any difficulty in communicating with other students using WhatsApp	Q6
	I do not find any difficulty in using features available in WhatsApp	Q7
	I can find information about online learning tasks and activities easily on WhatsApp	Q8
Subjective norm (SN)	My teacher asks me to use WhatsApp during online learning	Q9
	My friends ask me to use WhatsApp to support the online learning	Q10
	People in my surroundings use WhatsApp to support their online learning	Q11
Perceived playfulness (PP)	I feel happy to use WhatsApp to support my online learning	Q12
	I spend my spare time using WhatsApp to search for information about online learning activity	Q13
	Using WhatsApp motivates me to search many learning resources related to my study	Q14
Connectedness to learning (CL)	I feel that WhatsApp can help me to connect to other students in my class	Q15
	I made many friends with other classmates in the WhatsApp group	Q16
	I would like to enrol in another course that integrate WhatsApp, and make friends	Q17
	I like the class because I had many fun and friendly friends	Q18
Attitude (AT)	I am satisfied with the features in the WhatsApp to support online learning	Q19
	I am satisfied with the quality of online learning supported by WhatsApp	Q20
	I obtain necessary information related to online learning using WhatsApp	Q21
	I am satisfied with the support from using WhatsApp for online learning interaction	Q22
Technological Acceptance (AC)	I am happy to accept the use of WhatsApp to support online learning	Q23
	I will use WhatsApp to support online learning for the next few months	Q24
	I will recommend of using WhatsApp to my friends for online learning	Q25

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