International Journal of Advanced Trends in Computer Science and Engineering

Explaining Continuance Intention of a Cloud-Based Virtual Learning Environment with Psychological Ownership and the Technology Acceptance Model

Joanne Sau-Ching Yim[1], Priscilla Moses[2], Alia Azalea [3]

[1]Faculty of Social Science, Arts and Humanities, Tunku Abdul Rahman University College, Malaysia,
[2]Faculty of Creative Industries, Universiti Tunku Abdul Rahman, Kampar, Malaysia , yimsc@tarc.edu.my
[3]Faculty of Arts and Social Science, Universiti Tunku Abdul Rahman, Kampar, Malaysia, yimsc@tarc.edu.my

ABSTRACT

This study investigated teachers' intention to continue using a cloud-based Virtual Learning Environment (VLE) by incorporating the theory of psychological ownership and the Technology Acceptance Model (TAM). Psychological ownership refers to a sense of ownership where people feel psychologically attached to a particular object, and this concept is becoming increasingly relevant in technology adoption research. The study proposed that such phenomenon can also occur when teachers use a cloud-based VLE. Hence, a hypothesized model was tested with 402 practicing teachers from Malaysia. Measures were adapted and adopted from established scales used in previous research. Results from Partial Least Squares Structural Equation Modeling approach affirmed the potential effect of psychological ownership and its antecedents as external variables of TAM. Overall, the model explained 69% variance of teachers' intention in continuing to use the VLE. This study advances the theory of psychological ownership in the technological context, with evidences obtained within the ambit of cloud-based VLE.

Key words : Continuance Intention, Psychological Ownership, Perceived Usefulness, Perceived Ease of Use, Technology Acceptance Model.

1. INTRODUCTION

The Malaysian government implemented the 1BestariNet (1SmartNet) project, a large-scale project which made Malaysia the first in the world to connect the learning community in the country with a single cloud-based VLE (cVLE), the Frog VLE. The platform connects the Malaysian learning community of about 10,000 public schools, 5.5 million students, 500,000 teachers, and 4.5 million parents [1]. Globally, Frog VLE is being used by 12,000 schools, with more than 20 million users across 23 countries [2].

One of the critical problems facing information and communication technology (ICT) in education in Malaysia is the low adoption of these facilities by stakeholders [1]. The country is one of the pioneers in Asia to have in place strategic ICT plans in its education development [3]. Despite having an array of policies since the 1990s, teachers are not maximizing the adoption of technology in schools [1]-[3]. Hence, it is important to examine teachers' intention to continue using this cVLE, to understand and bridge the gaps between education policy planning and implementation.

Research on cVLE noted the critical roles teachers play when integrating the technology in their classrooms [4]. Teachers' control over cVLE implementation was found significant to its success, as they adapt their teaching to a virtual environment [4]. Apart from this, teachers' perceptions of a cVLE also affect their instructional effectiveness [1]. Scholars have found that perception of a cVLE's usefulness, ease of use, and attitude toward using cloud functionalities are instrumental in determining users' intention to replace traditional Learning Management System tools with cVLE [5]. However, studies on virtual learning environment mostly emphasized the perspective of students, university instructors or pre-service teachers, with little focus on the views of practicing school teachers [1].

The long-term sustainability of any technology is hinged on its continued usage [6]-[7], especially for teachers who master-mind the organization and planning of lessons for instructional practices. As such, this study aims to investigate teachers' intention to continue using a cVLE with the theory of psychological ownership and the Technology Acceptance Model in a non-mandatory use context.

2. LITERATURE REVIEW

2.1 Psychological ownership

Psychological ownership (PO) is the feeling of being psychologically tied to an object [8], a psychologically experienced phenomenon distinct from legal ownership, where individuals develop a sense of ownership toward a tangible or intangible object [9]. PO is becoming a relevant phenomenon in technology adoption research as individuals become reliant on technology, making it necessary in daily lives. Scholars had suggested that individuals can be psychologically tied to a particular technology, where the self becomes intertwined with a psychologically owned object [8]-[9]. Research had also demonstrated the potential of PO as a pertinent factor in affecting users' behavior, with different technologies as potential targets of ownership [10]-[11].

Existing literature has identified three key experiences for developing PO toward an object: (a) experienced control, (b) coming to intimately know, and (c) investment of the self [8], [9]-[13]. Experienced control refers to a personal sense of control over a particular object experienced through its functional use, which brings about a feeling of possessiveness [9, 13]. Coming to intimately know can be equated to having knowledge that concerns the breadth and depth of knowing an object, promoting familiarity and a sense of ownership toward the particular object [9]-[13]. Self-investment reflects users' personal investment of their time, ideas, efforts, and aspects of themselves into an object [8]-[13].

Teachers potentially encounter these three key experiences for developing PO as they use the Frog VLE. A cVLE which is built through deliberate users' actions operate on the control of teachers when they create learning contents for instructional purposes. Teachers have varying degrees of control on the interactivity in the platform, which may foster the emergence of PO for the cVLE. To operate effectively within this platform, knowledge about this cVLE is essential to use the applications and software that run through the cloud. Such complex tasks require more discretion from teachers, making it more likely they will invest more time, effort and intellectual ability. When teachers customize cVLE content and spaces, they may feel psychological attachment toward their ideas, designs, and intellectual contributions. The resultant cVLE content will embody their desired outcome, hence, teachers can develop a sense of PO for the cVLE.

2.2 Technology Acceptance Model (TAM)

TAM holds that users' beliefs of perceived usefulness (PU) and perceived ease of use (PEU) are direct antecedents of attitude toward use (ATT), which in turn influence intention to use, and henceforth affect system use [13]. PU is the belief that technology will help people to improve their work performance, while PEU is the belief that using a particular technology is free of effort [14]. ATT is the positive affect associated with using a technology, while intention to use describes an individual's willingness to use a technology [14]-[15]. TAM is a parsimonious and theoretically justified model, making it a good ground theory to investigate users' decision in using a specific e-learning technology.

Studies in e-learning continuance had found TAM suitable for explaining users' continuance intention [7]-[16]. However, some research had disregarded PEU on the premise that its importance may wear off as users become acquainted with the technology [6]. This study however chose to include this factor because a cVLE is an innovative technology which consists of various software applications and services that run through the cloud [17]. Users must be skilled at using these tools, and a recent local study had found teachers still lacked competency and needed training on the cVLE [4], suggesting PEU need to be included because it taps into the efficacy

dimension [14].

There is a dearth of studies involving PO in TAM, and the existing ones only involved separate variables of TAM (Table 1). Hence, this study will investigate PO with TAM in its totality to assess its applicability to explain continuance intention.

Table 1: Previous Studies which integrated PO in TAM

Authors	Context	Findings
Barki, Paré, Sicotte (9)	Clinical information system	PO influences PEU and PU
Zhao, Chen & Wang (11)	Social media	PO influences continuance use
Karahanna, Xu, Zhang (17)	Social Media	PO influences usage
Smith, Grant, Ramirez (18)	Job order system for hospital lab tests	PO influences PU, PU influences use intention
Lee and Chen (9)	Virtual world	PO influences future use intention
Paré, Sicotte, Jacques (20)	Clinical information system	PO influences PEU and PU

2.3 Objective of the study

The chief objective of the study is to explain continuance intention with the concepts of PO and TAM. The following hypotheses will underpin the study to achieve this objective:

H1: Experienced control of cVLE has a significant influence on psychological ownership of cVLE.
H2: Knowledge about cVLE has a significant influence on psychological ownership of cVLE.
H3: Self-investment has a significant influence on psychological ownership of cVLE.
H4: Psychological ownership of cVLE has a significant influence on perceived usefulness.
H5: Psychological ownership of cVLE has a significant influence on perceived ease of use.
H6: Perceived ease of use has a significant influence on perceived usefulness.
H7: Perceived usefulness has a significant influence on attitude toward use.
H8: Perceived ease of use has a significant influence on attitude toward use.
H9: Perceived usefulness has a significant influence on continuance intention.
H10: Attitude toward use has a significant influence on continuance intention.

In sum, the connections between the hypotheses are based on the premise that teachers who experience control over a cVLE, has good knowledge about it, and have invested themselves into it will tend to develop feelings of PO for the cVLE. The PO developed will influence teachers' beliefs of perceived usefulness and perceived ease of use about the

system, affecting their attitude and consequently their intention to continue to use the platform. Figure 1 shows the proposed research model.
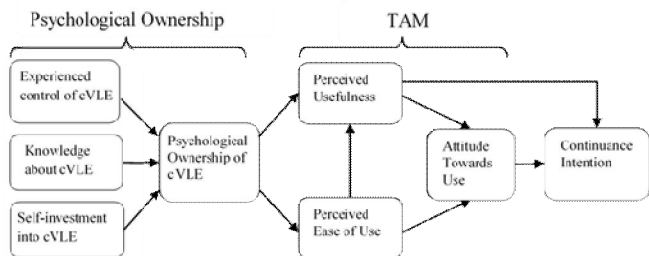

Figure. 1: Research Model

3. RESEARCH METHODS

3.1 Participants

The targeted population consisted of secondary school teachers in a Malaysian state. A sample size of 376 is derived with a formula [21], and satisfied 80% statistical power. Proportionate stratified sampling was employed to sample teachers from a list of ten school districts provided by the state education department. With this, 700 questionnaires were distributed with a return rate of 61%. The final sample was 402 after eliminating the unusable ones where data were screened for outliers and missing responses. Among the respondents, there were 300 (74.6%) females and 102 (25.4%) males with an average age at 40.81 years old (SD = 8.46), a mean teaching experience of 15.98 (SD = 8.50) years, and an average of 3.84 years of experience (SD = 1.64) in using the cVLE.

3.2 Measure

The instrument consisted of scales validated from published sources [6]-[7], [10]-[13], [2],-[23]. Items were measured with a seven-option Likert scale which anchored between 1 = strongly disagree and 7 = strongly agree. Three subject matter experts reviewed these items to ensure they represent the intended area of investigation. The instrument was also subjected to a pre-test involving seven teachers to identify issues on the questionnaire. In addition, a pilot test with 67 teachers was also carried out and Cronbach alpha of constructs were satisfactory with values that ranged between 0.890 and 0.965 [24].

4. DATA ANALYSIS

4.1 Multivariate assumption

Data were subjected to assessment of multivariate skewness and kurtosis using an online software available at https://webpower.psychstat.org. The results showed that distributions were non-normal as indicated by Mardia's multivariate skewness ($\beta = 10.502$, p < 0.01) and kurtosis ($\beta =$

131.560, p < 0.01). Hence, the non-parametric analysis software SmartPLS 3.2.6 was used to analyze the data, and significance of path coefficients was tested with bootstrapping method of 5000 resamples.

4.2 Assessment of measurement model

Internal consistency of the constructs was evaluated with composite reliability (CR), and Cronbach's alpha (α), while convergent validity was established with average variance extracted (AVE). Table 2 shows these values satisfied the stipulated requirements [24]. For discriminant validity, the square roots of AVEs were greater than the correlations between the constructs and other constructs implying these constructs are distinctively different from one another. This is further supported with heterotrait-monotrait (HTMT) in Table 2 with values lower than HTMT .85 [24].

Table 2: AVE, CR and HTMT Ratios of Constructs

Factors	AVE	CR	α	Heterotrait-Monotrait (HTMT)							
				1	2	3	4	5	6	7	8
1. EC	0.78	0.94	0.91								
2. KN	0.81	0.94	0.92	0.69							
3. IN	0.86	0.96	0.94	0.65	0.83						
4. PO	0.73	0.94	0.93	0.71	0.75	0.78					
5. PEU	0.81	0.96	0.94	0.67	0.69	0.72	0.79				
6. PU	0.85	0.97	0.96	0.64	0.71	0.72	0.80	0.79			
7. ATT	0.89	0.96	0.94	0.61	0.63	0.66	0.76	0.84	0.78		
8. CI	0.83	0.96	0.95	0.63	0.65	0.66	0.80	0.79	0.77	0.85	

Note: EC = Experienced Control; KN = Knowledge about cVLE; IN = Self-Investment; PO = Psychological Ownership; PEU = Perceived Ease of Use; PU = Perceived Usefulness; ATT = Attitude towards Use; CI = Continuance Intention

4.3 Assessment of structural model

First, multicollinearity was assessed where the highest Variance Inflation Factor (VIF) was 2.8, lower than the threshold of 3.3 [25]. Table 3 shows the results of path co-efficient (β) assessment where all hypotheses were significant (t > 1.96). The magnitude of the exogenous construct on the endogenous construct was assessed with effect size (f^2) according to the criteria of small = 0.02, medium = 0.15, and large = 0.35 [24]. There were three relationships with large effect sizes: PO had the largest effect on PEU, followed by the effect of ATT on CI, and PEU on ATT. Other relationships recorded effect sizes of small and medium as shown in Table 3. Overall, the model explained 69% of variance in continuance intention.

5. DISCUSSION OF RESULT

Overall, results supported the central premise of the study that PO which is brought about by experienced control, knowledge, and self-investment were significant drivers for user' beliefs (PEU and PU).

Table 3: Path Co-efficient Assessment

Hypotheses	β	SE	t-value	f^2	R^2
H1 EC → PO	0.28	0.05	5.36**	0.12	0.62
H2 KN → PO	0.21	0.07	2.80**	0.04	
H3 IN → PO	0.40	0.07	5.82**	0.16	
H4 PO → PEU	0.74	0.04	20.99**	0.71	0.55
H5 PO → PU	0.43	0.06	7.83**	0.25	0.65
H6 PEU → PU	0.43	0.05	8.03**	0.24	
H7 PEU → ATT	0.53	0.07	8.23**	0.37	0.67
H8 PU → ATT	0.34	0.06	5.33**	0.15	
H9 PU → CI	0.30	0.05	5.56**	0.13	0.69
H10 ATT → CI	0.59	0.05	10.95**	0.52	

Note: ** t-value > 1.96

Users' beliefs subsequently influenced ATT and consequently their continuance intention. In testing H1 to H3, the three key experiences had significant effects on PO. Self-investment explained the largest variance in PO (β = 0.40, p < .001), which is consistent with prior research [11]. Teachers invest themselves into a cVLE when they create virtual spaces and learning contents, facilitated by seamless access to resources. This finding supported the proposition of the theory of ownership, that the act of creation is one of the most profound means by which individuals invest themselves into an object [8]-[9].

This suggests that incentives can be provided to teachers to encourage contribution of effort, time, and ideas into the cVLE, while cloud service providers can reward teachers' contribution with recognition badges or points to redeem products from the app store. In testing H4 and H5, PO significantly influences PEU, and to a lesser degree, on PU. Results supported the notion that individuals evaluate their possessions more favorably than unowned ones [8]-[10]. PO has a profound influence on PEU reflected by it having the largest effect size among other hypothesized relationships. Hence, teachers with high PO toward the cVLE will tend to perceive higher ease of use of the system. Further, PEU is a significant determinant of PU, supporting H6 while implying that perceived ease of use is a pre-requisite for perceived usefulness [2]-[27].

For H7 and H8, both PEU and PU significantly affect ATT with PEU having a larger effect on it than PU. While these significant relationships are consistent with the TAM's proposition [14]-[28], not all studies showed the same support. Some studies found that PEU was not a significant factor in e-learning systems which were implemented earlier [15]-[16]. It was suggested that PEU is more applicable for new users, because the importance of ease of use will 'wear off' over time when users gain experience in using the technology. However, in the case of this study, experience gained did not seem to diminish the importance of ease of use although teachers have used Frog VLE for an average of 3.84 years since it was introduced 5 years ago. This difference may be attributed to the nature of cVLE being an innovative learning environment, which consists of a high degree of functionality using different applications to customize features and learning activities [17]. Hence, fundamental

competencies are still needed to navigate and apply these tools, and teachers will more likely to continue using the cVLE if they can use it without any difficulties.

The results also supported H9 and H10, concurring with research which found continuance intention to be significantly influenced by PU and ATT [29-32]. H10 had the largest effect size among the hypothesized relationships between the TAM variables, consistent with research on continuance intention of e-learning systems [1], [30]-[32]. Overall, findings affirmed the hypothesized relationships of TAM, supporting the belief-attitude-intention paradigm of human behavior which underlies the theory.

6. CONCLUSION

This study tested a model which explained 69% of variance in continuance intention. Findings demonstrated the potential of PO as a viable construct in enhancing the predictive ability of the TAM to explain teachers' continuance intention in a cVLE. Practical implications of the study are that continuous training programmes will be important even for teachers who had experience with the cVLE. Cloud-based VLEs consist of an array of subscribed virtualised resources, software and applications provided by cloud services. These applications and functionalities in a cVLE have to be relatively easy to apply and navigate (PEU), without which will affect teachers' attitudinal appraisal toward it (ATT), which in turn may affect their decision to continue using the platform.

The study had also given a fresh perspective of users' continuance intention through the lens of PO. Users can develop a psychological connection to a cVLE platform, which can result in their favourable opinion about the platform. Cloud application developers can enhance ownership by improving users' experiences of being in control, having knowledge, and self-investment into the platform. As human reliance on technology is inevitable, this study advances the technology adoption literature in understanding behaviour related to human interactions with technology. Thus, providing a point of departure in discussing the prevalence of psychological ownership in continuance intention in technology. Even though evidences on the construct measures demonstrated defensible levels of reliability and validity, replication of study in a larger scale is necessary to ensure external validity to lend confidence to inferences drawn from the study.

ACKNOWLEDGEMENT

REFERENCES

1. Hew TS & Kadir SA (2016), **Predicting instructional effectiveness of cloud-based virtual**. Industrial Management & Data Systems 116, 1557-1584
https://doi.org/10.1108/IMDS-11-2015-0475

2. FrogAsia. (2014), **About us**, Retrieved from Retrieved from https://www.frogasia.com/v3/aboutus/

3. United Nations Educational, **Scientific and Cultural Organization** (UNESCO) (2013), Malaysia education policy review abridged report.

4. Cheok ML & Wong SL, **Frog Virtual Learning Environment for Malaysian schools**: Exploring teachers' experience. Springer Singapore, (2016), pp:201-209.
https://doi.org/10.1007/978-981-10-0373-8_10

5. Stantchev V, Colomo-Palacios R, Soto-Acosta P & Misra S (2014**), Learning management systems and cloud file hosting services**: A study on students' acceptance. Computers in Human Behavior 31, 612-619.
https://doi.org/10.1016/j.chb.2013.07.002

6. Bhattacherjee A (2001), **Understanding information systems continuance:** An expectation-confirmation model. MIS Quarterly 25, 351-370.
https://doi.org/10.2307/3250921

7. Roca J, Chiu CM & Martı́nez FJ (2006), **Understanding e-learning continuance intention: An extension of the Technology Acceptance Model**. International Journal of Human-Computer Studies 64, 683-696.
https://doi.org/10.1016/j.ijhcs.2006.01.003

8. Pierce JL, Kostova T & Dirks KT (2001), **Toward a theory of psychological ownership in organizations**. The Academy of Management Review 26, 298-310.
https://doi.org/10.5465/amr.2001.4378028

9. Pierce JL & Jussila I, **Psychological ownership and the organizational context: Theory, research evidence, and application. Edward Elgar Publishing Limited**, Cheltenham, (2011)
https://doi.org/10.4337/9780857934451

10. Barki H, Paré G & Sicotte C (2008**), Linking IT implementation and acceptance via the construct of psychological ownership of information technology. Journal of Information Technology** 23, 269-280.
https://doi.org/10.1057/jit.2008.12

11. Zhang TX, Agarwal R & Lucas H (2011**), The value of IT-enabled retailer learning: Personalized product recommendations and customer store loyalty in electronic markets**. MIS Quarterly 35, 859-881.
https://doi.org/10.2307/41409964

12. Zhao Q, Chen CD & Wang JL (2016), **The effects of psychological ownership and TAM on social media loyalty: An integrated model. Telematics and Informatics** 33, 959-972.
https://doi.org/10.1016/j.tele.2016.02.007

13. Brown G, Pierce JL & Crossley C (2014), **Toward an understanding of the development of ownership feelings. Journal of Organizational Behavior** 35, 318-338.
https://doi.org/10.1002/job.1869

14. Davis F, Bagozzi R & Warshaw P (1989**), User acceptance of computer technology: A comparison of two theoretical models. Management Science** 35, 982-1003.
https://doi.org/10.1287/mnsc.35.8.982

15. Wang WT & Wang CC (2009), **An empirical study of instructor adoption of web-based learning systems. Computers & Education** 53, 761-774.
https://doi.org/10.1016/j.compedu.2009.02.021

16. Lin K (2011). **E-Learning continuance intention: Moderating effects of user e-learning experience. Computers & Education** 56, 515-526.
https://doi.org/10.1016/j.compedu.2010.09.017

17. Shiau W & Chau PY (2016), **Understanding behavioral intention to use a cloud computing classroom: A multiple model comparison approach. Information & Management** 53, 355-365.
https://doi.org/10.1016/j.im.2015.10.004

18. Karahanna E, Xu SX & Zhang N (2015**), Psychological ownership motivation and use of social media. Journal of Marketing Theory and Practice** 23, 185-207.

19. Smith T, Grant G & Ramirez A (2014), "**Investigating the influence of psychological ownership and resistance on usage intention among physicians"**. Proceedings of the 47th Hawaii International Conference on System Science, Hawaii, US.
https://doi.org/10.1109/HICSS.2014.351

20. Lee Y & Chen AN (2011), **Usability design and psychological ownership of a virtual world. Journal of Management Information Systems** 28, 269-307.
https://doi.org/10.2753/MIS0742-1222280308

21. Paré G, Sicotte C & Jacques H (2006), **The effects of creating psychological ownership on physicians' acceptance of clinical information systems. Journal of `the American Medical Informatics Association** 13, 197-205.
https://doi.org/10.1197/jamia.M1930

22. Krejcie R & Morgan D (1970), Determining sample size for research activities. Educational and Psychological Measurement 30, 607-610.
https://doi.org/10.1177/001316447003000308

23. Loyd B & Gressard C (1984), **Reliability and factorial validity of computer attitude scales. Educational and Psychological Measuremen**t 44, 501-505.
https://doi.org/10.1177/0013164484442033

24. Hair JF, Hult GM, Ringle CM & Sarstedt M, **A primer on partial least squares structural equation modeling (PLS-SEM).** Thousand Oaks, CA: Sage Publications (2017).
https://doi.org/10.15358/9783800653614

25. Diamantopoulos A & Siguaw JA (2006), **Formative vs reflective indicators in measure development: Does the choice of indicators matter? British Journal of Management** 13, 263-282.
https://doi.org/10.1111/j.1467-8551.2006.00500.x

26. Moses P, Wong SL, Bakar K & Mahmud R (2013), **Perceived usefulness and perceived ease of use: Antecedents of attitude towards laptop use among**

science and mathematics teachers in Malaysia. Asia Pacific Education Researcher 22, 293-299.
https://doi.org/10.1007/s40299-012-0054-9

27. Elyazgi M (2018), **Validating pupil's behavior intention to use e-book technology in their learning. International Journal of Engineering & Technology** 7(2), 511-518.
https://doi.org/10.14419/ijet.v7i2.29.13810

28. Ooi KL, Hew JJ & Lee VH (2018), **Could the mobile and social perspectives of mobile social learning platforms motivate learners to learn continuously? Computers & Education** 120, 127-145.
https://doi.org/10.1016/j.compedu.2018.01.017

29. Wu B & Zhang C (2014), **Empirical study on continuance intentions towards E-Learning 2.0 systems. Behaviour & Information Technology** 33(10), 1027-1038.
https://doi.org/10.1080/0144929X.2014.934291

30. Rodríguez-Ardura I & Meseguer-Artola A (2014), **What leads people to keep on e-learning? An empirical analysis of users' experiences and their effects on continuance intention. Interactive Learning Environments** 24(6), 1030-1053.
https://doi.org/10.1080/10494820.2014.926275

31. Alraimi KM, Zo H & Ciganek AP (2015**), Understanding the MOOCs continuance. Computers & Education** 80, 28-38.
https://doi.org/10.1016/j.compedu.2014.08.006

32. Cheung R & Vogel D (2013), **Predicting user acceptance of collaborative technologies: An extension of the technology acceptance model for e-learning. Computers & Education** 63, 160-175.
https://doi.org/10.1016/j.compedu.2012.12.003