Enhancing Student Involvement Based on Adoption Mobile Learning Innovation as Interactive Multimedia

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Abstract—The closure of schools and universities nationwide and even almost worldwide during the COVID-19 pandemic resulted in learning activities turning to distance learning. One of the increasing distance learning users is the mobile app. However, the problem educators experience when implementing learning by adopting m-learning applications is concerned about adequate student engagement or, in some cases, an inability to reach students fully. To that end, distance learning using m-learning has created questions about the importance of student engagement leading to understanding. Thus, this study investigated the influence of m-learning adoption on student engagement through digital readiness and presented 16 items of instruments. Electronic questionnaires collected data (N =89) from all masters and doctoral students in Indonesia. Testing the instrument's validity using confirmatory factor analysis, while reliability is measured using Cronbach's alpha and composite reliability. The results are significant for digital readiness as a mediator in student perception of the influence of the adoption of m-learning innovation on student engagement. Although students positively perceive that the adoption of m-learning has a positive effect, they must also have strong digital skills to complete their academic work. Besides, they must also be committed to fully engaged in learning activities using m-learning— this finding provides practical implications for improving effective and interactive online learning in college.

Keywords—Students' involvement, digital readiness, online learning, mobile learning, interactive multimedia

1 Introduction

Covid-19 pandemic disrupts all sectors, including education. The implementation of lockdown and social distancing led to the suspension of face-to-face learning activities. Therefore, the government provides online learning instruction rather than face-to-face learning. Face-to-face learning is considered ineffective in engaging students [1]. Thus, educational institutions turn to online learning to effectively deliver learning materials [2], [3]. However, online learning is also an important issue because not all regions have adequate information and communication technology [4]. Besides, the teachers' narrative notes reveal that student participation in online classes tends to be low due to a lack of parental supervision, internet access, resources, and teacher

skills [5]. To do so, teachers must optimize digital tools and resources to create interactive and affordable learning and teaching for students [6]. Thus, students will be encouraged to get involved in the learning process.

Student involvement is a crucial component of effective learning because significant learning activities will improve student performance [7]. Previous research has found that based on survey results from 186 colleges, students engaged successfully when learning activities involve students with materials, educators, and other students [8]. The type of learning media may influence students' perceptions of their engagement level [9]. One of the popular media that can increase student participation is mobile-based learning. This learning media has been implemented in Europe, using tablets and mobile devices to be the most popular learning media because it is effortless to use [10] [11]. According to Kabali, mobile devices are an exciting learning medium because they are easy to use [12]. This device's most important advantages are its screen, portability, and ease of use due to touch screen technology [13], [14]. Also, mobile learning is more mobile learning because students can use it anytime and anywhere [15].

Supported by the results of a survey from Common Sense Media in the United States shows that the ease of learning access using mobile devices resulted in this educational application began to be developed further as a teaching media to provide academic experiences for students [13], [16], [17]. To that end, the app is increasingly being adopted among developed and developing countries [14] by identifying the importance of developing educational applications that correspond to the current age and conditions. This educational application allows students to form their content [13]. The main factor influencing the adoption of digital technology devices as learning tools in higher education is technology experience and readiness. Mobile technology, whether students believe it is easy to use, offers various essential advantages in education [18]. It means that students' proficiency and readiness are indispensable in using mobile devices, as they will be aware of their course benefits.

Previous research on technology and student engagement has found that digital technology utilization can encourage student engagement [19], [20]. In line with Barak & Green, Henderson, Selwyn, & Aston, digital technology is becoming a central aspect of higher education, which inherently affects all aspects of the student experience [21]–[23]. Therefore, using digital technology can conduct more incentive teaching-learning processes, improve self-management and student progress, increase participation and involvement in the learning process, and predict increased student engagement [24]–[27]. However, there is no guarantee that student involvement is acting as a result of technology use [28]. Supported by Tamim, Bernard, Borokhovski, Abrami, & Schmid found that the application of technology in education had only a tiny to moderate impact on student achievement [29]. Instead, good planning and pedagogy and the right tools are essential because technology can improve teaching development [30], [31]. However, significant technology cannot replace poor teaching.

Furthermore, the interactivity and retention of learning using digital technology are usually lower than face-to-face learning [32]. Many students experience stress and frustration related to online education and difficulty completing tasks. Like Jaggars,

the form of stress experienced in online learning is technical difficulties and internet networks with an online learning environment, thus reducing their commitment and learning engagement [33]. Coomey and Stephenson, in the Min Hu & Hao Li's study, summarized 100 research reports and journal articles on online learning and concluded that there are four characteristics of online learning, one of which is participation or engagement [34]. In face-to-face learning, educators can use several teaching methods and strategies during the learning process based on interactive learning. Learning will implement appropriately to ensure the effectiveness of education and the quality of learning.

However, in an online learning environment, due to a lack of communication between students and educators and some uncontrollable factors such as learning environments, information gaps, and learning time, educators cannot understand the level of student engagement. In comparison, active student involvement in online learning indicates that they can efficiently carry out online learning. Otherwise, no matter how good the learning material equals zero. Therefore, further research is needed to analyse student involvement in online learning adaptation by paying attention to students' digital readiness. Key identified issues include various educational challenges during the COVID-19 pandemic, how they use smart mobile devices as teaching media, and the influence of mobile learning on students and students' digital readiness. This research can help educators understand student engagement, help students reflect on their behaviour, and increase their online learning process participation. After that, the research findings combined the proposed literature on adopting mobile learning with student involvement in online education mediated by student digital readiness.

2 Literature Review

With positive support for online learning advancement at universities, students can effectively achieve successful online learning. This research aims to test the adoption of m-learning, digital readiness, and student involvement in universities' online education contexts. Figure 1, in this section, illustrates this research model, which is the reason for the proposed hypothesis. This research suggests and tests the research model, consisting of three factors: m-learning, digital readiness, and student involvement.

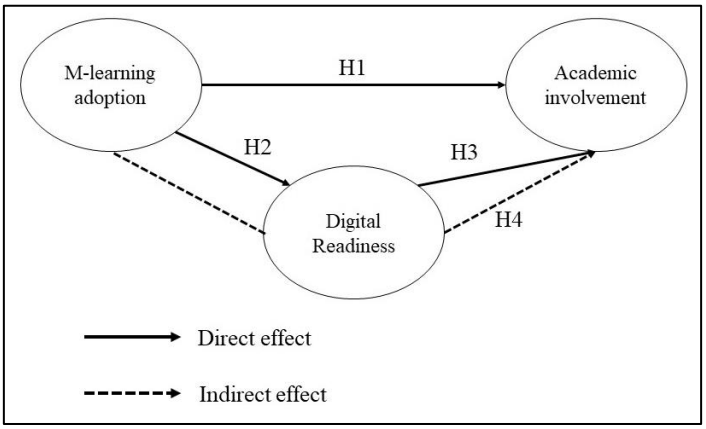

Fig. 1. The research model

2.1 Digital readiness and students' involvement

Digital readiness for students relates to knowledge, attitudes, and competencies to use digital technology to meet educational goals and higher education [35]. Student involvement in universities is likely to be enhanced by the adoption of digital technology, as found by Salman & Abdul Aziz and Kim, Hong, & Song, that students' digital readiness is related to the active application of technology for academic activities [36], [37]. Digital readiness for students, according to Margaryan, Littlejohn, & Vojt, includes the use of digital, which defined as the skill to perform academic tasks, the development of digital media competencies through the participation and evaluation of digital culture, and the application of information literacy skills [38].

Kim, Hong, & Song research found that students in Korea are digital natives who may not be actively influential in digital technology for academic activities or associate with digital literacy [37]. Students in universities currently show a gap between digital skills in informal contexts and formal learning [38]. Students' digital readiness includes the use of digital-related skills in the academic field, the development of digital media capabilities through participation, and the application of information literacy skills and learning strategies. It can be one of the crucial links between m-learning experience and student engagement. So, this study developed the following hypothesis:

Hypothesis 1 (H1): M-learning adoption is positively related to students' involvement

2.2 M-learning, digital readiness, dan students' involvement

As mobile device technology has overgrown, many young people and adults become regular users. What is more, tablet and smartphone devices are now popular among socioeconomic classes [39]. Due to its affordability compared to other digital devices, it is increasingly being adopted in developed and developing countries [14].

Previous research has shown that the use of these mobile devices has penetrated the context of higher education [18]. Specifically, many researchers have traced the effects of mobile device adoption on learning in higher education environments [40], [41]. Their findings suggest that mobile device learning apps improve critical thinking and student performance.

Researchers focusing on higher education showed that mobile devices' utilization in courses provides new potential for students to actively and effectively engage in the learning process [13]. Mobile device technology considers the most welcoming and interactive way for students to improve their conceptual and knowledge because they will learn to see the experience through various perspectives.

The learning-based mobile device contributes to the educational process. This type of tablet technology tends to have small dimensions, portability and is suitable for students and very interesting and very effective in improving students' accuracy in the learning process [13], [14]. It needs student digital readiness to achieve success in mobile device technology. Because without digital enthusiasm, students will find it challenging to understand the use of technology. Therefore, the hypotheses proposed in this study are:

Hypothesis 2 (H2): M-learning adoption is positively related to digital readiness

Hypothesis 3 (H3): Digital readiness is positively related to students' involvement

Hypothesis 4 (H4): The application of m-learning affects student engagement through digital readiness

3 Methodology

3.1 Data collection

This study applied a quantitative method based on a survey. Data analysis on the relationship of variables in the research model employed the SmartPLS software to obtain the respondent's results. The questionnaire consists of two main parts. The first section contains questions about demographic characteristics: gender, level of education, and regional origin. The second section includes closed-door questions about m-learning adoption, digital readiness, and student engagement.

This study asks the experts related to the education field to review the instrument of the questionnaire's contents. Based on feedback from experts, the item revises according to their advice. After the change, the next stage is testing the questionnaire on a sample of 30 students in Semarang. This testing aims to know for clarity and ease of use. The test results of this research instrument's validity and reliability see in table 2.

3.2 Sample

This study's population consists of random students selected from 36 provinces in Indonesia studying at Yogyakarta State University. The study involved 179 students chosen, considering specific demographic variations such as gender, level of educa-

tion, and regional origin. Of the initial samples, 20 declined, 70 refused to respond to the sent questionnaire, and 89 respond to the questionnaire. To that end, the final sample consisted of 89 students.

Table 1. Data Respondent

Attributes	Classification	Percent
Gender	Male	41.57
	Female	58.43
Education	S2	87.64
	S3	12.36
Province	Bengkulu	2.25
	Special Region of Yogyakarta	24.72
	Special Capital Region of Jakarta	3.37
	West Java	5.62
	Central Java	10.11
	East Java	7.87
	West Kalimantan	4.49
	South Kalimantan	6.74
	Central Kalimantan	4.49
	North Kalimantan	5.62
	East Nusa Tenggara	3.37
	Papua	1.12
	Riau	3.37
	North Sulawesi	4.49
	Central Sulawesi	8.99
	West Sumatera	3.37

Surveys are conducted through self-managed online questionnaires using google form. Respondents voluntarily participated in the study by sending a message via WhatsApp to click on the link address. We used a closed questionnaire because it only presents questions and a choice of answers. The selection of solutions in this study uses a Likert scale (1: strongly disagree-5: strongly agree). In the questionnaire, the study also raised questions about the frequency of mobile device use in online learning implementation using the Likert scale (1: almost never-5: always). The results showed that the frequency of mobile phone use for online learning activities was very high, with a median of 5.

3.3 Measurement

The questionnaire was adapted from previous research developed by researchers to test mobile device-based learning adaptations, digital readiness, and their involvement in the survey. Student engagement was measured using a scale developed by Handelsman, Briggs, Sullivan, and Towler [42]. The realities of student engagement demonstrated by Cronbach's alpha score of 0.841 are the instrument's reliability in a high category.

M-learning instruments are measured through students' evasion of their resources and abilities when engaging in m-learning [43]. Individual evaluation of skills and resources is an antecedent to adopting the them-learning component. Behavioral control is a positive predictor of the intention to adopt m-learning. Three items adapted from Chu and Chen included the statements: "I have the necessary knowledge to use the university's m-learning system," "Using the them-learning system is entirely within my control," and "I have the resources necessary to use m-learning applications." The scale showed strong reliability in this study: Cronbach's alpha equals 0.920.

The digital readiness instrument took from Hong and Kim, which measures universities' digital competencies that students feel for academic involvement [35]. Digital readiness is considered necessary for student academic success. Such instruments' reliability scale shows very strongly: Cronbach's alpha equals 0.841. Table 2 shows the research instrument.

Table 2. Measuring independent and dependent variables

Variables	Items		Factor	AVE	CR	α
Student involvement (SI)	SI1	I always study regularly	0.737	0.545	0.855	0.787
	SI2	I always find ways to make learning interesting to me	0.750			
	SI3	I always l learning material when thinking about the course between class meetings	0.854			
	SI4	I want to learn the material	0.740			
	SI5	Using m-learning is excellent fun	0.785			
M-learning adoption (MA)	MA1	Facilitate the implementation of the learning process	0.762	0.675	0.935	0.920
	MA2	The quality of the learning process is improving	0.803			
	MA3	The learning process is more effective	0.834			
	MA4	Increase productivity in learning	0.843			
	MA5	It can be used in all areas of learning	0.859			
	MA6	Following the learning methods used	0.841			
	MA7	Following the style in learning activities	0.804			
Digital readiness (DI)	DI1	I can generate keywords to search for information for academic work.	0.845	0.681	0.894	0.841
	DI2	I can communicate with classmates using real-time communication tools (e.g., video conferencing tools or messengers).	0.868			
	DI3	I can share everything, like my files with classmates, using online software.	0.870			
	DI4	I can collab with classmates using online software.	0.706			

3.4 Data analysis

Partial Least Squares-Structural Equation Modeling (PLS-SEM) was adopted to test the research model by empirically assessing structural models along with measurement models [44]. The study used SmartPLS 3.0 software [45] and utilized two

evaluation approaches: measurement models and structural models [46]. PLS-SEM is used to test research models, and hypotheses using latent variables with several variables observed using regression-based methods [47]. Also, PLS-SEM is more exploratory by understanding the coefficients of absolute paths and dependent variances described by independent variables in the research model, rather than checking match goodness [48].

PLS-SEM is a more practical approach to developing theories with limited context. Assumption of multivariate normality, smaller sample size, and measurement scale compared to covariant modelling-based structure equations. For the model conformity index, the study adopted the Chin criteria [49]. For PLS-SEM, the data size must be at least ten times the number of constructs associated with a single endogenous dependent construction. There are three constructs in this study, then the minimum amount of data to apply PLS-SEM is 30 (10 x 3 constructs). So, the total size is 89 exceeds the recommended sample size.

The fit model was measured by using the SRMR standard. The research model showed a value of 0.07 less than 0.08 [50]. The value indicates that the research model corresponds to the data. In other words, the model conformity index indicates 0.07, which means that the value of a good fit model [47].

4 Results

Of the 150 questionnaires distributed, 89 questionnaires were returned and were eligible for analysis. The overall respondent's answer results almost all answered agreed from each question. It is indicated by the result each variable influences the other. Furthermore, this study's data analysis uses the outer and structural models in SmartPLS.

4.1 Measurement model assessment

The goodness of fit test is the first step to analysing measurement models using SmartPLS [51]. This test can be measured by looking at the Standardized Root Mean Square Residual index (SRMR). Judging by the test results of fit, estimated, and saturated models must meet the criteria of SRMR values below 0.08 to be acceptable [50]. In this study, the SRMR value was 0.077, meaning the model was appropriate. Although the use of the goodness of fit test in PLS-SEM is still not widely used in research, the assessment's results are provided informatively in the test report [52].

In the next step, the measurement model assessment emphasizes the validity and relay test. Reliability testing is indicated by Cronbach's' alpha and composite reliability values. At the same time, validity tests can be measured using loading factor and average variance extracted (AVE) typically used to assess convergent validity. The recommended loading factor and Cronbach's' alpha value is $\geq$0.70 [53], and the CR and AVE values should be higher than 0.60 and 0.50 [44]. If an item's value is less than that criteria, the model removed it from data analysis.

Table 3. Reliability and analysis of convergent validity

Variables	Items	Loading	α	CR	AVE
Student involvement (SI)	S1	0.807	0.860	0.900	0.643
	SI2	0.813			
	SI3	0.835			
	SI4	0.845			
	SI5	0.700			
M-learning adoption (MA)	MA1	0.746	0.913	0.931	0.659
	MA2	0.805			
	MA3	0.839			
	MA4	0.856			
	MA5	0.819			
	MA6	0.845			
	MA7	0.761			
Digital readiness (DI)	DI1	0.875	0.856	0.903	0.699
	DI2	0.852			
	DI3	0.799			
	DI4	0.818			

Table 4. Discrimination Validity

Variables	Fornell-Larcker			HTMT		
	DI	***MA***	***SE***	***DI***	***MA***	***SE***
DI	0.836					
MA	0.745	0.812		0.838		
SE	0.772	0.829	0.802	0.896	0.836	

Table 3 confirms that the loading factor value is more than 0.7, and the CR and AVE values also show higher than 0.60 and 0.50 [44], [53]. Meanwhile, table 4 shows that the test results of the discrimination validity using the heterotraite-mononitrate ratio (HTMT) and Fornell-Larcker, prove that the value obtained is less than 0.90, meaning the HTMT and Fornell-Larcker values are accepted.

4.2 Structural model assessment

The next step, structural model analysis, aims to determine the hypothesis's significance. Table 5 will explain the R-square and R-square adjusted values.

Table 5. R-square value result

Variables	R-square	R-square adjusted
Digital readiness	0.555	0.550
Student involvement	0.741	0.735

Table 5 proves that the digital readiness of students is 0.555. The variance value of student digital readiness is explained by the mobile learning overspan of 55.5%, while other variables are not part of the model. Additionally, the student engagement varia-

ble's R-square value indicates the number 0.741 or 74.1 influenced by the variables studied in this research model. This study used a path coefficient to test the hypothesis, as shown in table 6. The bootstrap analysis results prove that this study supports the significance of the relationship that has been hypothesized.

Table 6. Summary of hypothetical test results

Hypotheses		β	t-value	p-value	Decisions
H1:	MA → SI	0.571	6.728	0.000	Supported
H2:	DI→SI	0.347	3.785	0.000	Supported
H3:	MA → DI	0.745	15.919	0.000	Supported
H4:	MA→DI→ SI	0.258	3.573	0.000	Supported

Hypothetical test results are listed in table 6, the results show that MA → SI (t=6,728; β=0.571); DI → SI (t = 3,785; β = 0.347); and MA→DI (t= 15,919; β = 0.745) had significant and positive correlation, so H1, H2, and H3 were supported in this study. Table 5 also shows that DI has positive partial mediation in the MAIN → SI path. Hence the hypothetical test results of mediation effects show (t= 3,573; β = 0.258) are significant and supported in this study.

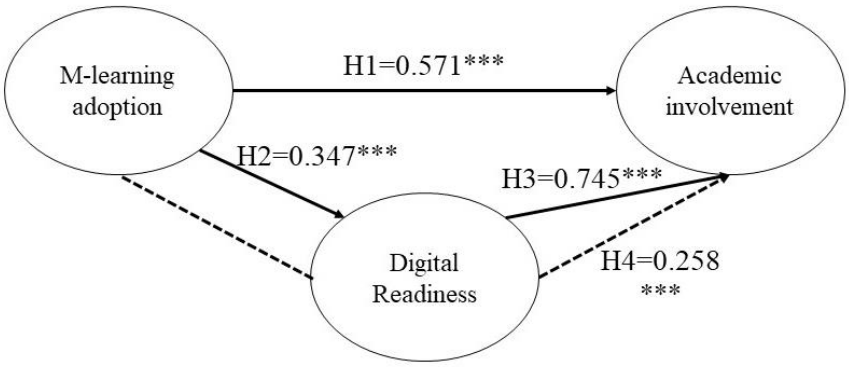

Fig. 2. PLS Model Of M-Learning Adoption of Students' Involvement through Digital Readiness

Figure 2 shows the path coefficient and significance level for each hypothesis, indicating that the hypothesis is supported at $p < 0.05$. The results prove that the adoption of m-learning (β=0.571, $p < 0.01$, supporting H1) has a significant favorable influence on students' involvement. Adopting m-learning (β=0.347, $p<0.01$, supporting H2) substantially influences digital readiness. Besides, digital readiness (β=0.745, $p<0.01$, keeping H3) positively affects students' involvement. To test how students' digital ability mediates m-learning adoption on students' participation represented in table 6 and 2. Table 6 and figure 2 show that digital readiness (β=0.258, $p<0.01$, supporting H4) can mediate the influence of m-learning adoption on students' involvement.

5 Discussion

In this study, we tested our research model to reveal the relationship between m-learning adoption and students' involvement. The finding indicates that the influence of m-learning adoption encourages student engagement. This research also examines the role of digital mediation readiness on m-learning adoption and student involvement in college settings.

This study tries to contribute to increased student involvement by using m-learning. The findings suggest that the first hypothesis (H1), stating that m-learning adoption affects students' participation, was supported in this study. It means that the better the use of m-learning adoption, the more student participation will also increase, and vice versa. The lowest item value in the them-learning adoption instrument is MA1: Facilitate in m-learning process's implementation based on the analysis results. It proves that the ease of using m-learning is still not satisfying students. Therefore, the lecturer or educator should make guidelines or procedures of m-learning usage to be more detailed and precise to understand m-learning easily.

This study's conclusions are essential to know that the adoption of innovation m-learning can influence student involvement in online learning. Previous student participation in m-learning in higher education significantly affects their performance levels [54]. In common with Kuh, students' efforts are intended for educational activities that can contribute to academic results [55]. The high level of relationships is significant due to students' commitment or action to engage in defense activities, resulting in better academic performance [56]. In other words, m-learning and student engagement directly predict their achievements in educational activities.

In the study results, m-learning can increase productivity in learning is the most significant factor that is 0.859. While m-learning facilitates the learning process's implementation is the lowest factor, which is 0.746. Thus, the increasing productivity in learning contributes the most in explaining the advantages of m-learning. This research is consistent with Bennett & Bennett, showing that the main obstacles teachers face in using technology are not on the limitations of technological means and funds, but rather on the willingness to use technology and confidence in technology benefits [57]. The belief in technology benefits can be seen from the advantages of technology compared to conventional methods. Added by Carter & Bélanger, technology influences students' increasing motivation in learning [58].

The second hypothesis (H2) reads digital readiness affects students' involvement, and the third hypothesis (H3) expressed with influential digital enthusiasm faced with the adoption of m-learning proved supported in this study. These findings are consistent with previous studies' results, which to guide students towards productivity and better results in using m-learning, it is necessary to improve their readiness [59]. One of the essential objectives of higher education using m-learning as interactive multimedia is to make students more interactive in the learning process through students' involvement [60]–[62]. To that effect, the adoption of m-learning plays a significant role. It means that students' experience and readiness in adopting m-learning can contribute to student engagement. Besides, students are confident in their digital

abilities for their academic work, meaning they have digital readiness, making them more likely to achieve better academic achievement.

The student involvement instrument shows that the lowest item value is SI5: Using m-learning is tremendous fun. To do so, educators need to improve them-learning app to become a more enjoyable learning app. One way is to add the latest learning features such as podcasts and assignments through social media such as TikTok, Instagram, etc. Meanwhile, the lowest item value on digital readiness instruments lies in DI3: I can share everything, like my files with classmates, using online software. This way, educators can create additional data-sharing features for students so they can access all learning materials through m-learning.

The fourth hypothesis is that m-learning innovation's adoption affects student engagement through digital readiness, proven supported in this study. This study's findings imply that students who actively adopt m-learning and have confidence still need to commit and strive to study the use of digital materials [37], [54]. Also, given that digital readiness mediates the relationship between the partial use of m-learning and student engagement, universities need to consider students' digital competencies with increasing student academic engagement and success [63], [64]. Therefore, universities should focus on supporting and ensuring students have an enriched experience using m-learning for their learning.

When students are more involved in learning, they will benefit more from their learning activities. Conversely, when students are less engaged in learning, they will find it challenging to engage in learning and gain a little advantage in learning activities. In learning using m-learning, whether students can participate in the learning process is the most critical factor to ensure learning effectiveness. Therefore, the essence of m-learning adoption is the continuous development of the student's cognitive level and to achieve practical and interactive learning. Students need to participate in learning actively [34].

This study's practical implications advise students to improve digital competencies to deepen their academic experience. Besides, universities need to provide training, direction, and support to students by regularly evaluating m-learning experiences and adoption rates for their involvement. Also, universities must recognize the need for technology integration in student learning and strive to integrate m-learning into the curriculum. In particular, integrated blended learning with learning needs proves to be a practical and interactive learning approach to improving learning outcomes, student achievement, student engagement, and academic satisfaction in higher education [65]–[68]. Theoretically, this research also provides additional insight into what factors influence student involvement. In addition to learning media, it also affects students' digital readiness. Therefore, this research contributes to adding theoretical studies in education, especially in selecting teaching media suitable for the current pandemic situation.

6 Conclusion

The impact of school and college closures in the COVID-19 pandemic situation is the switch of all learning from face-to-face to distance learning. Many problems still found in distance learning implementation are students' low involvement in the learning process. Therefore, the adoption of m-learning becomes one of the latest learning media alternatives and by student conditions, where portability and mobility take precedence in the present. In the implementation of m-learning, the critical factor influencing the learning process's success is students' readiness and involvement in using digital technology, namely m-learning. Thus, this study examines the influence of m-learning adoption on student engagement by mediating digital readiness variables. This study has four hypotheses, and all premises are consistently supporting in this study.

Most students fully feel that m-learning is more interactive and flexible in fulfilling their learning materials. Because interactive multimedia-based m-learning offers a lot of material interaction with students, learning performance and student satisfaction can also improve. This finding can be a reference for improvements from the same application or design of similar interactive learning applications in higher education and non-educational contexts. The implementation of m-learning requires a technology, materials, and learning environment that can attract attention, impressive appearance, and have an inspiring appeal. M-learning technology can improve student cognition and support student cognition during covid-19. This research proves that creating practical and interactive learning in the covid-19 pandemic can be done by utilizing technology such as m-learning.

The limitations of this finding are that the samples are still limited. However, the models come from all provinces in Indonesia. They are all enrolled in one Universitas Negeri Yogyakarta, one of the universities that implement digital-based learning and teaching. Besides, online polls are also a limitation in this study because polls' filling relies heavily on respondents' integrity and honesty. As a result, researchers cannot control the integrity of its contents.

Meanwhile, this study also has a limitation of only investigating three constructs: m-learning adoption, digital readiness, and students' involvement. Furthermore, it is vital to test additional antecedents in this study. For example, aspects of social interaction should be more considered. Because technology can increase social interaction, social interaction is ultimately more important to students than technology. In turn, social interaction affects students' ability to engage in learning [69-70]. The research model can also be expanded to antecedents to predict digital readiness, student engagement, and m-learning adoption. For example, they add ancestors to parental support, student background, and technology adoption experiences.

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