electronics

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Factors Influencing Students' Continuous Intentions for Using Micro-Lectures in the Post-COVID-19 Period: A Modification of the UTAUT-2 Approach

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Abstract: Micro-lectures, i.e., short learning videos on a specific aspect of a topic, have become one of the most effective technology-based learning media approaches and were widely used during the COVID-19 pandemic. However, in the post-pandemic era starting from early 2022, as K-12 students have been allowed to resume going to school, it is necessary to evaluate students' intentions to continuously use micro-lectures for learning mathematics. Therefore, this study aims to explore attitudes and continuous intentions of students towards the utilization of micro-lectures. To investigate students' intentions of using micro-lectures, we utilized the unified theory of acceptance and use of technology (UTAUT-2). Data were collected from 321 junior high school students (14–17 years old) in Bandung, Indonesia, who used online classes and micro-lectures to learn mathematics during the pandemic. A structural equation model was also used to analyze the independent (performance expectancy, effort expectancy, social influence, facilitating condition, hedonic motivation, and habit) and dependent (attitude and continuous intention) variables. Furthermore, online questionnaires were used to obtain data on students' attitudes and continuous intention to utilize micro-lectures in the post-COVID-19 era. The results suggested that effort expectancy (EE) and hedonic motivation (HM) had a significant effect on attitudes, whose correlation with habit also influenced the continuous intention during this post-pandemic period. Despite these results, the habit variable was found to be the factor most influencing continuous intention. These results provide information to teachers, schools, and the government to continuously increase the use of micro-lectures based on improving student learning performances in the post-pandemic era.

Keywords: post-pandemic; learning media; behavior intention; mathematics education

Citation: Wijaya, T.T.; Tang, J.; Cao, Y.; Weinhandl, R.; Lavicza, Z. Factors Influencing Students' Continuous Intentions for Using Micro-Lectures in the Post-COVID-19 Period: A Modification of the UTAUT-2 Approach. *Electronics* **2022**, *11*, 1924. https://doi.org/10.3390/electronics11131924

Academic Editors: Boni García, Carlos Alario-Hoyos, Mar Pérez-Sanagustín, Miguel Morales and Oscar Jerez

Received: 8 May 2022
Accepted: 26 May 2022
Published: 21 June 2022

1. Introduction

The COVID-19 pandemic has reportedly caused significant changes in many sectors, including education [1], as people are advised to develop and rely on technologies towards carrying out activities while avoiding direct contact [2]. This has led to the rapidly increasing demand for the use of appropriate technologies [3]. Due to the increasing number of positive Indonesian COVID-19 patients in March 2020 [4,5], the government declared a lockdown where students were temporarily unable to attend school towards carrying out face-to-face teaching and learning activities, leading to the commencement of online education [6,7]. To ensure the effectiveness of these online activities, various learning approaches were applied to all educational levels [8–10]. Many Indonesian institutions utilized video conferencing tools such as Zoom and Google Meet as learning media [11,12], due to their having a similar traditional style to schools where the teacher explains and the students listen. Based on these conditions, the pandemic situation is a challenge for institutions and teachers in this country, where circumstances forced the transformation of teaching and learning in classrooms to online learning. During the lockdown period, micro-lectures were

observed as one of the most widely used learning media to help students understand mathematical materials [13,14]. In 2020, the pandemic condition became an opportunity for this medium to develop and support online learning [10,15,16]. Additionally, the initial aim of the learning medium was to focus on important understandable points towards improving students' comprehensive ability when learning new concepts and knowledge [17].

Despite these advantages of online learning, some previous studies have argued that the pandemic shifted from a face-to-face teaching method to online learning to deliver new knowledge to students [18,19]. According to Kramarski [20], the use of the formative assessment concept was very important to continue teaching and learning activities through online educational media. In online education, the model for delivering materials is divided into two categories, namely synchronous and asynchronous [21]. The combination of several digital platforms based on increasing communication and interaction in teaching and learning activities is observed in the synchronous approach [22], while the asynchronous method uses technology-based media to enrich educational processes, as well as help students, by repeating the subject matter taught when taking virtual lessons [23]. This confirms that one of the asynchronous-based learning media is the utilization of micro-lectures. Before the pandemic, the development of this learning medium was not widely used as a supplement to improve students' understanding of new theories [24,25]. However, teachers were increasingly using micro-lectures in learning activities after the emergence of COVID-19, although video conferencing and other media had weaknesses within the country, such as a lack of virtual facilities or expensive internet prices [26–28]. This proves that micro-lectures are likely to essentially increase the usefulness of their effects and uses due to the pandemic situation, which forced the transformation of the learning approaches [29].

Previous studies are observed to be very limited in the analysis of students' intention towards micro-lectures. There is only one study from K. Wang et al. [25] based on the use of micro-lectures learning media before the pandemic (2016–2017), through the technology acceptance model (TAM). However, the other reports focused more on experimental pretest–posttest analyses to evaluate the effect of micro-lectures on student outcomes [30–32]. This shows that no experiment has been carried out on the factors influencing students to continuously utilize micro-lectures after the COVID-19-related school shutdowns. By June 2022, Indonesia is expected to return to the "new normal" era, where all business and trade sectors are to be carried out as previously performed [2,33]. In the education sector, students are also expected to start attending school for face-to-face learning for the new academic year (2021–2022). Therefore, this study aims to determine the continuous intention of students towards using micro-lectures as a supplement for mathematics learning in the post-pandemic period. This is expected to provide several contributions towards appropriately understanding the factors influencing students' continuous intention to use micro-lectures when returning to the traditional direct learning method. The results are also expected to help in appropriately understanding the use and benefits of the learning media, especially in mathematics, to improve academic performance in the post-pandemic period. In addition, it contributes to the provision of significant suggestions to micro-lecture developers, school principals, and policymakers, to relevantly consider the factors influencing students' continuous intention during this period.

2. Literature Review

2.1. Micro-Lectures in Mathematics Education

Micro-lectures have been widely used and proven to improve students' mathematical abilities, as studies have continuously promoted in the educational sector since the early 2000s [24,34], and were also increasingly used during the COVID-19 pandemic [29]. This explains that the learning media aims to actively promote students to learn according to their needs, through the combination with online education [25]. Before and during the pandemic, micro-lectures were often used to review lessons [24,35], defined as a short, less than 10 min, video focusing on new knowledge and concepts [36]. When students

do not understand the teacher's in-class explanation, this learning media helped them in reviewing important points [31,34]. Many platforms were also used before and during the COVID-19 pandemic as the sources of micro-lectures, such as Moodle [37,38], YouTube [39, 40], and others. Due to the convenience of this media, teachers created their educational sources according to the learning circumstances and needs. In this decade, micro-lectures are often used in schools to support the flipped learning approach and review lessons capable of meeting the needs of students as individualized education (Zhang and Xu, 2015). Meanwhile, there is no empirical study analyzing students' continuous intention towards the utilization of micro-lectures after a post-pandemic period.

In such learning environments, a significant change was observed before and after the pandemic. This explained that some studies emphasized specific influential factors and analyzed the effectiveness of these learning tools before and during the pandemic, respectively [29,41,42]. Before this condition, many reports focused on increasing the use of micro-lectures as learning media for students [24,25,43]. Meanwhile, the online learning approach became more advanced, with the educational tools being increasingly used as complementary media after the 2-year existence of the pandemic [8,44]. This indicates the need for subsequent studies on the factors influencing the continuous intention to use micro-lectures during a post-pandemic period when more strong evidence is observed on the effect of the learning media on students' abilities.

2.2. Unified Theory of Acceptance and Use of Technology (UTAUT)

Based on many technological models, UTAUT has been widely used as a comprehensive tool for measuring the acceptance and use of online learning media [45–47]. Venkatesh et al. (2012) believe that the original UTAUT model can still be developed to predict better user behavior intention and usage behavior towards new technologies. This led to the development of the UTAUT-2 by Venkatesh et al. [48] from the previous 2003 UTAUT model. The UTAUT model is also a combination of the theories of reasoned action and planned behavior (TRA and TPB), as well as the technology acceptance model (TAM) [2,49].

Based on Figure 1, the UTAUT2 model was formed from 7 elements, namely performance and effort expectancies, social influence, facilitating conditions, hedonic motivation, price value, and habit [50]. Compared to the initial version, the proposed UTAUT-2 extension produces a substantial increase to explain the variance (R^2) in intention behavior from 56% to 74% and usage behaviors from 40% to 52%, respectively [51]. Moreover, the model is used to explain students' behavioral intentions and teachers' attitudes towards online learning media [38,51,52]. Despite these conditions, some studies criticized that UTAUT-2 was still rarely used in various countries and contexts [51]. This led to the selection of the proposed model, which is expected to increase the variance explained in the factors influencing students' continuous intention to use micro-lectures after the pandemic. Figure 2 shows a proposed model illustrating the initial hypothesis to explain the assumed influential factors of the learning media's continuous intention. This proposed model was derived from UTAUT-2 (Venkatesh et al. [48]) and modified through the addition of attitude, as a variable affecting students' continuous intention based on previous reports. The hypotheses of this study are as follows.

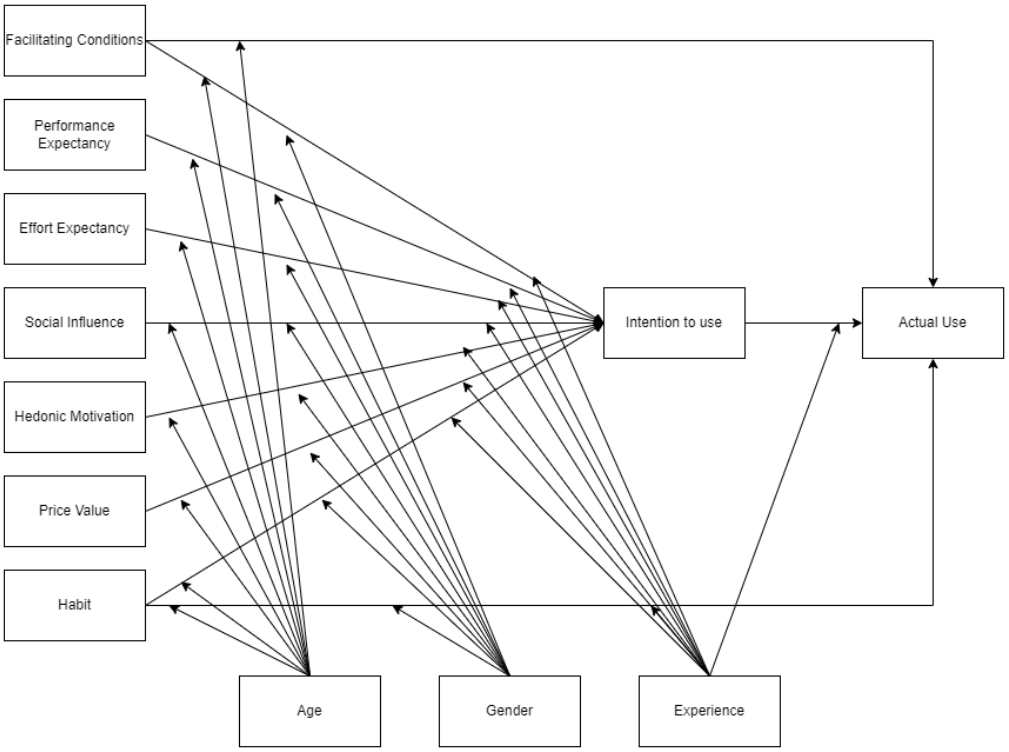

Figure 1. The original UTAUT-2 model with moderator variable.

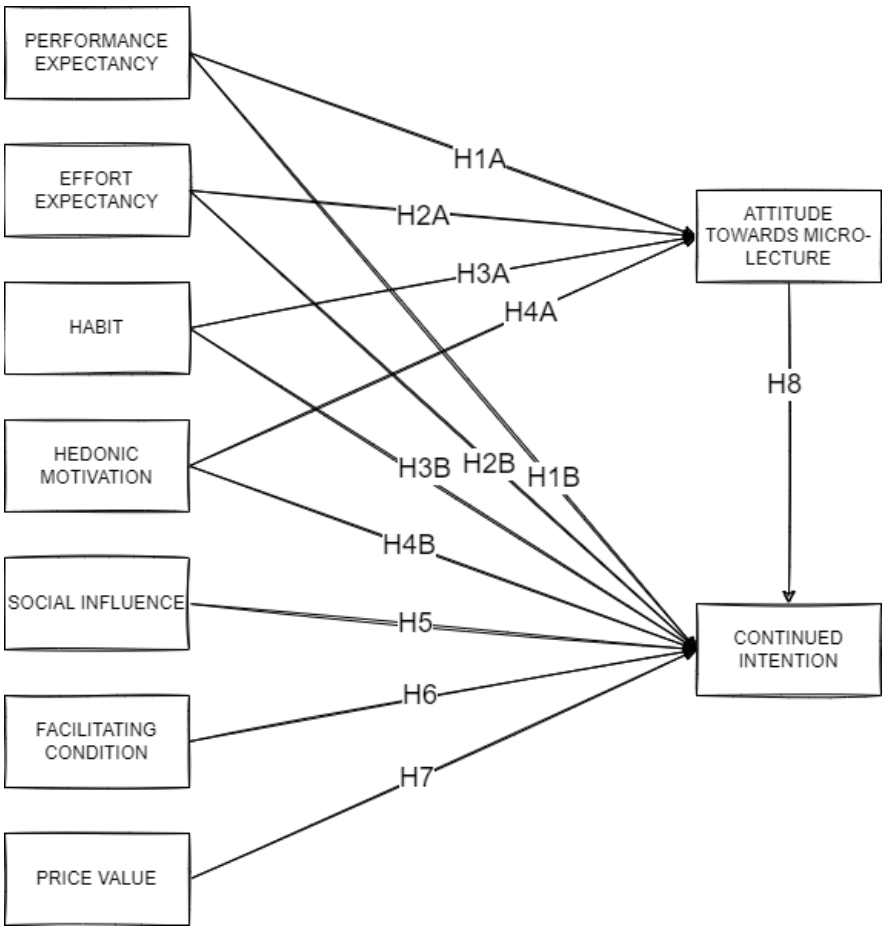

Figure 2. The proposed model and hypothesis.

2.2.1. Performance Expectancy (PE)

Performance expectancy is the level to which a person believes that technology improves efficiency and effectiveness [48,53,54]. It is also the degree to which students believe that using micro-lectures enhances their mathematical abilities and scores in the post-pandemic period. This shows that students need to have a positive attitude and believe that the learning media has mathematical improvement capabilities. In this condition, intentions are mostly predicted based on the confidence level of people in the assistance system or tool used in their daily lives. This shows that performance expectancy is significant when students believe that micro-lectures have the capability to improve their mathematical abilities and learning outcomes in the post-pandemic period. For example, students believed that these tools often helped in understanding mathematical materials when used at the end of the pandemic. In this case, their continuous intention to keep using the micro-lectures after the COVID-19 condition is very possible. Thus, in the present study the following is hypothesized:

Hypothesis 1 (H1). *There is a significant positive effect of PE on students' attitudes towards micro-lectures in the post-pandemic period.*

Hypothesis 2 (H2). *There is a significant positive effect of PE on the continuous intention to use micro-lectures in the post-pandemic period.*

2.2.2. Effort Expectancy (EE)

Effort expectancy is the degree to which a person does not have a problem with the use of the technology (costly and slow) [53]. This often occurs when a person has previous experience with the utilized technologies [55]. Furthermore, UTAUT has been widely used to analyze the influential level of EE on a person, as well as students and teachers, towards the acceptance of online learning media in the educational sector [56,57]. Effort expectancy is also confirmed to have a strong influence on the intention to use technology-based media, as some previous reports explained that it was an essential factor affecting the utilization of online learning in the educational sector [58–60]. In this present study, EE was effortlessly used to explore students' continuous intention to use micro-lectures in the post-pandemic period. Based on the mathematics teachers, previous reports stated that EE affected the use of the learning media in China [35]. Despite these results, it was still not significant for technology-based learning media according to a few reviews [59], [61]. Thus, in the present study the following is hypothesized:

Hypothesis 3 (H3). *There is a significant positive effect of EE on students' attitudes towards micro-lectures in the post-COVID-19 period.*

Hypothesis 4 (H4). *Effort expectancy has a significant effect on students' continuous intention to use micro-lecture in the post-pandemic period.*

2.2.3. Habit (HB)

Habit is one of the interesting determinants introduced by Venkatesh in the development of UTAUT-2 [48]. In some previous reports, habit was observed as a determinant with a greatly significant effect on a person towards the utilization of online learning media [51,62]. Meanwhile, it was the main factor influencing the use of new technologies according to other reviews [51,52]. This confirms that the intention of people towards the use of habit increases when they utilize new technologies [51]. These observations are reinforced by the study of de Guinea and Markus [63], where intention behavior is transformed into a habit. This explained that when the use of technologies became a person's habit, the utilization intention was no longer needed. These results were due to the definition of habit as a mechanism for the repetition of unrealized behaviors, indicating its ineffectiveness on a person's attitude. Thus, in the present study the following is hypothesized:

Hypothesis 5 (H5). *Habit does not have a significant effect on students' attitude to use micro-lectures in the post-pandemic period.*

Hypothesis 6 (H6). *Habit has a significant effect on students' continuous intention to use micro-lectures in the post-pandemic period.*

2.2.4. Hedonic Motivation (HM)

The pleasure obtained when using a new technology affects the intention to utilize digital media [40,64]. This is because some previous studies confirmed that hedonic motivation (HM) predicted behavioral intention (BI) towards using online learning media [40,65,66]. It is also observed to have influential abilities on teachers and students regarding the utilization of mobile learning technology [62,67]. Furthermore, various reports have reportedly used HM with ATT (attitude toward technology) in UTAUT-2, with a positive effect being observed on attitude towards the use of interactive social media [68]. Another result also indicated that the enjoyment felt by students significantly influenced the use of online media [69], leading to the hypothesis that HM affects the continuous intention to use micro-lectures in a post-pandemic period. The pleasure obtained from using this media to learn mathematics also positively affects students' continuous intention to use micro-lectures even when the pandemic is over. Thus, in the present study the following is hypothesized:

Hypothesis 7 (H7). *Hedonic motivation affects students' attitudes towards micro-lectures in the post-pandemic period.*

Hypothesis 8 (H8). *Hedonic motivation influences students' continuous intention to use micro-lectures in the post-pandemic period.*

2.2.5. Social Influence (SI)

Social influence is the degree to which a person believes that the environment leads to the use of technologies in their daily activities [53]. This has a big impact, especially at the beginning of technological utilization [70]. It also affects the intention to use new technologies when an individual obtains societal support for utilization [38,71,72]. Moreover, social influence affects the utilization of online learning media even when unwanted [71,73]. Using UTAUT-2, Venkatesh (2012) found that it was the biggest factor influencing an individual towards the use of technological equipment under mandatory conditions. These effects nevertheless become insignificant when observed under voluntary conditions. Based on various reports, SI was found to have a positive and significant effect on a person's and students' intentions to ordinarily and educationally use technology-based media, respectively [53,74,75]. This was in line with other previous studies, where SI affected students towards using video-based learning media [35]. Thus, in the present study the following is hypothesized:

Hypothesis 9 (H9). *Social Influence has a significant effect on students' continuous intention to use micro-lectures in the post-pandemic period.*

2.2.6. Facilitating Conditions (FC)

The intention to use new technology is influenced by resources and institution support, which are often observed as facilitating conditions [38,69,76]. This indicates that a supportive team and knowledge are very important in innovative technological utilization [37]. According to some previous reports, FC had a significant impact on BI [35], with a direct influence observed on the intention of an individual to use online media [69]. However, others found that FC did not have a significant impact on BI and UB [46,77]. This is then analyzed as a factor influencing the continuous intention of junior high school students

in using micro-lectures during the post-pandemic period. Thus, in the present study the following is hypothesized:

Hypothesis 10 (H10). *Facilitating conditions have a significant effect on students' continuous intention to use micro-lectures in the post-COVID-19 period.*

2.2.7. Price Value (PV)

Price value is widely used to predict teacher intentions to use online learning media [62], with a study confirming a positive relationship between PV and mobile internet utilization [52]. These conditions revealed that the micro-lectures used by students required an internet quota to download and replay learning activities, with price value determining its significance level on students' continuous intention to use micro-lectures after the pandemic. In addition, sensible and low-cost mobile internet access influences the intention to use the learning media during this period [69]. Thus, in the present study the following is hypothesized:

Hypothesis 11 (H11). *Price value has a significant effect on students' continuous intention to use micro-lectures in the post-pandemic period.*

2.2.8. Attitudes towards Micro-Lectures (ATT)

According to a previous review, the attitude towards behavior measured a person's interest and use of new technologies [78]. This confirmed that the factor defined students' feelings when using micro-lectures to help them learn mathematics during the post-pandemic period. Meanwhile, other reports proved that attitude was influenced by several factors, namely performance and effort expectancies, social influence, facilitating conditions, hedonic motivation, price value, and habit [51,79]. A positive correlation was also found between the attitude towards technology and the intention to use new technology [80,81]. This verified that the factor was important in influencing students' continuous intention to use micro-lectures after the pandemic. Thus, in the present study the following is hypothesized:

Hypothesis 12 (H12). *Attitude has a significant effect on students' continuous intention to use micro-lectures post-COVID-19.*

3. Methods

This study used a quantitative approach: the researcher made an initial hypothesis about what factors influence the students' continuous intention to use micro-lectures in the post-COVID-19 period and finally tested the initial hypothesis using the SEM technique to find the answer. The UTAUT-2 model (Venkatesh et al., 2012) was developed to analyze the determinants with a positive influence on students' intention to use micro-lectures after the pandemic. The adopted questionnaire used a 5-point Likert scale [82], where 1, 2, 3, 4, and 5 = SD, D, *n*, A, and SA (strongly disagree, disagree, neutral, agree, and strongly agree), respectively [83]. Subsequently, each question item was developed based on the existing literature and instruments in previous studies, as shown in Appendix A.

3.1. Study Instrument

The original English questionnaire was translated and validated by two professors and doctoral students, containing nine determinants with a total of 23 items. Subsequently, the link was transferred to the mathematics teacher for distribution to the students experienced in the utilization of micro-lectures during the pandemic. From January to March 2022, 336 data were obtained, with 321 analytically used due to the incomplete nature of 15. Based on the average, each respondent filled out the questionnaire more than 8 min before submission, with the complete instrument containing various demographic data, such as gender, class, and micro-lectures experience (Table 1).

Table 1. The demographic data.

Factor		*n*	%
Gender	Male	194	60.44%
	Female	127	39.56%
Use micro-lectures to learn math	More than 4 times a week	201	62.62%
	1–3 times a week	91	28.35%
	Once a week	29	9.03%
Class	7	116	36.14%
	8	111	34.58%
	9	94	29.28%
The device used to open the micro-lectures	Smartphone	297	92.5%
	Tablet	241	75.08%
	Laptop/computer	201	62.61%

According to Table 1, 60.44% and 39.56% were female and male students, with 29.28, 34.58, and 36.14% being 9th, 8th, and 7th graders, respectively. Based on the device of study, more than 60% of students had smartphones, tablets, and laptops regarding the utilization of micro-lectures during the pandemic. Approximately 62.62, 28.35, and 9.03% also used micro-lectures to learn mathematics more than four times, once–thrice (1–3), and once a week, respectively.

3.2. Data Collection Technique

A purposive sampling technique [65] was used at one public junior high school in Bandung, where the target samples were students from grades 7–9 (14–17 years) who used micro-lectures as a supplement to learning mathematics during the pandemic. This selection process was conducted based on experience and familiarity with micro-lectures, as participation was voluntary without any form of duress. The samples were also provided with a gift in the form of learning tools as a sign of gratitude for seriously participating in the exercise. In addition, informed consent was obtained from all the study participants.

3.3. Ethical Considerations

Although the participants were provided with rewards, compliance with all study ethics was still very important during coding, analysis, and data collection. All responses also remained anonymous for the prevention of bias [8].

3.4. Data Analysis

A structural equation modelling (SEM) was used to test the predictive models and analyze the relationship among variables. This approach has been widely used in the social science fields to analyze and evaluate the suitability of the theoretical model through empirical data [60,84,85]. SEM is also appropriately considered to test the assumptions in student or teacher acceptance of online learning media [86,87], such as micro-lectures. Meanwhile, the literature on SEM has demonstrated the need to adopt different approaches, based on the type of study, as well as sample normality and size [88]. In the present report, covariance-based SEM was used according to the referential recommendations from Hair et al. [89], where the objectives were to test, confirm, and compare alternative theories. This indicated that the first and second reflective measures were used according to the techniques frequently used in UTAUT-2, the theoretical approach, and the modelling. Based on a strong literature review, UTAUT-2 was modified by adding an attitude being influenced by PE, EE, HB, and HM, with SEM analyzing and interpreting the reliability of measurement and structural models, which specifically incorporated a linear specification reflecting the dependencies between the latent and the measured variable. In this present condition, all the analyses were performed with AMOS software, with the reliability test being conducted through the CFA-based Cronbach alpha and CR (composite reliability) [90,91]. Additionally,

subsequent analysis was performed on each latent variable, *t*-value, as well as the item loading and AVE for each question and construct, respectively [84,92].

4. Results

Before conducting a path analysis and developing conclusions on the influential factors, the data normality, as well as assessment of the measurement and structural models, were initially evaluated. In this condition, the reliability, as well as convergent and discriminant validity (CV and DV) tests, were used to evaluate the measurement model based on suggestions [93,94]. Furthermore, the structural models were often used to measure the strength and direction of each construct.

4.1. Normality Analysis

The data normality test (Table 2) was analyzed with the skewness and kurtosis values on each variable, which were between −0.795 and −0.112 and between −0.978 and 4.156. With both values between ±3 and ±10 for skewness and kurtosis, the data were observed to be normally distributed [50].

Table 2. Normality testing and descriptive statistics.

Variable	Min	Max	Skewness	c.r.	Kurtosis	c.r.
HM1	1.000	5.000	−0.332	−2.430	0.544	1.989
HM2	1.000	5.000	−0.216	−1.579	0.479	1.753
HM3	1.000	5.000	−0.395	−2.892	0.557	2.036
PE1	1.000	5.000	−0.475	−3.473	0.242	0.887
PE2	1.000	5.000	−0.387	−2.830	0.002	0.006
CI2	1.000	5.000	−0.136	−0.997	0.463	1.692
CI1	1.000	5.000	−0.138	−1.009	0.838	3.063
ATT1	1.000	5.000	−0.112	−0.818	0.488	1.783
ATT2	1.000	5.000	−0.418	−3.057	0.539	1.972
ATT3	1.000	5.000	−0.169	−1.236	0.443	1.621
PV1	1.000	5.000	−0.318	−2.324	−0.267	−0.978
PV2	1.000	5.000	−0.382	−2.797	−0.067	−0.244
PV3	1.000	5.000	−0.427	−3.127	0.062	0.225
FC1	1.000	5.000	−0.795	−5.815	0.965	3.530
FC2	1.000	5.000	−0.512	−3.741	0.111	0.404
SI1	1.000	5.000	−0.474	−3.469	0.514	1.879
SI2	1.000	5.000	−0.262	−1.915	1.137	4.156
HB1	1.000	5.000	−0.192	−1.406	0.463	1.693
HB2	1.000	5.000	−0.182	−1.334	0.031	0.114
HB3	1.000	5.000	−0.268	−1.959	0.469	1.716
EE1	1.000	5.000	−0.343	−2.508	0.304	1.111
EE2	1.000	5.000	−0.233	−1.707	0.077	0.283
EE3	1.000	5.000	−0.197	−1.442	0.041	0.149
Multivariate					196.099	51.802

4.2. Measurement Model for Measuring Reliability and Validity

The reliability test is often found to reflect the internal stability and consistent level of each measurement questionnaire [95]. This indicated that a good reliability questionnaire was obtained when the Cronbach $\alpha > 0.7$ [89]. In this report, the Cronbach's alpha value on each construct ranged between 0.74–0.95, confirming the existence of high questionnaire reliability and internal consistency between latent variables. It also analyzed the loading factor, composite reliability, and average extraction variation to assess convergence validity. In Table 3, the AVE, loading factor, and CR values are found to be more than 0.5, 0.7, and 0.5, respectively [96], indicating a very good convergent validity for this model.

Table 3. The measurement construct validity (n = 321).

Construct	Items	Mean	SD	Factor Loading	Cronbach Alpha	CR	AVE
Performance expectancy	PE2	3.56	0.90	0.81	0.927	0.81	0.68
	PE3	3.42	0.94	0.80			
Effort expectancy	EE1	3.55	0.83	0.56	0.742	0.77	0.53
	EE2	3.38	0.86	0.65			
	EE3	3.27	0.89	0.78			
Habit	HB1	3.36	0.82	0.92	0.892	0.93	0.81
	HB2	3.43	0.87	0.86			
	HB3	3.35	0.83	0.81			
Hedonic motivation	HM1	3.34	0.83	0.93	0.955	0.96	0.90
	HM2	3.34	0.88	0.93			
	HM3	3.33	0.87	0.93			
Social influence	SI1	3.45	0.90	0.82	0.76	0.83	0.71
	SI2	3.31	0.75	0.76			
Facilitating conditions	FC1	3.78	0.89	0.75	0.78	0.71	0.55
	FC2	3.43	0.93	0.66			
Price value	PV1	3.42	1.03	0.89	0.93	0.93	0.81
	PV2	3.31	0.97	0.90			
	PV3	3.29	0.95	0.89			
Attitudes towards micro-lectures	ATT1	3.52	0.86	0.90	0.94	0.96	0.89
	ATT2	3.42	0.78	0.94			
	ATT3	3.42	0.83	0.92			
Continuous intention	CI1	3.31	0.75	0.94	0.91	0.95	0.90
	CI2	3.38	0.81	0.91			

4.3. Discriminant Validity

To analyze the discriminant validity (DV) for each construct, the square root of the AVE values was calculated and compared with the correlation coefficient. The bold diagonal values are the square root of AVE, which needs to be greater than the inter-construct correlations below to meet discriminant validity. This shows that DV is accepted when the results are greater than the correlations for each construct. In this case, the square root of the AVE values exceeded the correlation coefficients for all constructs [97], as shown in Table 4.

Table 4. The discriminant validity test.

	PV	FC	SI	HM	HB	EE	PE	ATT	CI
PV	**0.770**								
FC	0.370	**0.375**							
SI	0.400	0.309	**0.325**						
HM	0.543	0.343	0.383	**0.673**					
HB	0.475	0.366	0.369	0.507	**0.554**				
EE	0.409	0.293	0.311	0.384	0.360	**0.322**			
PE	0.275	0.233	0.254	0.322	0.316	0.249	**0.530**		
ATT	0.481	0.332	0.356	0.509	0.449	0.362	0.282	**0.587**	
CI	0.425	0.313	0.338	0.425	0.441	0.331	0.286	0.416	**0.494**

4.4. Confirmatory Factor Analysis

Based on the recommendation from Hair et al. [98], the structural model should be measured using the highest likelihood estimation process, through the goodness-of-fit analysis. Table 5 shows the goodness-of-fit values for the assessment model. This revealed that the absolute (CMIN/df = 2.83; GFI = 0.87, RMR = 0.02; RMSEA = 0.07), incremental (AGFI = 0.82; NFI = 0.92; CFI = 0.95), and parsimonious (PNFI = 0.72; PGFI = 0.62) SEM measurements of the proposed model had a good fit. According to Doll [99] and Hair [100], the GFI and NFI greater than 0.8 showed acceptable fits.

Table 5. Measurement for model fit *.

Measurement	Fit Indication	Obtained Value	Recommended Criteria
Absolute fit measures	CMIN/df	2.83	1< x < 3
	GFI	0.87	>0.8
	RMSEA	0.07	<0.08
	RMR	0.02	<0.08
Incremental fit measures	NFI	0.92	>0.8
	CFI	0.95	>0.8
	AGFI	0.822	>0.8
Parsimonious fit measures	PNFI	0.72	>0.05
	PGFI	0.62	>0.05

* Source: Browne and Cudeck [101].

For endogenous variables, the R^2 data were considered the most important criterion when testing a structural model, although no agreed standard was recently observed [60]. Based on this condition, a Cohen's standard [102] was used to interpret the R^2 value, where a large and small explanatory power was found above 0.26 and 0.02, respectively. Furthermore, the R^2 values for students' attitude and continuous intention towards the use of micro-lectures in the post-pandemic period were 0.745 (74.5%) and 0.781 (78.1%), respectively, indicating that the model had a large explanatory power. This was then compared to the UTAUT-2 model (54% explanatory power) to explain usage behavior for new technology.

4.5. Structural Model and Hypothesis Test

An assessment of the structural coefficient was presented to analyze the proposed model, which aimed to predict students' continuous intention to use micro-lectures in mathematics lessons (Figure 3). The results confirmed that this model was quite suitable for behavioral explanations, due to the goodness-of-fit being observed in acceptable ranges.

Based on Figure 3 and Table 6, students' attitude towards mathematical micro-lectures was positively influenced by EE ($\beta = 0.620$, $p < 0.001$) and HM ($\beta = 0.313$, $p < 0.001$). Meanwhile, the continuous intention to use micro-lectures during the post-pandemic period was positively influenced by ATT ($\beta = 0.175$, $p < 0.05$) and HB ($\beta = 0.445$, $p < 0.001$). This states that two constructs had significant positive and direct impacts on students' attitudes and continuous intention.

Table 6. Hypothetical analysis. Note: *** $p < 0.001$.

Hypothesis	Relationship			Estimate	S.E.	C.R.	*p*-Value	Interpretation	
								0.05	0.01
H1A	Performance expectancy	→	Attitude	−0.031	0.058	−0.537	0.591	Rejected	Rejected
H1B	Performance expectancy	→	Continuous intention	0.028	0.060	0.462	0.644	Rejected	Rejected
H2A	Effort expectancy	→	Attitude	0.620	0.162	3.834	***	Accepted	Accepted
H2B	Effort expectancy	→	Continuous intention	0.063	0.620	0.102	0.919	Rejected	Rejected
H3A	Habit	→	Attitude	0.138	0.106	1.301	0.193	Rejected	Rejected
H3B	Habit	→	Continuous intention	0.445	0.114	3.892	***	Accepted	Accepted
H4A	Hedonic motivation	→	Attitude	0.313	0.079	3.974	***	Accepted	Accepted
H4B	Hedonic motivation	→	Continuous intention	−0.125	0.087	−1.431	0.152	Rejected	Rejected
H5	Social Influence	→	Continuous intention	0.624	0.758	0.824	0.410	Rejected	Rejected
H6	Facilitating conditions	→	Continuous intention	−0.214	0.244	−0.873	0.382	Rejected	Rejected
H7	Price value	→	Continuous intention	−0.009	0.072	−0.127	0.899	Rejected	Rejected
H8	Attitude	→	Continuous intention	0.175	0.076	2.288	0.022	Accepted	Rejected

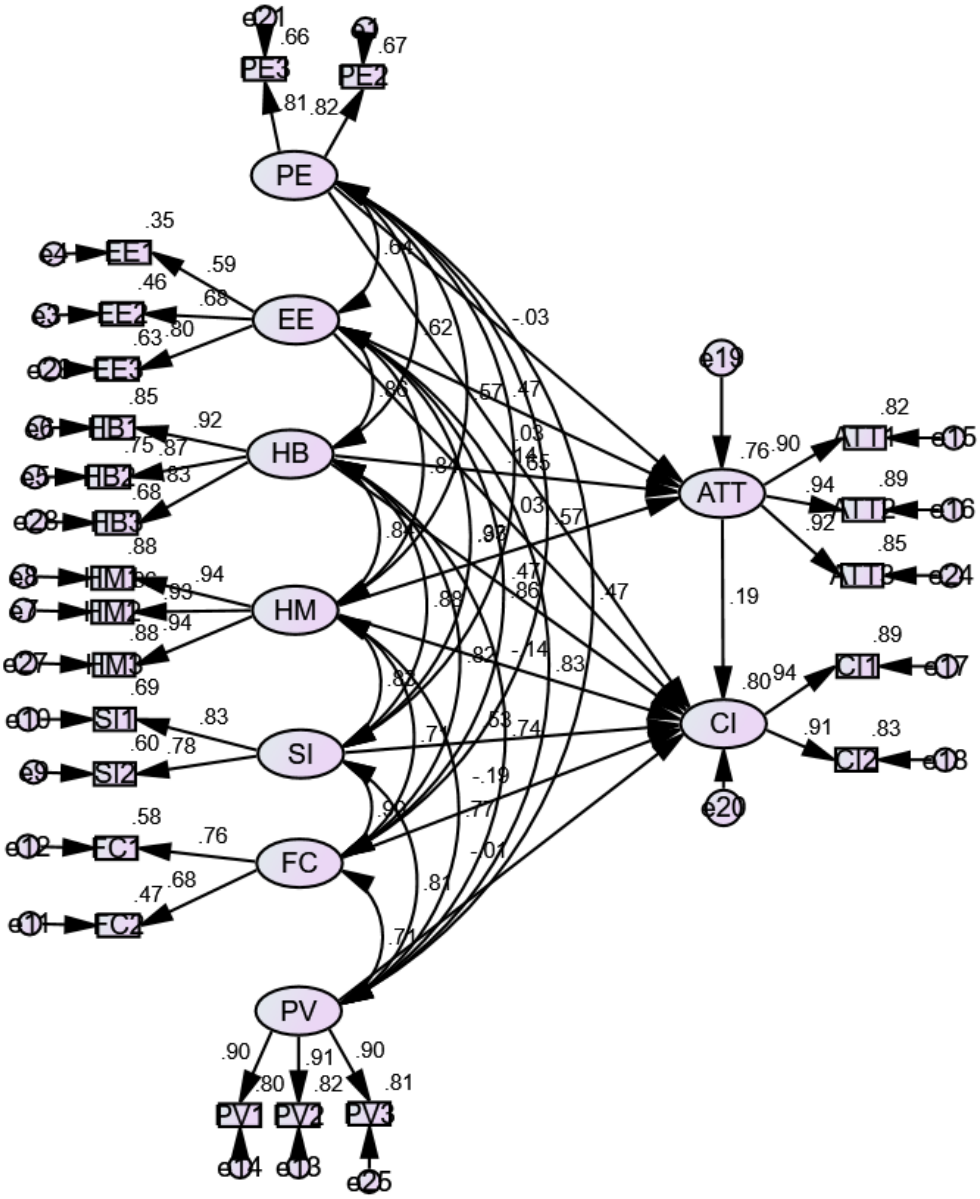

Figure 3. The SEM for the proposed model. Note: PV = price value, FC = facilitating conditions, SI = social influence, HM = hedonic motivation, HB = habit, EE = effort expectancy, PE = performance expectancy, ATT = attitude, and CI = continuous intention.

The most significant positive factor that directly affects students' attitudes towards micro-lectures was found to be effort expectation. The results show that micro-lectures were easy to use during the post-pandemic period, so students' attitudes towards micro-lectures also improved. The factor that had a positive direct effect on attitude was hedonic motivation. The enjoyable learning experience felt by students has a relationship with students' attitudes towards micro-lectures. Furthermore, the most significant factor that had a direct effect on continuous intention was habit. The results of this study suggest that when the use of micro-lectures has become a habit, the continuous intention of students will also increase. Finally, students' attitudes towards micro-lectures have a relationship with the continuous intention to use micro-lectures post-COVID-19. If students' attitudes towards micro-lectures are high, then their continuous intention to use micro-lectures is also high.

5. Discussion

The proposed model was developed by extending the UTAUT-2 to examine the factors affecting students' attitudes and continuous intention to use micro-lectures in mathematics lessons. This experiment succeeded in theoretically and empirically supporting the applicability of UTAUT-2 as a useful model for appropriately understanding CI (continuous intention). Using questionnaires and SPSS/AMOS software, data were also obtained from junior high school students and analyzed through the SEM technique. The influence results showed that effort expectancy affected the attitude towards micro-lectures. This proved that if students find that reviewing mathematics lessons with the help of micro-lectures did not require a big effort, then students will have a good attitude towards mathematics learning. Moreover, attitude also had an indirect effect on continuous intention. This was in line with a previous study, which showed that effort expectancy affected attitude and intention towards using new technologies [79,103,104]. Another report also verified that people often utilize new technology that is easily understood [105]. Furthermore, hedonic motivation was found to positively affect the attitude towards micro-lectures, indicating that students observed the media to be fun and exciting when learning mathematics. Based on the results, the HM-based micro-lecture had the ability to transform students' perceptions of the difficulties and boringness of the subject. Hedonic motivation also had a large indirect effect on students' continuous intention to use micro-lectures after the pandemic. This was in line with previous studies, where HM had a positive effect on the intention to use new technology. Hedonic motivation is the strongest factor and has the most significant effect on students using animation-based media because of the entertainment effect that exists in animation-based media [106]. In addition, the HM factor also has a significant positive effect that affects the possibility of teachers increasing their use of the mobile internet for teaching because they feel that using mobile internet is an enjoyable experience [62].

Attitude also had a direct effect on students' continuous intention to use micro-lectures after the pandemic. This was in line with previous reports, where attitude was the main factor influencing the intention to use new technologies [77,107,108]. However, it was not the determinant with the biggest effect on students' CI in the present analysis. This suggests that subsequent experiments should conduct additional analyses to appropriately understand the effect of attitude on the intentions to use new technologies. According to the results, no significant effect was observed for facilitating conditions due to its inability to influence students' CI to use micro-lectures during the post-pandemic period, as consistently observed in other reports [109]. Moreover, price value did not have a significant effect on mathematical micro-lectures continuous intention, as shown in Martins et al. [68], where PV did not influence the students using digital textbooks. This was not in line with Choi [110], where the factor affected a person's use of MOOC. It was also supported by a previous report, where PV was more significant in the business and economic fields than in the educational sector [48]. Habit was observed to have the most significant effect on students' CI to use micro-lectures after the pandemic. This was because the utilization of the media to learn mathematics had become a habit during the COVID-19 period, for approximately 2 years. In this condition, students were found to often use micro-lectures to prepare and review lessons before and after classes. The results also stated that they liked watching micro-lectures while performing their homework. Therefore, both students and teachers are found to continuously use new technology when it has become a habit. This was in line with a previous review, where HB affected the intention and behavior to use new technology.

6. Theoretical and Practical Implications

Theoretical and practical implications are provided for the maintenance of using micro-lectures during the post-pandemic period. The increased use of this media is also expected to improve students' learning outcomes and mathematical abilities.

This is the first study to extend UTAUT-2 in explaining the continuous intention of using micro-lectures after the COVID-19 pandemic. The results suggest that the extended

model provided empirical evidence of CI in the mathematical learning media. This theoretically provides valuable insight into the attitude and continuous intention of this educational field. It also provides additional knowledge on the CI theory of using micro-lectures. Therefore, the development of the UTAUT-2 model theoretically provides possible prospects for future reports. This is useful for micro-lecture developers and schools to identify the influential factors that should be considered when developing several strategies. It also confirms that habit is a significantly important predictor in influencing students' continuous intention to use micro-lectures after the pandemic.

Firstly, principals and teachers should continuously familiarize students with the internal and external use of micro-lectures as additional learning media, based on the influence of ATT, EE, and HB on CI. Secondly, mathematics teachers need to create many interesting and attractive educational media. Thirdly, the resolution of micro-lectures should be optimal and appropriate to meet the needs of students, as problems are often encountered with internet quotas. Fourthly, the ease of using this media for learning must be considered, with teachers also explaining the methods of effectively using the educational tools for mathematical knowledge. Fifthly, the duration of the micro-lectures is also another factor to be considered, as a long watch often breaks concentration and causes fatigue. When developing this learning media, teachers and schools should abide by the duration suggested by previous studies, which is not more than 10 min. This enables students to stay focused, as well as to not become bored and frustrated when using micro-lectures to learn mathematics.

After the pandemic, mathematics teachers are expected to be busy again with various activities, such as teaching preparation, administration, homework, and developing practice questions, which allows less time to create micro-lectures as a supplement for students. This explains that the key to using the learning media remains with the teacher, as the school and creation team are expected to support the educator's development needs. When supported with adequate infrastructures such as hardware, software, and the internet, teachers are more likely to continuously develop micro-lectures for students. This confirms that the habit of using the media for learning is influenced by many aspects, including teachers and schools. Therefore, familiarizing students with the use of micro-lectures as an additional mathematical learning supplement is one of the methods of improving and increasing educational abilities and effectiveness during the post-pandemic period.

7. Conclusions

This study was conducted to explain and predict the factors influencing students' continuous intention to use micro-lectures to learn mathematics after the pandemic based on the UTAUT-2 model, with SEM being utilized to validate and develop conclusions. The empirical results showed that ATT and HB were the strongest predictors of factors influencing students' continuous intention to use micro-lectures after the pandemic, with HM and EE also having a significant effect on learning attitude. Moreover, habit was the most significant factor influencing the CI to use this educational media. This report contributed to the increase in using micro-lectures after the COVID-19 period, which proved to improve learning outcomes. It also contributed to the awareness of developing countries with various factors in mathematical fields, such as attitudes towards online learning media.

8. Limitations

Firstly, the study is limited to the junior high school level in Bandung, Indonesia, with the sole focus on the continuous intention to use mathematical micro-lectures after the COVID-19 pandemic. The results are also not generalized to all educational levels, indicating a lack of studies at elementary, senior high, and tertiary institutions. Secondly, other reports commonly considered the extension of the TAM-2 model, due to it being widely used to analyze behavioral intention towards the use of new technology. Thirdly, it is undeniable that the use of micro-lectures is also influenced by teachers and schools, with

many studies showing that students often used online learning media when instructed. Therefore, a subsequent study is suggested to examine the factors influencing the intention of teachers to teach mathematical micro-lectures. Fourthly, the moderating effects of gender and educational level were not assessed on the continuous intention to use this learning media. This indicates that subsequent studies need to examine this relationship. Fifthly, there is a need for future research to support a deeper understanding through a mixed-method approach when investigating the factors affecting junior high school students to use mathematical micro-lectures after the pandemic.

Author Contributions: Conceptualization, T.T.W.; methodology, T.T.W.; validation, R.W.; formal analysis, T.T.W. and R.W.; investigation, R.W.; project administration, T.T.W.; writing—original draft, T.T.W. and R.W.; writing—review and editing, T.T.W. and R.W. All authors have read and agreed to the published version of the manuscript.

Funding: This work was supported by Guangxi Zhuang Autonomous region postgraduate Education Project (2020JGA129) and improve teaching ability of elementary and secondary school teaching project (JSSKT2020012).

Data Availability Statement: The data presented in this study are available upon request from the corresponding author. The data are not publicly available due to privacy.

Acknowledgments: We want to thank Professor Jianlan Tang and Professor Yiming Cao who generously offered their time, insights in our study. And we also wish to thank Professor Zsolt Lavicza for his valuable comments on an earlier version of this paper.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Item	Performance Expectancy	Source
PE1	I continue to use YouTube after the pandemic because it helps me understand math material	[53]
PE2	I continue to use YouTube after the pandemic because it improves my math scores	
	Effort expectancy	
EE1	I do not need much effort when using micro-lectures to learn math	[53]
EE2	I assume learning math through YouTube is easy	
EE3	Micro-lectures are easy to use	
	Social influence	
SI1	My teacher advised me to use YouTube to study maths after the pandemic	
SI2	My friends use YouTube to study maths after the pandemic	
	Facilitating condition	
FC1	I have a cellphone, laptop, or tablet to learn math through YouTube	[53]
FC2	People are helping me when I do not know how to use YouTube to study maths after the pandemic	
	Hedonic motivation	[48]
HM1	I continue to use YouTube to study maths after the pandemic because it is fun	
HM2	I continue to use YouTube to study maths after the pandemic because it is entertaining	
HM3	I continue to use YouTube to study maths after the pandemic because it is so much fun	
	Price value	[48]
PV1	I continue to use YouTube to study maths after the pandemic because it is cheap	
PV2	I continue to use YouTube to study maths after the pandemic because internet costs are affordable	
PV3	I continue to use YouTube to study maths after the pandemic because the internet price is acceptable	
	Continuous intention	[111,112]
CI1	I continue to use YouTube to learn math after the pandemic	
CI2	I recommend the micro-lectures to learn maths to my friends	
	Habits	
HB1	I continue to use YouTube to learn math after the pandemic because I am used to it	[48]
HB2	I continue to use YouTube to learn after the pandemic because I am used to repeating math lessons	
HB3	I continue to use YouTube to study maths after the pandemic because I am used to using it to do my homework	
	Attitude	
ATT1	Learning math using YouTube after the pandemic is a good idea	[92,113]
ATT2	Learning math using YouTube after the pandemic is very interesting for me	
ATT3	Learning math using YouTube after the pandemic is so much fun	

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