Factors Influencing Learning Intention of Advanced Placement MOOCs: Insights from an Investigation into Information Technology Adoption

Kuo-Liang Ou
Tsing Hua University, Hsinchu
klou@mx.nthu.edu.tw

Wen-Chi Fong
Tsing Hua University, Hsinchu
fong.wenchi@gapp.nthu.edu.tw

Abstract: *Massive open online courses (MOOCs) have attracted recent scholarly attention, mainly because MOOCs have effectively made higher education accessible. However, MOOCs tend to have low completion rates, and many scholars have attempted to remedy this by investigating the psychological, cognitive, physiological, and demographic factors affecting completion rates. Nevertheless, most studies have rarely investigated the student's information technology (IT) background, focusing instead on self-awareness, self-recognition, intrinsic motivation, or external factors. Thus, this study adopted the technology acceptance model (TAM) to explore factors affecting MOOC learning intention, specifically in advanced placement (AP) MOOCs. This study also recruited 435 student participants from a university in Taiwan who took MOOCs for AP. Questionnaires were used to analyze the factors affecting completion rates. The results revealed that personal and IT backgrounds significantly affected perceived ease of use (PEU); perceived usefulness (PU) significantly affected attitude toward use (ATU); PEU significantly affected ATU; PEU significantly affected PU; ATU significantly affected behavioral intention to use (BITU); PU significantly affected BITU; and BITU significantly affected course completion rates. The results suggest that universities first understand students' personal and IT backgrounds before promoting their AP MOOCs as this can assist students in their learning and provide the necessary support.". Furthermore, universities must also establish a complete course-provision process and formulate learning strategies to attract, guide, and inspire students to adapt to the learning modes that AP MOOCs entail. In doing so, students are more likely to perceive MOOC learning modes as being innovative and thus learn more effectively.*

Keywords: MOOCs, technology acceptance model, advanced placement, learning intention

1. Introduction

Massive open online courses (MOOCs) can be considered pioneering educational innovation in the 21st century and become an essential research topic (Raffaghelli, Cucchiara, & Persico, 2015). Many countries have begun to support formal and informal learning through MOOCs, provided the necessary certification mechanisms, and cooperated with higher education institutions to promote MOOCs to improve student competitiveness (Joo, So, & Kim, 2018). Due to the impact of COVID-19, both teachers and students have become accustomed to the online learning mode, and at the same time, the utilization of MOOCs as a method of instruction has increased (Boltz, Yadav, Dillman, & Robertson, 2021). MOOCs have become one of the most highly influential technologies and have achieved favorable results in the development of various fields due to their fragmented and globalized features for the learning of various subjects. Meanwhile, based on the successful experience in higher education, MOOCs have begun to develop towards regionalization and have been applied in advanced placement (AP) courses by colleges and universities.

AP courses originated from three elite high schools in the US in 1951, namely Phillips Academy, Phillips Exeter Academy, and Lawrenceville School, in collaboration with Harvard University, Princeton University, and Yale University. The aim of AP courses is to connect the learning done in the last two years of high school with the learning done in the first two years of university; improve the student's ability for independent learning, research, and analysis; and provide more diverse learning opportunities for qualified students. At present, universities can directly teach using MOOCs. They can be more confident of the quality of students who have taken such university-held MOOCs and have passed the AP examinations. For example, edX cooperates with Davidson College in North Carolina to provide three AP courses, in calculus, physics, and microeconomics. Several universities have also launched MOOCs for AP, including Boston University, Massachusetts Institute of Technology (MIT), the Cooper Union, and Georgetown University. This approach has not only made AP courses more popular but also diversified the development of MOOCs.

MOOCs have been widely applied in higher education environments (Al-Emran, Mezhuyev, & Kamaludin, 2018); however, several studies have reported that MOOCs have unsatisfactory completion rates (Lan & Hew, 2020; Romero-Rodríguez, Ramírez-Montoya, & Aguaded, 2020; Tamjidyamcholo, Gholipour, & Kazemi, 2020). In addition, more studies have analyzed the difficulties encountered in the recent promotion of MOOCs (Kynge, 2020; Ma & Lee, 2020). These difficulties include personal factors (e.g., self-control and attitude), environmental factors (e.g., the login system on the Internet platform used and the student's economic situation), use barriers, and value barriers. These barriers may decrease students' acceptance of learning online.

The Technology Acceptance Model (TAM) is an effective method that can be used to explore the factors influencing user acceptance of technological products (Davis, 1989; Lee, Kozar, & Larsen, 2003). The key variables in this model are perceived ease of use (PEU), perceived usefulness (PU), attitude toward using (ATU), and behavioral intention to use (BITU). In education, scholars have also adopted TAM to explore the acceptance of learning environments. For example, Teo (2006) indicated that PEU and PU of TAM resulted in more positive student intention toward learning and toward the

use of information, which in turn increased their use of technology. Other findings on the relationship of learning outcomes in educational technology have also aided government agencies in their promotion of education of science and technology (Mohammadi, 2015; Ullah, Hoque, Aziz, & Islam, 2023).

To understand whether a student's personal background and information technology (IT) background (environmental factors, use barriers, and value barriers) affect the promotion of AP courses of MOOCs, this study used the TAM model to verify the relationships between relevant variables. Adopting the TAM proposed by Davis, as the basic research framework, this study analyzed the PEU, PU, ATU, and BITU to examine students' intention and behavior of using MOOCs for the AP. Moreover, the personal and IT backgrounds of students were used as external variables to identify factors that affect student completion rates in AP MOOCs. Our findings suggest that to increase the completion rates, universities should first understand the IT backgrounds of students before offering AP courses.

2. Related works

2.1 *MOOCs in Higher Education*

MOOCs were named as such in the 2008 Connectivism and Connective Knowledge (CCK08) conference in Canada. The large-scale emergence of MOOCs has been considered to begin with Stanford University's artificial intelligence course in 2011. This course attracted more than 160,000 students from over 190 countries worldwide. In general, the success of MOOCs has profoundly affected the ecology of higher education. The innovative learning mode entailed by MOOCs has allowed people

to appreciate how learning can take place outside a physical classroom; teaching and learning have gradually transitioned to using Internet technology, away from books and conventional pedagogical methods (Anderson, Gifford, & Wildman, 2020). This new-generation digital learning model integrates teacher–student interaction and peer-to-peer interactive learning, encouraging students to engage in self-directed learning and set their own learning pace.

Despite these advantages above, however, Jordan (2014) analyzed data published by major MOOC platforms and noted a low completion rate of approximately 6.5%. Several researches indicated that students' technology literacy, personal background, learning motivation, self regulation and interaction are the impact factors that affect the completion rate of MOOCs (Terras & Ramsay, 2015). Hone and El Said (2016) conducted a survey of 379 MOOCs students at Cairo University. Their results indicated that MOOCs students who did not complete the courses reported the following problems: challenging courses, an excessive number of course modules, long videos, and a lack of interaction with instructors and other students. In addition, Lin, Lin, and Hung (2015) conducted interviews and reported that rich course content, the presence of a real-time discussion platform, and short video length improved learning in MOOCs. Furthermore, Romero-Rodriguez, Ramirez-Montoya, and Gonzalez (2020) studied the relationship between MOOCs completion rate and student's information skills. Their findings revealed that relative to their less wealthy counterparts, students from a wealthier socioeconomic bracket were more likely to complete courses and obtain certificates due to their greater access to social and economic resources.

The low completion rate may be due

to a lack of facility with digital technology. A systematic literature review by Lu, Zhao, Guo, Wang, and Huang (2018) identified two reasons explaining the low completion rate of MOOCs. The first pertained to course factors (i.e., intention of individuals, and the effects of course quality and service quality), which constitute an essential condition for continuous learning (Alraimi, Zo, & Ciganek, 2015). The second pertained to personal factors; specifically, MOOC design must consider the student's IT literacy and individual characteristics with respect to learning motivation and ability for self-regulation (Terras & Ramsay, 2015).

2.2 Advanced Placement in MOOCs

AP is an educational program that allows high school students to take entry-level university courses and obtain university credits through standardized course examinations. Hallett and Venegas (2011) noted that students who scored well in the AP examinations were generally more likely to be admitted to a university, and some students have reported that obtaining high school and university credits through this method has allowed them to graduate earlier and pay fewer tuition fees. In addition, relative to students who did not take the AP examinations, students who did were more likely to enroll in a university with a four-year degree program, obtain a higher grade point average and a bachelor's degree, and earn more after graduation (Chajewski, Mattern, & Shaw, 2011).

Although much research has indicated the efficacy of the AP program, the findings have been inconsistent, causing some experts to doubt the effectiveness of the AP program. For example, Duffett and Farkas (2009) and Tai (2008) argued that the rapid expansion of AP has made it difficult for schools to design and prepare for advanced courses, which has

indirectly affected the university enrollment rate. In addition, Sadler, Sonnert, Tai, and Klopfenstein (2010) noted that if most students fail the AP examinations, many secondary schools will incur considerable economic loss because it is expensive to set up a high school course as an AP course.

With regard to the evidence for and against the effectiveness of AP courses, Harvard University with MIT has launched 26 free MOOCs that have covered AP, high-school, and university-level learning material in edX, and hopes that the new courses developed will allow more high school students to be exposed to higher-level content, equipping them with the prior knowledge that is useful for various first-year university courses. Moreover, edX stated that using learning-platform functions can help users to surmount those obstacles encountered (1) in face-to-face learning between instructors and students, (2) by financially disadvantaged students, and (3) by students who live far from the university. Barbour and Mulcahy (2013) showed that students' passing rate in a rural school surpassed the previous record high. Similarly, students can also participate in MOOCs for AP regardless of their family background and income level. These students obtained higher scores than their original AP examination results (Johnston & Barbour, 2013). Furthermore, Najafi, Evans, and Federico (2014) also discovered that (1) the role of instructors of MOOCs for AP must adapt to the student's learning mode, and (2) students must be able to learn autonomously and not be dependent on instructors. The study also noted that the time spent by students who took MOOCs for AP was another factor that affected student completion rate.

2.3 Technology Acceptance Model

The TAM extended the analysis to

evaluate the user's degree of acceptance of technology from the user's perspective; and the model has been used to elucidate the conditions that affect a user's use intention and behavior toward a piece of technology. Davis (1989) introduced the PEU and PU to develop the TAM. The variables of PEU, PU, ATU, and BITU can affect the user's acceptance (and corresponding use) of a piece of technology. In general, PEU is positively correlated with ATU, PEU is positively correlated with PU and BITU, and BITU is positively correlated with both actual use and acceptance behavior. In recent years, the TAM has been widely adopted in numerous studies because of the rapid development of IT—in particular, whether a user will use and continue to use IT. The variables constituting the TAM framework are detailed in Figure 1 and Table 1 with reference to Davis (1989).
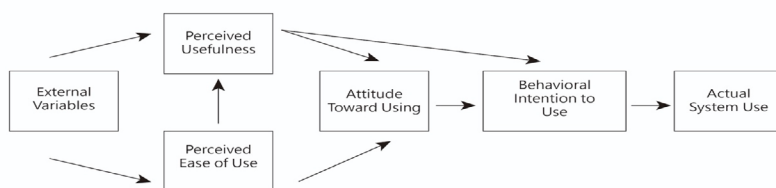

Figure 1

Framework of the technology acceptance model

Table 1

Variables of the technology acceptance model

Variable	Description
External Variables	Other factors that affect the user's perceptions of how useful and how easy to use a piece of technology is. These variables include characteristics of the piece of technology, social environment, self-efficacy, the user's work, the system user interface, and the user themselves.
Perceived Usefulness (PU)	The user's perception of how much a piece of technology improves their efficiency at work. A user with a greater PU has a more positive attitude toward and a correspondingly higher frequency of using a piece of technology.
Perceived	
Ease of Use (PEU)	The user's perception of how easy to use a piece of technology is. A user with a greater PEU has greater acceptance and a correspondingly greater preference toward a piece of technology.
Attitude Toward Using (ATU)	The user's attitude toward using a piece of technology. ATU is affected by PU and PEU. If PU and PEU are both high, then ATU is also positive.
Behavioral Intention to Use (BIU)	The user's willingness to use a piece of technology. ATU is positively correlated with BITU. BITU is also affected by ATU and PU.

Figure 1 illustrates the TAM framework. Specifically, a user's actual use of a piece of new technology or the user's acceptance of a piece of technology can generate PEU and PU through external variables, and PEU can affect PU. In addition, PU and PEU can jointly affect ATU. Subsequently, ATU and PU can also affect BITU. Finally, BITU can affect an individual's use of IT system.

Table 2 summarizes the findings of studies pertaining to the TAM. These studies were distinguished into studies that (1) conceptualize the TAM, (2) test the validity and reliability of the TAM, (3) revise the TAM, and (4) apply the TAM to particular IT systems. Many scholars have reported on many variables that can affect a user's acceptance of an information system, such as their personal background, the quality of the system, and learning outcomes. Other studies have also used the TAM to explore the use of various information systems, such as self-efficacy in personal-computer use, Internet use behavior, online shopping intention, and the use of WebCT.

Table 2

Studies related to the technology acceptance model

Relevant studies	Content	References
Conceptualizing the model	Prevalent in the early literature. These studies reached a consensus on what the TAM is. The external validity of the TAM was demonstrated by comparing the TAM with other models.	(Davis, 1989) (Adams, Nelson, & Todd, 1992) (Mathieson, 1991)
Testing the validity and reliability of the model	Factor analysis was used to test for validity; two scales were constructed. The scales were verified using different methods for testing reliability and validity.	(Davis, 1989) (Szajna, 1994)
Revising the model	Additions and deletions were made to the concepts and relationships internal to the TAM. The external variables related to the TAM were investigated. Structural equation modeling was used to construct a causal model of the TAM.	(Chau, 1996) (Venkatesh, 2000) (Juan, 2006)
Applying the model to other information systems	Perceived usefulness and perceived ease of use were used to form other variables. Studies determined the key to the successful adoption of a piece of information technology.	(Lim, 2000) (J. C. L. Lin, H. , 2000)

In summary, most of recent studies have demonstrated that factors affecting the learning mode of students in MOOCs pertained to the instructor's planning of the curriculum, giving of incentives when implementing the curriculum, and leveraging of platform functions. However, studies have rarely investigated how the student's personal and IT backgrounds affect their completion rate. Therefore, this study used the TAM as the fundamental research framework to further analyze whether students' personal and IT backgrounds can affect the completion rate of MOOCs for AP. Moreover, PEU, PU, ATU, BITU, and the student's personal and IT backgrounds were used to explore (1) the behavioral intentions of students toward new technology and (2) the factors that affect their completion rate. Furthermore, this study also predicted which internal and external variables affect the student's use intention toward a MOOCs learning system. Finally, questionnaire data were analyzed to verify the framework and hypotheses proposed in this study. This study's focus on AP MOOCs through a TAM perspective can be considered to be novel and a contribution to the literature.

3.Method

Many universities have offered AP courses through MOOCs, which offer course certification, credit exemption, free courses, and a diverse range of courses to attract students who have been admitted to the university. Arranging AP courses for students during the window period for admission is done in the hope that every student can pass these courses under favorable conditions maintained by the university. In doing so, universities ensure that freshmen do not waste time during the holiday period, can experience the university's learning mode early, and can cultivate good independent-study habits prior to entering university life, which is new to them. Therefore, this study focused only on this window period, analyzing whether the factors affecting the completion rate of students are related to student's personal and IT backgrounds. In this study, a student was defined as completing a course if they had finished viewing at least 80% of the videos. Subsequently, behavioral analysis was conducted and the correlation between variables was analyzed using questionnaire data. This study's findings aid educational bodies that aim to promote MOOCs.

This study enrolled 435 university students who have taken MOOCs for AP in Taiwan. The TAM was adopted to investigate the factors affecting course completion rate. The topics focused on factors that influenced the learning outcomes of courses taken under different IT applications and under students' different personal and IT backgrounds. The TAM and behavior under given personal and IT backgrounds were used as the theoretical basis to explore the factors that affect students' course completion rate and degree of technological acceptance. According to the literature review, particularly on studies regarding the influence of environmental conditions when students participated in MOOCs for AP, this study proposed the following research hypotheses:

H1: Personal and IT backgrounds significantly affect PEU.

H2: Personal and IT backgrounds significantly affect PU.

H3: PU significantly affects ATU.

H4: PEU significantly affects ATU.

H5: PEU significantly affects PU.

H6: ATU significantly affects BITU.

H7: PU significantly affects BITU.

H8: BITU significantly affects course completion rate.

After consulting the literature, this study established a TAM framework that included the four dimensions of PEU, PU, ATU, and BITU, based on students' personal and IT backgrounds. BITU was considered to immediately lead to actual use behavior, and finally motivated students to successfully complete the course. The research hypotheses are illustrated in Figure 2.
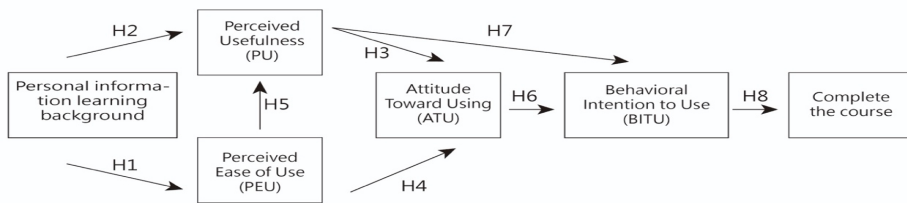

Figure 2

Research hypotheses

This study was a confirmatory empirical study. The questionnaire content was designed after the research variables were determined according to previous studies. Table 3 summarizes the operational definitions of the variables in the research hypotheses.

Table 3

Operational definition of each variable in research hypotheses

Variable	Operational definition
External variable	Student's personal background and IT background.
PEU	Students find it easy to learn using MOOCs learning system.
PU	Students think that using the MOOCs learning system aids their learning in particular and their study prospects in general.
ATU	Students' evaluations of the system (both positive and negative) and their behavioral tendency related to the use of technology after using the MOOCs learning system.
BITU	Student's willingness or intention to continue using the MOOCs learning system in the future.

To understand the effect of MOOCs as a learning system for the AP on student's learning intentions and behaviors, this study collected data by distributing online questionnaires. The questionnaire contents are presented in Tables 4 to 8. Subsequently, the data were analyzed to determine the correlations between variables, and structural equation modeling was performed in Lisrel to verify the relationship of personal and IT backgrounds with PEU, PU, ATU, BITU, and course completion rate. The variables related

to the IT background are derived from the literature of Tzouveli, Mylonas, and Kollias (2008) and supplemented by interviews with the teaching faculty, computer center staff, and academic affairs involved in this study. These variables focus on students' background and their ICT environments. (Table 4)

Table 4

Items constituting the student's personal and IT backgrounds

Item	Content
A1	Credits of IT courses taken in high school
A2	Time spent learning online on weekdays
A3	Time spent learning online on weekends
A4	Time spent online on weekdays (not learning)
A5	Time spent online on weekends (not learning)
A6	Use of mobile learning
A7	Whether the student takes other MOOCs
A8	Credits for AP courses
A9	Number of hours taken to study other MOOCs offered by the university
A10	Gender
A11	High-speed Internet resources
A12	How advanced the student's IT equipment is

Table 5

Items of PEU

Item	Content
B1	I can easily learn how to operate the MOOCs to study for the AP.
B2	I can easily understand the materials I read from the MOOCs to study for the AP.
B3	I can easily understand the various learning functions in the MOOCs to study for the AP.
B4	I find the MOOC system user friendly.
B5	I can easily and proficiently use the MOOCs to study for the AP.
B6	I find it easy to use the MOOCs to study for the AP.
B7	Overall, I find the MOOCs offered by the university easy to learn and use when studying for the AP.

Table 6

Items of PU

Item	Content
C1	Using the MOOCs to study for the AP allows me to fully learn what I want in a short time.
C2	Using the MOOCs to study for the AP improves my learning outcomes.
C3	Using the MOOCs to study for the AP learning improves my professional competence.
C4	Using the MOOCs to study for the AP improves my professional ability.
C5	Using the MOOCs to study for the AP prepares me for future classes.
C6	Using the MOOCs to study for the AP aids my studying.
C7	The learning method entailed by MOOCs is more effective than that entailed by the use of computers, communications devices, and consumer-electronics.

Table 7

Items of ATU

Item	Content
D1	I think that MOOCs work great in studying for the AP.
D2	I am satisfied with the use of the MOOCs to study for the AP.
D3	I feel that the use of MOOCs to study for the AP is interesting.
D4	I think that the use of MOOCs to study for the AP is suitable for me.
D5	MOOCs for the AP provide an excellent learning environment.

Table 8

Items of BITU

Item	Content
E1	I am willing to enroll in MOOCs in the future to study for the AP.
E2	I will continue to use MOOCs for the AP to gain professional knowledge on my own.
E3	I will recommend my peers to use MOOCs for the AP to improve their professional knowledge.
E4	I hope that the university will continue to offer MOOCs for the AP for me to pick up the knowledge that I want.
E5	Innovative diverse MOOCs will increase my intention to complete the course.

4. Results and discussion

The overall relationship between the variables observed when students studied MOOCs for the AP, which was based on the research hypotheses, is illustrated in Figure 3:
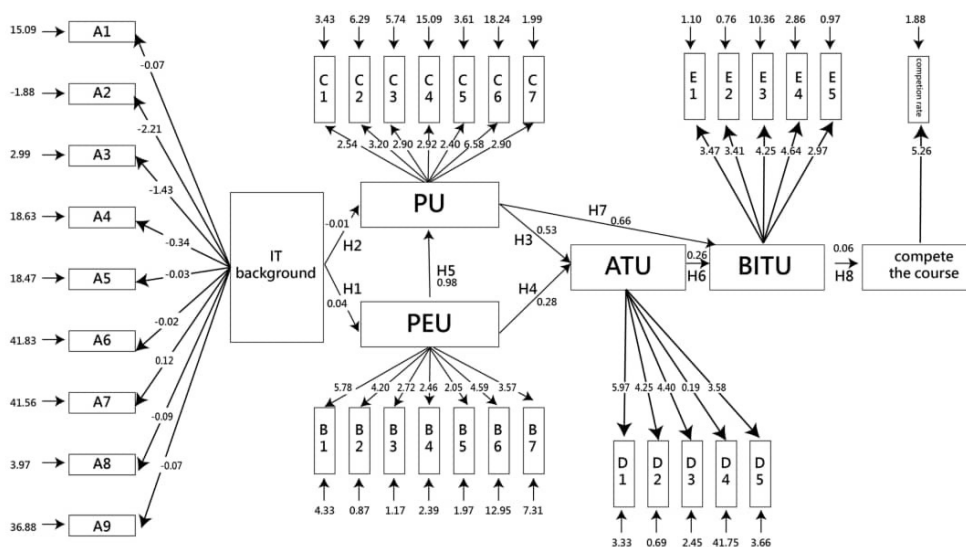

Figure 3

Structural equation modeling analysis results

As detailed in Table 9, this study's hypotheses were consistent with the scope of the TAM. All hypotheses achieved significance except for H2 (which stated that personal and IT backgrounds significantly affect PU).

Table 9

Empirical results of research hypotheses

Item	Research hypothesis	Standardized path coefficient	Significance
H1	Personal and IT backgrounds significantly affect PEU.	0.04	Significant
H2	Personal and IT backgrounds significantly affect PU.	-0.01	Nonsignificant
H3	PU significantly affects ATU.	0.53	Significant
H4	PEU significantly affects ATU.	0.28	Significant
H5	PEU significantly affects PU.	0.98	Significant
H6	ATU significantly affects BITU.	0.26	Significant
H7	PU significantly affects BITU.	0.66	Significant
H8	BITU significantly affects course completion rate.	0.06	Significant

As for the relationship between the variables observed when students studied MOOCs for AP, the results of the H1–H8 hypotheses were verified to be consistent with the overall research hypothesis. These results are detailed as follows:

H1: Personal and IT backgrounds significantly affect PEU.

As indicated in responses to item A1, high school students who had attended IT courses adapted readily to the online learning mode. Therefore, this study determined that offering MOOCs for AP to high schools makes learning easier and yields a high course completion rate. As indicated in responses to items A2 and A3, students with the habit of studying online were easier to adapt to the innovative learning mode entailed by MOOCs. As indicated in responses to items A4 and A5, students with Internet access on weekdays or weekends (for purposes other than studying) used the Internet more frequently; these students adapted readily to online learning mode entailed by MOOCs. This finding indicates that if students with a basic grasp of IT develop the habit of learning online prior to attending a MOOC, then they can adapt better to learning in a MOOC (for the AP). As indicated in responses to item A6, students had greater learning intention if they were offered the online mobile learning application. Mobile learning is likely to be dominant in the future because smartphones are becoming increasingly popular. Mobile learning apps should thus be developed. As indicated in responses to items A7 and A8, students with a history of taking MOOCs adapted well to using and learning from MOOCs; these students are likely to have a higher course completion rate. As indicated in responses to item A9, many students noted that they could afford 15 min daily on a MOOC. This finding indicated that short videos improve students' intention to learn and rate of course completion. The remaining items (A10–

A12), which inquired into gender, Internet bandwidth, and how advanced the student's computer equipment is, yielded nonsignificant results. The aforementioned results supported H1.

H2: Personal and IT backgrounds significantly affect PU.

The statistical analysis indicated that personal and IT backgrounds nonsignificantly affected PU, implying that students were unaffected by the PU of the MOOCs for AP. Hence, H2 was unsupported.

H3: PU significantly affects ATU.

Davis (1989) demonstrated that higher PU results in more positive attitudes toward using a piece of technology. The empirical results of the present study also indicated that among students with IT backgrounds, high PU was associated with high ATU. Therefore, H3 was supported.

H4: PEU significantly affects ATU.

Students with a basic IT background tended to have higher PEU. These students tended to state that MOOCs were easy to use, which, in turn, affected their ATU. Therefore, H4 was supported.

H5: PEU significantly affects PU.

Students with a basic IT background tended to state that use MOOCs were easy to use. In addition, being able to obtain relevant learning resources improved students' PU of MOOCs. Therefore, H5 was supported.

H6: ATU significantly affects BITU.

Wu (2000) demonstrated that the BITU formed during the learning process affects ATU and the likelihood of using a piece of

technology in the future. According to the empirical results of the present study, H6 was supported.

H7: PU significantly affects BITU.

Davis (1989) demonstrated that higher PEU leads to higher levels of PU, BITU, and the use and acceptance of a piece of technology. The empirical results of the present study indicated that H7 was supported.

H8: BITU significantly affects course completion rate.

BITU facilitates in increasing the course completion rate. According to the empirical results of the present study, H8 was supported.

This study used personal and IT backgrounds as external variables of the TAM, doing so to investigate factors that can affect students' completion rate of MOOCs. Students were more likely to accept MOOCs and perceive MOOCs to be useful and easy to use if they had used computers and were accustomed to using the Internet on weekdays. Adding mobile learning functionality makes learning more convenient, which increases student learning intention. Therefore, this study posited that personal and IT backgrounds affect learning intention. Students with a weaker IT background often encounter learning difficulties when using MOOCs for the AP, which limits their access to learning opportunities. Universities must first understand the personal and IT backgrounds of students and establish a complete course-provision process when promoting innovative learning (e.g., by having computer literacy as a prior course to cultivate the student's ability to use the information system). Moreover, with respect to MOOCs functionality and the MOOCs interface, universities must provide complete instructions and learning mechanisms to guide and inspire students to

adapt to the learning mode of MOOCs for AP, thus helping students to learn better by encouraging them to perceive online learning more positively.

5. Conclusion

This study on MOOCs for AP adopted the TAM to explore the possible factors that affect students' course completion rate. The questionnaire data of 435 students were collected and analyzed to determine the relationship of personal and IT backgrounds (which constituted external variables in the TAM) with PU, PEU, ATU, and BITU. This study's contributions are twofold. First, many recent studies on MOOCs completion rate have aided the creation of interactive digital courses, reduced use barriers, and enhanced use values. However, the results of this study suggest that the personal and IT backgrounds of students can be considered to develop suitable digital courses in the context of the TAM; through TAM, these courses can make students more motivated to learn. Second, this study overcame the limitations imposed by specific subjects and age groups employed in previous studies on MOOCs, doing so by focusing on AP courses taken by high school students and developing a new concept that has not been discussed in the literature.

This study concluded that students have different BITU of using MOOCs for AP because of differences in personal and IT backgrounds. In addition, high school students who are conversant with IT perceived MOOCs to be useful and easy to use. Students' personal and IT backgrounds must be considered in MOOC design to make students more motivated to learn and, in turn, more likely to complete the courses. Therefore, high schools should cultivate IT literacy in advance before offering credit-based MOOCs. Universities should also shorten the duration

of professional foundation courses, streamline course videos, and establish learning tools (e.g., mobile learning interfaces) to reduce the learning barriers of students, thereby enhancing their learning intention and ability to complete the courses taken.

References

Adams, D. A., Nelson, R. R., & Todd, P. A. (1992). Perceived usefulness, ease of use, and usage of information technology: A replication. *MIS Quarterly,* 227-247.

Al-Emran, M., Mezhuyev, V., & Kamaludin, A. (2018). Technology acceptance model in M-learning context: A systematic review. *Computers & Education, 125*, 389-412.

Alraimi, K. M., Zo, H., & Ciganek, A. P. (2015). Understanding the MOOCs continuance: The role of openness and reputation. *Computers and education, 80,* 28-38. https://doi.org/10.1016/j.compedu.2014.08.006

Anderson, V., Gifford, J., & Wildman, J. (2020). An evaluation of social learning and learner outcomes in a massive open online course (MOOC): a healthcare sector case study. *Human resource development international, 23*(3), 208-237. https://doi.org/10.1080/13678868.2020.1721982

Barbour, M., & Mulcahy, D. (2013). Examining enrollment trends in schools participating in online learning in newfoundland and labrador. *Morning watch (St. John's), 41*(1-2), 1.

Boltz, L. O., Yadav, A., Dillman, B., & Robertson, C. (2021). Transitioning to remote learning: Lessons from supporting K-12 teachers through a MOOC. *British Journal of Educational Technology, 52*(4), 1377-1393. https://doi.org/10.1111/bjet.13075

Chajewski, M., Mattern, K. D., & Shaw, E. J. (2011). Examining the role of Advanced Placement® exam participation in 4-Year college enrollment. *Educational measurement, issues and practice, 30*(4), 16-27. https://doi.org/10.1111/j.1745-3992.2011.00219.x

Chau, P. Y. K. (1996). An empirical assessment of a modified technology acceptance model. *Journal of management*

information systems. 13, 195-204.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS quarterly,* 319-340.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340. https://doi.org/10.2307/249008

Duffett, A., & Farkas, S. (2009). *Growing pains in the advanced placement program: Do tough trade-offs lie ahead?* Thomas B. Fordham Institute.

Hallett, R. E., & Venegas, K. M. (2011). Is increased access enough? Advanced placement courses, quality, and success in low-income urban schools. *Journal for the education of the gifted, 34*(3), 468-487. https://doi.org/10.1177/016235321103400305

Hone, K. S., & El Said, G. R. (2016). Exploring the factors affecting MOOC retention: A survey study. *Computers and education, 98*, 157-168. https://doi.org/10.1016/j.compedu.2016.03.016

Johnston, S., & Barbour, M. K. (2013). Measuring success: Examining achievement and perceptions of online advanced placement students. T*he American journal of distance education, 27*(1), 16-28. https://doi.org/10.1080/08923647.2013.755072

Joo, Y. J., So, H.-J., & Kim, N. H. (2018). Examination of relationships among students' self-determination, technology acceptance, satisfaction, and continuance intention to use K-MOOCs. *Computers and education, 122*, 260-272. https://doi.org/10.1016/j.compedu.2018.01.003

Jordan, K. (2014). Initial trends in enrolment and completion of massive open online courses. *International Review of Research in Open and Distance Learning, 15*(1), 133-160. https://doi.org/10.19173/irrodl.

v15i1.1651

Juan, C. R., Chiu, C. M., & Francisco, J. M. (2006). Understanding e-learning continuance intention: An extension of the technology acceptance model. *Human-computer studies, 64*, 683–696.

Kynge, L. (2020). Finding the best Way to deliver online educational content in low-resource settings: Qualitative survey study. *JMIR medical education, 6*(1), e16946-e16946. https://doi.org/10.2196/16946

Lan, M., & Hew, K. (2020). Examining learning engagement in MOOCs: A self-determination theoretical perspective using mixed method. *International Journal of Educational Technology in Higher Education, 17*, 7. https://doi.org/10.1186/s41239-020-0179-5

Lee, Y., Kozar, K. A., & Larsen, K. R. (2003). The technology acceptance model: Past, present, and future. *Communications of the Association for information systems, 12*(1), 50.

Lim, K. H. B., L. (2000). The effect of multimedia on perceived equivocality and perceived usefulness of information system. *MIS quarterly, 24*, 449-471.

Lin, J. C. L., H. . (2000). Towards an understanding of the behavioural intention to use a web site. *International journal of information management. 20*, 197-208.

Lin, Y.-L., Lin, H.-W., & Hung, T.-T. (2015). Value hierarchy for Massive Open Online Courses. *Computers in Human Behavior, 53,* 408-418. https://doi.org/10.1016/j.chb.2015.07.006

Lu, M., Zhao, H., Guo, Y., Wang, K., & Huang, Z. (2018, 8-11 Aug. 2018). A Review of the Recent Studies on MOOCs. *The 13th International Conference on Computer Science & Education (ICCSE)*, Sri Lanka, 2018, pp. 1-5. https://doi.org/10.1109/ICCSE.2018.8468793

Ma, L., & Lee, C. S. (2020). Drivers and

barriers to MOOC adoption: perspectives from adopters and non-adopters. *Online Information Review, 44*(3), 671-684. https://doi.org/10.1108/OIR-06-2019-0203

Mathieson, K. (1991). Predicting user intentions: Comparing the technology acceptance model with the theory of Planned Behavior. *Information Systems Research 2*(3):173-191. https://doi.org/10.1287/isre.2.3.173

Mohammadi, H. (2015). Investigating users' perspectives on e-learning: An integration of TAM and IS success model. *Computers in Human Behavior, 45*, 359-374. https://doi.org/10.1016/j.chb.2014.07.044

Najafi, H., Evans, R., & Federico, C. (2014). MOOC integration into secondary school courses. *The International Review of Research in Open and Distributed Learning, 15*(5).

Raffaghelli, J. E., Cucchiara, S., & Persico, D. (2015). Methodological approaches in MOOC research: Retracing the myth of Proteus. *British Journal of Educational Technology, 46*(3), 488-509. https://doi.org/10.1111/bjet.12279

Romero-Rodríguez, L. M., Ramírez-Montoya, M. S., & Aguaded, I. (2020). Determining factors in MOOCs completion rates: Application test in energy sustainability courses. *Sustainability (Basel, Switzerland), 12*(7), 2893. https://doi.org/10.3390/su12072893

Romero-Rodriguez, L. M., Ramirez-Montoya, M. S., & Gonzalez, J. R. V. (2020). Incidence of digital competences in the completion rates of MOOCs: Case study on energy sustainability courses. *IEEE Transactions on Education, 63*(3), 183-189. https://doi.org/10.1109/TE.2020.2969487

Sadler, P. M., Sonnert, G., Tai, R. H., & Klopfenstein, K. (2010). *AP: A critical examination of the advanced placement program*. Harvard Education Press.

Szajna, B. (1994). Software evaluations and choice: predictive validation of the technology acceptance instrument. *MIS quarterly, 18*, 319-324.

Tai, R. H. (2008). Posing tougher questions about the Advanced Placement program. *Liberal Education, 94*(3), 38.

Tamjidyamcholo, A., Gholipour, R., & Kazemi, M. A. (2020). Examining the Perceived Consequences and Usage of MOOCs on Learning Effectiveness. *Iranian journal of management studies, 13*(3), 495-525. https://doi.org/10.22059/ijms.2020.281597.673640

Teo, T. (2006). Attitudes toward computers: A study of post-secondary students in Singapore. *Interactive Learning Environments, 14*(1), 17-24. https://doi.org/10.1080/10494820600616406

Terras, M. M., & Ramsay, J. (2015). Massive open online courses (MOOCs): Insights and challenges from a psychological perspective. *British Journal of Educational Technology, 46*(3), 472-487. https://doi.org/10.1111/bjet.12274

Tzouveli, P., Mylonas, P., & Kollias, S. (2008). An intelligent e-learning system based on learner profiling and learning resources adaptation. *Computers & Education, 51*(1), 224-238. https://doi.org/10.1016/j.compedu.2007.05.005

Ullah, M. S., Hoque, M. R., Aziz, M. A., & Islam, M. (2023). Analyzing students' e-learning usage and post-usage outcomes in higher education. *Computers and education open, 5*, 100146. https://doi.org/10.1016/j.caeo.2023.100146

Venkatesh, V. M., M. G. (2000). Why don't men ever stop to ask for directions? Gender, social influence ,and their role in technology acceptance and usage behavior. *MIS quarterly, 24*, 115-139.