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STUDENTS' PERCEPTION OF LEARNING MANAGEMENT SYSTEM SUPPORTED SMARTPHONE: SATISFACTION ANALYSIS IN ONLINE PHYSICS LEARNING

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ABSTRACT

Learning Management System Supported Smartphone (LMS3) is a new and innovative application in online physics learning synchronously. The research aims to investigate the level of students' satisfaction in using LMS3 and determine predictor variables that affect the level of students' satisfaction. A descriptive study with survey method was implemented to 71 physics education students who attended online physics learning. The instrument in this research was a Students' Satisfaction of LMS3 Questionnaire (S2LMS3Q). The average percentage determined the level of student's satisfaction, and multiple correlations and multiple regressions determined the predictor variables. The level of satisfaction in using LMS3 reached a high level with an average of 76.03%. At the 0.01 significance level, the adjusted R^2 value of four predictor variables was 0.393. The multiple correlation analysis showed β for each predictor variable were 0.34 for gender, 0.07 for age, 0.43 for experience in using LMS, and 0.13 for internet connection. In conclusion, the level of students' satisfaction was high, and the most influential predictor variables were the experience in using LMS and age. This study suggests an in-depth evaluation of online learning through students' perceptions in order to improve the quality of further learning.

Keywords: Learning Management System (LMS); mobile learning; students' satisfaction

INTRODUCTION

The rapid technological development (Rizal et al., 2020b) significantly impacts on education, led to learning and teaching innovations that are more flexible in time and place and easier to access learning materials (Dobrota et al., 2012; Naidu, 2018). The technology integration in learning activities at various educational levels by presenting online learning activities has been conducted in many countries (Rizal et al., 2019) and has become increasingly popular in learning and teaching activities to replace traditional classes (Lin & Chen, 2017). Online learning with various tools has influenced learners well in developing their knowledge and skills (Jung & Lee, 2020; Patiar et al., 2020).

Technology in learning has several advantages for users. First, technology can improve the effectivity of learning by reducing cost and spared time to prepare learning instructions (De Witte & Rogge, 2014). Second, technology provides the flexibility of learning time and place (Toro & Joshi, 2012). Third, technology in learning facilitates students to improve their digital competence (Amhag et al., 2019), strengthens their confidence in online learning, and trains teachers in using ICT on their future classrooms (He, 2014). Fourth, ICT allows the greater flexibility and autonomy in the learning environment for students (Evens et al., 2017) and provides a positive impact on achievement where students who learn to

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use technology are significantly better than those who do not use technology (Tamim et al., 2011)

In recent years, seeing the positive benefits of technology in learning, many universities implemented online learning accessed by mobile devices (Gao et al., 2014; Rizal et al., 2020a). It was called mobile learning (Martin & Ertzberger, 2013), a type of new learning supported by mobile devices including smart communication technologies that which wherever can connect many users (Bernhaupt & Pirker, 2014). It became a new fast trend learning in the educational environment since mobile technology development has supported learning during mobile activities (Han & Shin, 2016). Mobile learning provides students enjoyable learning activities and personalized learning on their mobile devices. It gave the students the practicability and new meaning learning (Dreamson et al., 2018).

Mobile learning requires two types of supporting devices, which are hardware and software (Singh et al., 2017). The hardware consists of various internet-connected communication devices (Cabanban, 2013) including Personal Digital Assistants (PDAs), smartphones, notebooks and netbook computers, tablet devices and computers, digital cameras, portable media players, game consoles and portable game devices, audience response systems, Universal Serial Bus (USB), and storage devices. A smartphone is the most practical device and widely used by people (Anshari et al., 2017). Dependence on smartphones is quite clear, and smartphone usage among teenagers and students was overgrowing (Vanden Abeele, 2016). They used the smartphone for daily online activities (García-Ormaechea et al., 2014) and supporting their learning (Anshari et al., 2016).

The second device supporting mobile learning is software. Software components can be classified as Mobile Operation System (MOS) and Mobile Application (MA). MOS is a responsible software interface for managing and operating hardware units (mobile devices) and assisting the user to use those units (Hamed et al., 2017). The most well-known MOSs are Android, Windows Phone OS, iOS, and Symbian. MOSs are generally installed on a hardware device when purchasing a device. MA is a self-contained software designed for a mobile device and performing specific tasks for mobile users (Amalfitano et al., 2013). MAs are developed with an integrated development environment and are deployed to application stores, such as Google Play, App Store (Tracy, 2012).

A widely used mobile application in online mobile learning activities is the Learning Management System (LMS) (Kocaleva et al., 2015). LMS is defined as a Web-based application to assist administration, combines rich multimedia resources and various educational activities, and has functioned as an online platform for group discussions, uploading content material, and assessing assignments (Gutman, 2017). In the beginning, LMS was widely used for facilitating distance learning activities in locations which are far from the learning environment. LMS can help the student in remote regions with no opportunity to attend class involved learning (Nurakun Kyzy et al., 2018). However, at present, the use of LMS has significantly expanded to various universities (Gu et al., 2013; Schoonenboom, 2014; Zacharis, 2015).

Many studies revealed the number of positive impacts of using LMS in learning. Marineo & Shi (2019) said that the literacy module integrated into the LMS had a positive impact on the students' academic achievement. Students who are involved in LMS activities have better performance and academic achievement than students who are not involved in LMS (Mijatovic et al., 2013). Çavus (2011) described that integration of LMS into mobile learning had benefits and advocated LMS as a trend of mobile learning in the future. LMS-implemented online learning offers many superiorities such as increased opportunity and access, optimized teaching, improved students' achievement, and improved satisfaction and a better sense of engagement (Moskal et al., 2013).

To support the practicality of the LMS, which has several advantages in online learning activities, it requires a familiar mobile device used by all age categories of people. A smartphone is a device that has been widely used by the community and has good practicality. Indonesian smartphone users were estimated to be more than 100 million people. With this amount, Indonesia will become the country with the fourth-largest smartphone user in the world after China, India and America (Rahmayani, 2015). The Ownership of smartphones among Koreans in 2015 increased by 82.6% (Agency Korea Internet & Security, 2015). In Switzerland, 97% of adolescents aged 12-19 years own a smartphone (Haug et al., 2015). The smartphone ownership rates in the US increased from 35% in 2011 to 64% in 2015, and 85% of people aged 18–29 own a smartphone.

In addition to widespread use, the use of smartphones in accessing LMS will provide

many advantages. It can support independent and collaborative learning experiences, help students in removing the rigidity of learning experiences and involve lazy learners (Rapp & Duncan, 2012). The other advantages are to help students to focus for a longer learning time, increase self-esteem, remove barriers to ICT use, and bridge the gap between mobile phone literacy and ICT literacy. It can be flexible and efficient to provide flexibility to students who are visual or have hearing impairments (Rapp & Duncan, 2012).

Based on the potency and weaknesses of smartphones and LMS in learning activities, the authors developed their own LMS that be supported smartphone and can be applied in physics learning activities. This LMS is named Learning Management System Supported Smartphone (LMS3). The LMS3 was developed as a web-based learning application with an e-learning platform that can be accessed at http://lms3.saena.web.id/. Furthermore, the original mobile application for Android can be downloaded at http://lms3.saena.web.id/LMS3.apk. LMS3 has been judged by many experts and had validation value that meets Aiken minimum criteria (Aiken, 1985).

LMS3 has also been tested on a limited scale of online physics learning using a smartphone and has gotten feedback for system improvement. Students' satisfaction becomes crucial and has a vital role in evaluating the usefulness of LMS3 in online physics learning using a smartphone. Students' satisfaction is a general evaluation of the students' experience of the application system and likely to influence students (Almarashdeh, 2016). The application system's success can generally be indicated by a students' experience satisfaction (Limayem & Cheung, 2011).

Maslow (1943) stated that satisfaction is essential for everyone. Students' satisfaction in meeting various needs in learning activities will have positive psychological impacts. When students are satisfied with online physics learning using LMS3 accessed on a smartphone, students will feel happy following the learning, get the meaning of learning, and increase their learning motivation. Psychologically, students are stimulated to continue attending lectures until the end by using a smartphone to achieve all learning objectives. The positive students' satisfaction with the use of smartphones in online physics learning will support students to get the maximum academic achievement and optimize the use of smartphones to support their learning (Chiang et al., 2017). Also, high student satisfaction will make students ready for more challenges in lectures using smartphones. Besides the learning objectives that have been set, students are ready to get more complex tasks to be able to practice some additional skills during the learning process (Winberg & Hedman, 2008).

The opposite condition will happen if students are not satisfied with the use of smartphones in accessing LMS3. Students will be confused about what they have to do and decrease their learning motivation. It impacts on students' ignorance following learning, and they are following lessons without focus and eliminating the meaning of learning. Students tend to face failure in achieving learning goals and get poor learning outcomes (Mafuna & Wadesango, 2016). The destructive impacts of students' dissatisfaction are also low students' attitude, motivation, and performance and hinder learning activities (Bradford, 2011; Rodriguez et al., 2017). Alpay et al. (2008) in their research found that students' discomfort in taking lessons caused dissatisfaction and caused students to stop taking lessons in courses in the engineering department.

Several factors influence the student's satisfaction in their learning. Rubin et al. (2013) mentioned social, cognitive, and teaching presence as being essential to the students' satisfaction. Presence of teaching contributed as the most critical role for students to evaluate online learning. The interaction between users has a vital role in online learning modalities. Demographic and culture of students also influence the appropriate interaction techniques in online learning. Ke & Kwak (2013) identified several elements of students' satisfaction: authentic learning, active learning, learner autonomy, learner relevance and technology competence. Students' satisfaction is also able to determine by the learner-instructor interaction and learner-content interaction combined with technology efficacy. Kuo et al. (2013) added students' satisfaction with online mobile learning is affected by human and technological factors such as the interaction between users, user's attitude, implemented educational technologies, and course design. He also found that the primary determinant of user satisfaction, including computer self-efficacy, system functionality, features of content, learning climate, and performance expectation. Female students' satisfaction significantly affected by instructor characteristics and facilitating learning conditions (Dang & Zhang, 2016).

Based on the problems that have been discussed and also the importance of student's satisfaction of LMS3-Integrated Online Physics Learning (LMS3IOPL), the research was carried

out, which led to two main objectives. The first is to determine the level of students' satisfaction in conducting online physics learning synchronously using LMS3 accessed by smartphone, and the second is to determine the most influential predictor variables of students' satisfaction among the four variables, which are gender, age, and previous experience in using LMS, and internet connection.

METHODS

This study is descriptive using a survey method. The survey aims to gather information by systematically asking questions to respondents so that they can produce statistics that accurately represent the population of interest (Groves et al., 2011). This research was conducted by distributing online satisfaction questionnaires to respondents via Google form, which can be filled in a specific time wherever the students were. The students were directed to fill out the form honestly according to their perception without including names. Students were explained that their perceptions did not affect the assessment of academic achievement. Respondents can complete surveys by their smartphone or computer. Online surveys have several advantages, including low cost and practicality in contrast to traditional surveys which require paper and pencil based survey (Guterbock & Marcopulos, 2019)

Participants involved in this research were 71 students who followed LMS3IOPL in the even semester 2019/2020 academic year. They are students of physics education, Faculty of Teacher Training and Education, Universitas Siliwangi, Tasikmalaya. They consisted of 20 students of the third year, 25 students of the second year, and 26 students of the first year.

The used instrument in this research was a satisfaction questionnaire that called Students' Satisfaction of LMS3 Questionnaire (S2LMS3Q). S2LMS3Q was used to collect data from students' perceptions of LMS3IOPL. S2LMS3Q consists of two parts. The first part contained questions of gender, age, experience in using LMS, and internet connection. The second part contained the ten closed questions about participant's experience in LMS3IOPL such as 1) Application user-friendliness, 2) Communication interactivity, 3) Work collaboration, 4) Virtual lab access, 5) Teaching material availability, 6) Evaluation system, 7) Assessment variety, 8) Assignment submission, 9) Feedback quality, 10) Synchronous learning. S2LMS3 was adapted from the Likert-scaled students' satisfaction questionnaire that was developed by (Horvat et al., 2013) with the high reliability (0.834) (Cronbach, 1951; Vaske et al., 2017).

The collected data were processed and analyzed statistically. The average percentage of students' perception was used to determine the level of students' satisfaction based on ten quality characters in LMS3IOPL. The average percentage was determined by Equation 1 (Haviz et al., 2020).

$$P = \frac{C}{M} x100\%$$

P is the percentage average, C is collected score by students' perception, and M is the maximum score of students' perceptions. The category of students' perception can be confirmed in Table 1 (Riduwan, 2006).

Table 1. The Category of Students' Satisfaction

Percentage average	Criteria
85 – 100	Very high
70 – 84	High
55 – 69	Moderate
40 – 54	Low
0 – 39	Very low

The predictor variables, which impacted students' satisfaction, was determined by multiple correlation and multiple regression. The multiple correlations were used to determine the correlation between predictor variables and students' satisfaction. The multiple regression was conducted to determine the best linear combination of gender, age, experience in using LMS, and internet connection.

RESULTS AND DISCUSSION

Demographics of Participant

Participants were grouped on four demographics, according to gender, age, experience in using LMS, and internet connection. The demographics of the participants are shown in Table 2.

Table 2. Demographics of Participants

NO	Variable	f	%
1	Gender		
	Male	21	30%
	Female	50	70%
2	Age		
	< 20 years	29	41%
	> 20 years	42	59%

3	Experience in using LMS		
	Less than two years	53	75%
	More than two years	18	25%
4	Internet connection		
	Strong	23	32%
	Moderate	33	46%
	Weak	15	21%

Female students dominated participants in this research, with 70% of total participants. The participants also were categorized by age. The ages of the participants were relatively and proportionally distributed between participants who were under twenty years and over twenty years. Most of the students lack experience in using LMS. 75% of them were new LMS users. This percentage was mostly contributed by students in the first and the second year. The first year-students generally never used an LMS while they were studying in senior high school. Internet connections in where students live are quite diverse. In general, the internet connection they frequently access was in the medium and strong category. The students who have weak internet connections live in rural areas. They usually used campus' Wi-Fi or looked for areas that have good internet connections.

The Level of Students' Satisfaction with LMS3IOPL

The first objective of this study is to analyze the level of students' satisfaction with LMS3IOPL accessed on a smartphone. Students' satisfaction data were collected using an S2LMS3Q consisted of 10 quality characters from LMS3. The recap of the perception of 71 physics education students is shown in Table 3.

Table 3. Recap of Students' Satisfaction in Attending LMS3IOPL

No	Quality Character of LMS3	Frequency of score					Percentage	Category
		SD (1)	D (2)	N (3)	A (4)	SA (5)		
1	Application user-friendliness	6	5	5	46	9	73,24	High
2	Communication interactivity	3	4	19	21	24	76,62	High
3	Work collaboration	6	3	17	35	10	71,27	High
4	Virtual lab access	6	2	10	36	17	75,77	High
5	Teaching material availability	3	6	11	45	6	72,68	High
6	Evaluation system	2	3	12	38	16	77,75	High
7	Assessment variety	4	3	5	37	22	79,72	High
8	Assignment Submission	5	1	2	42	21	80,56	High
9	Feedback quality	1	12	18	27	13	70,98	High
10	Synchronous learning	2	1	3	48	17	81,69	High
		Mean					76.03	High

Students' satisfaction with LMS3IOPL showed a positive perception. Table 3 shows that all percentages for each item of character quality are in the range of 70-84. The mean of students' satisfaction percentage was 76.03 in high-level satisfaction.

The high level of student satisfaction with LMS3IOPL accessed by smartphone will have positive impacts on the implementation of physics learning activities. Synchronous learning activities guided through LMS3IOPL will provide opportunities for students and teachers to communicate and interact effectively so that good psychological relationship could be formed between students and teacher. This condition can encourage students' interest in science (Raved & Assaraf, 2011). This interest will generate good learning motivation for students and is very supportive of quality and meaningful science learning activities and will ultimately have a positive impact on their academic achievement (Hampden-Thompson & Bennett, 2013).

Several previous studies showed a similar result. Swartz et al. (2010) got high satisfaction responses from their students after applying online learning with a smartphone. Synchronous online learning through smartphone provides student chance to interesting peer collaboration (Watts, 2019). Students can communicate freely in synchronous and asynchronous media to build

an excellent online community (Cho, 2012; Safaruddin et al., 2020). Students can individually manage their interaction and communication, information, time, and group work (Wozniak et al., 2012)

Other studies have also received positive responses from students after implementing online learning through smartphone and have succeeded in determining predictor variables associated with students' satisfaction (Arbaugh et al., 2009). Online learning which provides supported video stimulated students' interest in the subject (Alexander, 2013). Students able to intensively interact with various contents of online media; this includes reading interactive texts, interactive computer-based multimedia, access study guides, and completing assignments (Nandi et al., 2015).

The results of a study conducted by Cole et al. (2014) in detail explained 472 students (85%) were satisfied with full online lectures through a smartphone, and the remaining 41 students (15%) expressed dissatisfaction with online lectures. The dissatisfied experience of students can be influenced by the convenience of using a traditional face to face learning (Callaway, 2012). The students admitted that their dissatisfaction was due to lack of interaction with their peers and instructors, even though this interaction was significant in influencing the level of students' satisfaction (Kuo et al., 2014). They faced the difficulties in discussion and harmed the understanding of teaching materials.

The positive response of students to LMS3IOPL through smartphone is the success of online learning in showing the advantages compared to conventional teaching. The positive response of student satisfaction reflects how the students view their learning experience. It is considered as one of the five elements for the evaluation of the quality of online learning identified by the Online Learning Consortium (Alqurashi, 2019).

LMS3IOPL accessed by smartphone has flexibility in space and time, easy access to material, free interaction between students and lecturers, and sharper sense of community between participants. Besides, the online learning also provided a learning experience that closes with real life through solving daily problems that are connected to the concepts of material, training several abilities in using digital technology, increasing focus on lectures, increasing communication and collaboration skills, and increasing capacity to offer a more fantastic range of resources and acquisition of efficiency (Cabero Almenara et al., 2010).

The highest percentage of character quality is the synchronous learning process which is the most prominent thing in LMS3. The synchronous learning processes implemented in LMS3IOPL follow Problem Based Learning (PBL) syntax which includes five stages of activities namely problem finding, group discussion, independent study, problem-solving, presentation of results (Agustina et al., 2017). This synchronous learning activity makes online learning that can present virtual teaching by presenting the instructor's function. It seems that teaching activities carried out by the teacher to play a very vital role in the perception of students towards online learning (Mahmood et al., 2012). This can reduce students' awkwardness for the new online learning environment because the instructor did not facilitate them. It means that the process of adaptation of the new online learning environment could be more straightforward.

Prediction of Students' Satisfaction Factors in LMS3IOPL from Combination of Four Variables

To determine the most influential predictor variables in students' satisfaction of LMS3IOPL will be carried out in two steps. The first step is to determine the mean, standard deviation, and inter-correlation between the four predictor variables (gender, age, experience in using LMS, and internet connection). The result of data processing in the first step is shown in Table 4.

Table 4. Mean, Standard Deviation, and Inter correlation between Students' Satisfaction and Four Predictor Variables

Variable	M	SD	Gender	Age	Experience in using LMS	Internet connection
Satisfaction of LMS3IOPL	76.03	9,72	0.34**	0.31**	0.37**	0.35**
Gender	1.70	0.32	1	0.15**	0.19**	0,11**
Age	1.59	0.24		1	0.07**	0.12**
Experience in using LMS	1.25	0.19			1	0.05**
Internet connection	2.11	0.26				1

Note: **correlation is significant at the 0.01 level (2-tailed)

Table 4 shows the highest correlation between the predictor variables was 0.19. It means the correlation between predictor variables was very weak, and under the suggestion of Tabachnick (2007) that the correlation coefficient between independent variables must be lower than 0.9.

The combination of the four predictor variables provides a significant contribution in predicting students' satisfaction levels accurately. The adjusted R^2 of predictor variables was 0.393, which means that all predictor variables affect 39.3% of the variance of students' satisfaction with LMS3IOPL. The adjusted R^2 value shows how well a model of the data (Al-Sheeb et al., 2018). This result showed that the combination of the four predictor variables contributed to determining students' satisfaction. Cohen (1992) has explained that the impact of a variable can be categorized into three categories; small, medium, and large which each adjusted R^2 values for each category respectively; 0.0196, 0.1304, and 0.2592. Therefore, adjusted R^2 is higher than the large value. The four predictor variables in this study have a significant or large effect on students' satisfaction.

The second step is that multiple regression analysis was carried out to analyze the most influential predictor variables. The influence of predictor variables on the level of students' satisfaction can be seen from the β value. The greater the β value, the greater the effect of predictor variables on students' satisfaction. The result of multiple regression could be seen in Table 5.

Table 5. Multiple Regression Analysis between Four Predictor Variables and Student' Satisfaction

Variable	B	Standard error	β
Gender	3.52	0.45	0.34**
Age	-4.61	1,67	0.07**
Experience in using LMS	2.53	1.12	0.43**
Internet connection	3.21	0.14	0.13**
Constant	35.31	6.01	

Note: **correlation is significant at the 0.01 level (2-tailed)

β value in Table 5 indicated that the two variables "experience in using LMS" and "gender" were the most significant predictors of the dependent variable "students' satisfaction in LMS3IOPL". The students who have experienced LMS3 more than two years were more satisfied in LMS3IOPL and the males have contributed to the prediction.

In-depth analysis related to experience shows students who have used LMS3 longer tend to have high levels of satisfaction. This can be influenced by the new atmosphere that was presented in using LMS3. Besides, students with long experience in operating an application already possess the raw ability of technology to use new technology (Correia et al., 2020). Students who have experience in using digital technology in online learning show significant differences in technological skills (Oliver & Corn, 2008). Students with previous online learning experience tended to have more effective learning strategies when taking online courses so they can conduct effectively new online learning (Wang et al., 2013). The effect of the experience of using LMS in online learning to the level of student satisfaction has also been investigated by Kehrwald et al. (2011) which showed contrasting results where students who had recently used LMS in online learning tended to have higher levels of satisfaction. While the students who were not familiar to use media or tools in online learning will experience problems and feel exorbitant stress. They need more time to adjust to learning innovations using online technology (Harrison et al., 2018).

The second variable considered influential on the level of students' satisfaction is gender. The results obtained in the study are consequent with research that has been done by many researchers (Yamashita et al., 2015). Venkatesh et al. (2012) found that females had a better attitude in using online learning technology than male students. While Ates Çobanoğlu (2018) claimed men were more positive than women. The male students were demonstrating higher computer self-efficacy than female students (He & Freeman, 2010). The results of this study contradict the Rowel (2015) study, which showed that gender was no significant effect on student satisfaction. From some contradictions in the number of studies, further research is still needed to support it.

Two other predictor variables considered in this study are age and internet connection. The study found that age did not have a significant impact on students' satisfaction. It was a contrast to Kuo et al. (2013) study which stated that age has a significant effect on learning satisfaction. The older participants tend to be more satisfied with mobile online learning. In this study, age did not have a significant impact because the age has been grouped into two categories, and there were no significant differences in students' age.

The internet connection does not have an impact on students' satisfaction as much as age. In this study, the internet connection is only a factor that supports fluency in implementing online learning. Wu (2016) stated that the technical problem related to internet connection became a significant obstacle when students conducted online learning. Initially, the authors had a contradictive prediction that internet connection would contribute to the level of students' satisfaction, as stated in Norzaidi et al. (2008). He found that the students' satisfaction in online learning was influenced by the students' degree of comfort with using the Internet (Morris, 2010). When the internet connection was stable, learning activity will be held effectively (Wei & Chou, 2020).

CONCLUSION

The majority of the preservice physics teachers are satisfied with LMS3IOPL accessed on a smartphone. The average level of satisfaction reaches a high level. Statistically, there were two the most influential predictors, namely the experience in using LMS and gender. Students who have more experience in using LMS tend to show higher levels of satisfaction. In gender, men show a higher level of satisfaction compared to women.

The results of this study delivered recommendations for implementing online learning effectively by involving synchronous learning through a smartphone to provide an interactive communication environment with students. It is necessary to make an introduction first to students who are new in using this technology. Further in-depth research on students' experience needs to be conducted to find out various issues that become obstacles in online learning and become recommendations for improving online learning in the future.

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