

The mediating role of motivation for creative performance of cloud-based m-learning

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The purpose of this study was to investigate the predictability of cloud-based m-learning for creative performance, and the mediating effect of motivation. The participants were 116 college students, who participated in the pre-test and post-test of a teaching experiment. The conclusions of this study are as follows: (1) cloud-based m-learning has a significant positive effect on the motivation of students, particularly on expectancy and affect; (2) cloud-based m-learning has a significant effect on the creative performance of students, particularly on elaboration and novelty; and (3) cloud-based m-learning exhibits predictability for creative performance and affects creative performance through using motivation as a mediator.

Introduction

In the era of a knowledge-based economy under the influence of globalisation and information, cultivating creativity is the top priority for excelling in the face of fierce competition (European Union, 2016; Gaspar & Mabic, 2015; Janger, Schubert, Andries, Rammer, & Hoskens, 2017). Considering the close connection between motivation and creativity (Amabile, 1996), enterprises and educational institutions have adopted various strategies to motivate individuals and ultimately promote creative performance (Gajda, 2016; Horng, Tsai, Yang, Liu, & Hu, 2016). Amid the rapid development of cloud computing technologies, many countries have invested heavily in developing cloud-related industries and cloud-based education (National Science Foundation, 2016). For example, the United States Federal Government now spends approximately 8.5% of its budget on providing services, such as cloud computing (The White House, 2016). The Ministry of Education of Taiwan has pledged, in its Plan to Promote Cloud-Based Applications and Platform Services in Education, to spend US\$34 million over 5 years to build a national cloud-based service for schools (Ministry of Education, 2013). Cloud-based mobile learning (m-learning) can have multiple effects. In addition to motivating students, inspiring creativity, and inducing creative performance, cloud-based m-learning can have various qualitative and quantitative effects (Lin, Wenb, Jou, & Wub, 2014).

Resources often employed to support cloud-based m-learning include cloud storage, professional knowledge databases, communication and interaction interfaces, and creative thinking software (Lin et al., 2014; Zurita, Baloian, & Frez, 2014). In addition, cloud-based m-learning is particularly suitable for engaging in cooperative and constructivist learning (Chang & Yu, 2015; Shorfuzzaman, Alelaiwi, Masud, Hassan, & Hossain, 2015; Wang & Jou, 2016). Therefore, this study explored the influence of cloud-based m-learning on the motivation and creative performance of learners. The results can contribute to building a theoretical framework regarding creativity and a designing framework for teaching practice.

Literature review

Cloud-based m-learning

Cloud-based m-learning is learning that occurs through use of cloud-based services and mobile devices (Alexandru, Nicolae, & Loredana, 2013; García-Peñalvo, Johnson, Alves, Minović, & Conde-González, 2014; Shorfuzzaman et al., 2014). The integration of three types of cloud computing platforms, infrastructure as a service (IaaS), platform as a service (PaaS) and software as a service (SaaS), enables learners to use handheld digital devices (e.g., cell phones, laptops, and tablets) to obtain, process, share, and store information seamlessly. Thus, learners can complete learning tasks by connecting to remote hardware equipment (Chao et al., 2015; Lin et al., 2014; Wang & Jou, 2016).

The features of cloud-based m-learning include abundant resources (remote soft- and hardware), convenient access (anytime and anywhere), high interactivity (available for co-editing and sharing),

individualisation, and self-regulated and self-directed learning (Lin et al., 2014; Wang & Jou, 2016; Zurita et al., 2014). Creativity consists of four major components: (1) domain-relevant skills, (2) creativity-relevant processes, (3) task motivation, and (4) social environment (Amabile, 2012). These components can be fulfilled by using the features of and resources offered by cloud-based m-learning, which is beneficial for sharing professional knowledge, assisting in creative thinking (Karakaya & Demirkan, 2015; Pektas & Demirkan, 2011), building a creative culture within communities (Karakaya & Demirkan, 2015; Muldner & Burleson, 2015; Tsai, Horng, Liu, & Hu, 2015), fostering a creative environment (Chang, Chien, Yu, Lin, & Chen, 2016), and inspiring community members to develop creative motivations (Karakaya & Demirkan, 2015). Subsequently, creative processes and results can be improved. As a project, we conducted a teaching experiment in a university to examine the effects of cloud-based m-learning on students' motivations and creative performance based on following two hypotheses:

- H1. Cloud-based m-learning has a significant effect on motivation.
- H2. Cloud-based m-learning has a significant effect on creative performance.

Motivation

Motivation is a vital component of creativity and represents a force that drives individuals to engage in learning, inspiring individual passion for creative learning and creation tasks (Amabile, 2012). Many scholars assert that intrinsic motivation is essential in generating creativity, because such motivation can increase positive influences, cognitive flexibility, risk-taking abilities, and persistence (Horng et al., 2016). Empirical studies have indicated that motivation is correlated with creative behaviour (Horng et al., 2016; Soroa, Balluerka, Hommel, & Aritzeta, 2015). However, self-perceived creative behaviour does not necessarily equal creative performance. The ultimate goal of creativity is creative performance, namely, creative products (Gajda, 2016; Wallas, 1926). Therefore, the relationship between motivation and creative performance warrants further exploration (Gajda, 2016). After identifying the causal relationship between motivation and creative performance, we can improve creative performance by strengthening motivation.

Similar to approaches used in general investigations regarding the motivation that drives learning, scholars have employed intrinsic motivation as a principal factor when conducting motivation research on creative behaviour tendencies (Horng et al., 2016; Soroa et al., 2015). However, factors influencing creative performance are numerous, and both intrinsic and extrinsic motivation are vital (An, Song, & Carr, 2016; Gajda, 2016). Hence, integrating these two types of motivation can comprehensively explain the driving forces of creative behaviour (Pintrich, 1989; Song, Kalet, & Plass, 2016). The integrated motivational factors comprise three components, value, expectancy and affect (Pintrich, 1989), which can be measured using seven subscales (Erturan, Arslan, & Demirhan, 2014; Smith & Chen, 2015). In this study, we also used these three components as the basis for measuring motivation:

1. Value components: including intrinsic goal orientation, extrinsic goal orientation, and task value.
2. Expectancy components: including control of learning beliefs, self-efficacy for learning, and expectancy for success
3. Affective components: including test anxiety.

Creative performance

The ultimate purpose of creativity is the production of creative products (Wallas, 1926). The main characteristics of creative products are novelty and usefulness (Miron-Spektor & Beenen, 2015), although the features might vary slightly according to professional field. For example, the features of creative products in the fields of engineering and visual design might differ (Honziková & Krotký, 2017; Miron-Spektor & Beenen, 2015; Vuletic, Duffy, Hay, McTeague, & Pidgeon, 2018).

Furthermore, the purpose of product creativity assessment can also vary. For example, novelty and usefulness are valued when assessing the creative performance of students (Chang et al., 2016); when the purpose is to improve and commercialise products, social aesthetic requirements and elaboration are emphasised (Lan & Kaufman, 2013). Therefore, ratings are made based on novelty, resolution, and elaboration (Besemer, 1998), among other aspects (Miron-Spektor & Beenen, 2015). By adopting a

product design perspective, scholars have also subdivided product creativity into material, function, structure, and style factors (Chang & Yu, 2015). This division provides guidance for designers or learners to engage in creative design.

In addition, assessment tools, such as the Creative Product Semantic Scale (CPSS) (Besemer, 1998), Student Product Assessment Form (SPAF) (Reis & Renzulli, 1991), and Creative Idea Scale (CIS) (Chang & Yu, 2015), are used to assess creativity by examining the overall work or ideas. Nevertheless, these tools are also based on the framework of novelty, resolution, and elaboration. Therefore, we employed this framework to assess the creative performance resulting from cloud-based learning.

H3. Motivation has a mediating effect on the predictability of cloud-based m-learning for creative performance.

Method

In order to investigate the predictability of cloud-based m-learning for creative performance and the mediating effect of motivation, a teaching experiment was conducted in a university. A non-equivalent group, pre-test post-test, quasi-experimental research design was used in this experiment. In the pre-test of motivation, we collected scores from the first design homework assignment as the pre-test scores before conducting the teaching experiment. Following 9 weeks of experimentation, the created images were rated. These scores served as the post-test scores in the post-test of motivation.

Participants

The participants, who were first-year students drawn from four classes at a national university in Taipei City, Taiwan, were randomly assigned to either the experimental group or the control group. The experimental and the control groups consisted of 59 and 57 students, respectively, giving a total of 116 participants. In accordance with the research ethics rules of Center for Research Ethics (CRE), National Taiwan Normal University and the research ethics rules of Ministry of Science and Technology, all participants were over 18 years old, were advised that taking part in the teaching experiment was entirely voluntary, and that their participation would have no consequences on their studies or grades.

All participants were anonymously identified by codes so that their personal identities were not disclosed. For each participant, we obtained an informed consent. The collected data did not pertain to an investigation on the individual characteristics of each student. The data was collected and processed anonymously and exclusively at group level, and subject to scientific communication (oral and written). A scientific report was provided at the end of the study to share the results. Further, there was no conflict of interest.

Independent variable

In this study, the independent variable was teaching strategy. Both groups adopted the analyse-create-make three-step design program (Archer, 1984). In addition, participants in the experimental group adopted the cloud-based m-learning strategy, where cloud-based applications (Facebook, Mindomo, and Cubie) were used to facilitate creative design. The creative task was to use the computer software Adobe Photoshop to design an innovative and elaborate digital image possessing communicative features. Figures 1 to 3 show the software employed and the participants' work.



Figure 1. A mind map drawn using Mindomo



Figure 2. A screenshot of draft discussions that took place on Cubie



Figure 3. Digital images created by students

Facebook was used as a main platform for uploading, downloading, and sharing web resources, learning materials, and works. Mindomo was used to produce mind maps, and it helped participant students address creative ideas and co-work cooperatively. Finally, Cubie was used to interact synchronously by texts, figures, and sketches. Additionally, students could propose and refine novel design ideas by relay sketching collaboratively on Cubie. The main teaching procedures are listed in Table 1.

Table 1
Main teaching procedures

Phase	Step	Experimental Group	Control Group
Analysis	Data collection	<ol style="list-style-type: none"> 1. Introduction of the learning task. 2. Introduction of three cloud-based tools (Facebook, Mindomo, and Cubie). 3. Formation of groups on Facebook. 4. Downloading of resources, such as digital textbooks and image materials from Facebook. 	<ol style="list-style-type: none"> 1. Introduction of the learning task. 2. Teachers assign students to groups and make a group list. 3. Downloading of resources, such as digital textbooks and image materials.
Creation	Analysis	<p>During class:</p> <ol style="list-style-type: none"> 1. Teachers explained drawing techniques, media usage, creative techniques and the concept of design. <p>After class:</p> <ol style="list-style-type: none"> 2. Students used Mindomo to organise and analyse creative concepts regarding materials, composition, modelling, colour and ideas, before drawing mind maps. 3. Students used the Mindomo platform to create mind maps of their creative concepts by sharing and coediting the images with group members. 4. Students used Cubie software to draw out their creative concepts and discuss them with their group members. 	<p>During class:</p> <ol style="list-style-type: none"> 1. Teachers explained drawing techniques, media usage, creative techniques and the concept of design. <p>After class:</p> <ol style="list-style-type: none"> 2. Students organised and analysed creative concepts regarding materials, composition, modelling, colour, and ideas, before drawing mind maps. 3. Students shared and discussed their creative concepts in face-to-face discussions. 4. Students used paper and pen to write down their design concepts.
	Finalisation	<ol style="list-style-type: none"> 1. Students finalised the creative concepts of their works after using Cubie for a group discussion. 2. Students used references downloaded from Facebook to search for suitable materials or conducted independent Internet searches and shared the results. 	<ol style="list-style-type: none"> 1. Students voted on their preferred design concept maps to finalise the design concepts. 2. Students independently searched for the materials and resources that they needed.
Making	Development	<p>After class:</p> <ol style="list-style-type: none"> 1. Students began to draw their design and used Cubie to upload drafts and report on progress. 2. Students used Cubie to revise and discuss their design and used the drawing function to communicate creative concepts. 3. Students made revisions based on the advice provided by group members until the design was completed. 	<p>After class:</p> <ol style="list-style-type: none"> 1. Students began to draw their design and discussed progress periodically. 2. Students revised their works repeatedly based on advice provided by group members until the design was completed.

Presentation	Before class:	Before class:
	1. Students uploaded their work to Facebook.	1. Students uploaded their work to a shared folder.
	2. Students reviewed their peers' works and clicked "Like" on successful designs or offered compliments.	
	During class:	During class:
	3. Teachers and students used Facebook and screen broadcasting equipment to review all uploaded work.	2. Teachers and students used screen broadcasting equipment to review all uploaded work.
	4. Students used Google Form to complete a mutual group-peer assessment questionnaire.	3. Students used a mutual assessment form to assess peers' work.

Dependent variables

In this study, we employed a revised version of the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich, 1989; Wu & Cheng, 1992) to determine the motivation of students for digital image creation learning. The revised MSLQ consisted of three components, value, expectancy and affect, totalling 33 items. The factor analysis explained 62.03% of the variance, had a Cronbach's α for internal consistency of between .71 and .91, and showed satisfactory reliability and validity. Value component included three subscales: intrinsic goal orientation, extrinsic goal orientation, and task value. Expectancy component included three subscales: control of learning beliefs, self-efficacy for learning, and expectancy for success. Affect component included one subscale: test anxiety. Sample questions included:

- Mastering this learning content is important. (value component)
- I am sure I can perform excellent in this learning unit. (expectancy component)
- While facing exams, I always feel not well. (affect component)

For creative products, we used the creative indices for digital images developed by Chang (2002) as a basis, and included novelty (of materials and ideas), usefulness (communicability of meanings and liveliness of composition) and elaboration (of techniques) as the dimensions to be rated, adopting a 7-point Likert scale. The results of a pre-test showed the Cronbach's α for internal consistency of the rating mechanism was .88; the Kendall coefficient of concordance for inter-rater reliability was $W = .83$, indicating satisfactory reliability, greater than 0.70 (Amabile & Pillemer, 2012; Karakaya & Demirkan, 2015).

Data analysis

We conducted an analysis of covariance (ANCOVA) to explore the effects of cloud-based m-learning on motivation and creative performance, as well as the effects of motivation on creative performance. The results were used to test H1 and H2. In addition, regression analysis was performed to investigate whether learning motivation mediates the effect of cloud-based m-learning on creative performance, and whether cloud-based m-learning exhibits predictability for creative performance. The results were used to test H3.

Research results

Cloud-based m-learning and motivation

H1: Cloud-based m-learning has a significant effect on motivation.

The results of the multivariate ANCOVA showed a Wilk's Lambda of .05 ($p < .001$) and Eta squared of .95, thus indicating a significant effect (Murphy & Myers, 2004). The results of the univariate ANCOVA revealed that cloud-based m-learning had a moderately significant effect on the expectancy exhibited by the two groups of participants ($F = 8.61, p < .01$; Eta squared = .07) and a significant effect on affect ($F = 15.82, p < .01$; Eta squared = .12). The results of a post hoc comparison showed that the

experimental group exhibited motivation that yielded higher scores compared with the control group, for expectancy (63.98 > 59.76) and affect (24.74 > 21.08). Nevertheless, no significant difference existed in the value dimension ($F = 2.51$). The results are shown in Tables 2 and 3.

Cloud-based m-learning and creative performances

H2: Cloud-based m-learning had a significant effect on creative performance.

The results of the multivariate ANCOVA showed a Wilk’s Lambda of .81 ($p < .001$) and Eta squared of .19, indicating a significant effect (Murphy & Myers, 2004). The results of the univariate ANCOVA of the creative performance items showed that both groups exhibited creative performance indicating significant effects on elaboration ($F = 11.12, p < .01$; Eta squared = .09) and novelty ($F = 16.98, p < .01$; Eta squared = .13). By contrast, we determined a moderately significant effect on usefulness ($F = 4.11, p < .05$; Eta squared = .03). The results of a post hoc comparison showed that the experimental group had higher scores compared with the control group for elaboration (6.12 > 4.58), novelty (9.47 > 8.19) and usefulness (10.29 > 8.26). The results are shown in Tables 2 and 3.

Table 2
Descriptive statistics for motivation and creative performance

Item	Control Group (<i>n</i> = 57)					Experimental Group (<i>n</i> = 59)				
	Pre-test		Post-test		Adj <i>M</i>	Pre-test		Post-test		Adj <i>M</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Motivation	143.98	18.17	155.34	17.92	–	145.69	23.31	165.94	21.77	–
1. Value	66.86	11.78	73.15	8.82	74.21	67.92	13.07	76.08	11.04	75.64
2. Expectancy	57.15	8.60	59.98	7.89	59.76	57.12	10.83	63.52	8.88	63.98
3. Affect	21.03	4.20	22.20	3.47	21.08	20.01	3.80	24.34	5.00	24.74
Creative performance	18.59	4.19	20.17	6.53	–	19.06	5.92	25.62	5.68	–
1. Elaboration	4.05	1.25	4.62	1.70	4.58	4.01	1.43	5.71	1.43	6.12
2. Novelty	7.20	1.85	8.25	2.30	8.19	7.18	2.21	9.15	2.31	9.47
3. Usefulness	7.34	1.89	8.32	2.91	8.26	7.49	2.30	10.07	2.57	10.29

Table 3
ANCOVA of motivation and creative performance

Item	Source	Sum of Squares	<i>df</i>	Mean square	<i>F</i>	<i>p</i>	Eta sq	
Motivation	Value	Experimental treatment	253.57	1	253.57	2.51	.12	.02
		Error	12146.30	115				
	Expectancy	Experimental treatment	603.60	1	603.60	8.61**	.01	.07
		Error	8410.20	115				
	Affect	Experimental treatment	298.26	1	298.26	15.82**	.00	.12
		Error	2262.05	115				
Creative performance	Elaboration	Experimental treatment	25.35	1	25.35	11.12**	.00	.09
		Error	273.51	115				
	Novelty	Experimental treatment	85.24	1	85.24	16.98**	.00	.13
		Error	602.27	115				
	Usefulness	Experimental treatment	28.35	1	28.35	4.11*	.04	.03
		Error	827.06	115				

** $p < 0.1$, * $p < .05$.

Predictability of cloud-based m-learning for creative performance with motivation as a mediating factor

H3: Motivation has a mediating effect on the predictability of cloud-based m-learning for creative performance.

Using teaching strategy as the independent variable X, creative result as the dependent variable Y and motivation as the mediator M, we conducted three simple regressions and one multiple hierarchical regression. The findings showed that teaching strategy could predict creative performance ($b_c = .51, R^2 = .26, p = .000 < .01$) by explaining 26% variance. Teaching strategy could predict motivation ($b_a = .46, R^2 = .21, p = .000 < .01$) by explaining 21% variance. Motivation could predict creative performance ($b_b = .62, R^2 = .38, p = .000 < .01$) by explaining 38% variance. The results satisfied the three conditions of a mediating effect, as identified by Baron and Kenny (1986). Teaching strategy could predict motivation indirectly ($bc' = .47, R^2 = .22, p = .000 < .01$) by explaining 22% variance. The results of a multiple hierarchical regression showed the total effect of teaching strategy and motivation on creative results ($.51 + .46 \times .62 = .79$) (Path c + Path c'). The explained variance was 65.7%, as shown in Figure 4.

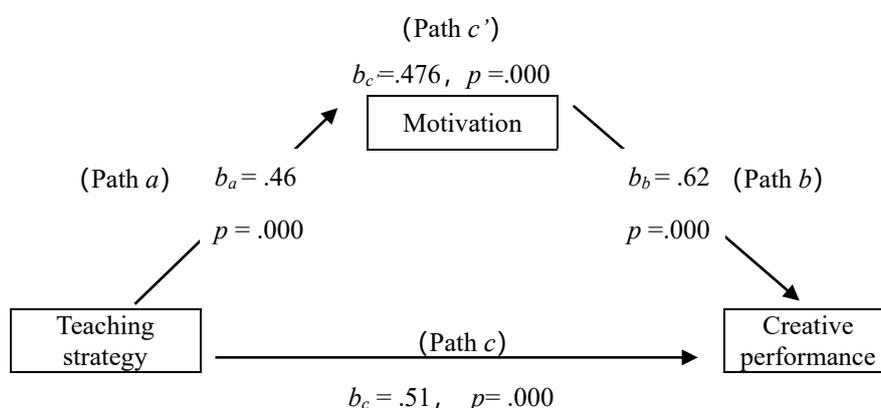


Figure 4. Paths of the effects of teaching strategy and motivation on creative performance

Discussion

Cloud-based m-learning and motivation

The results of this study showed cloud-based m-learning had a significant positive effect on the motivation exhibited by students. This finding is consistent with that of Jou and Wang (2013). In particular, the effects on expectancy and affect were significant. During the cloud-based m-learning conducted in this study, learners used the creative thinking software Mindomo to motivate creativity before using social networking software (Facebook and Cubie) to coedit and share the creative results. Therefore, learners could interact and cooperate with each other at any time, and observed the process of, and works created by, themselves and others. Therefore, learners felt less anxious and more comfortable and had an enhanced sense of self-worth, which is a positive feeling. Immediate appearance, participation, and response can strengthen motivation and reduce alienation, which were problems in previous types of online learning.

Cloud-based m-learning provides access to more relevant information (regarding methods and examples of creation) and resources (e.g., image materials), which enables learners to become more confident in completing the tasks (Cybulski, Keller, Nguyen, & Saundage, 2015). In addition, the high interactivity and cooperative creation that occur during the process of learning resulted in stronger group support and encouragement (Cybulski et al., 2015), thus motivating learners to continue participating (Lin et al., 2014). High expectancy and positive affect resulted in stronger motivation for creative activity and learning (Hadwin & Järvelä, 2011; Hew & Kadir, 2016; Nouri, Erez, Lee, Liang, Bannister, & Chiu, 2015).

Hence, the features of cloud-based m-learning, which include remote resource integration, high interactivity, coediting, and resource sharing, can effectively enhance the motivation of learners. Because the learning content presented to the two groups was controlled, the value that both groups of participants

placed on learning contents and processes did not differ significantly. In future research, researchers could combine the value of learning content and learning processes with cloud computing. For example, more suitable applications could be adopted, or the importance of the capacity of cloud computing highlighted. In this way, the value dimension of motivation can be enhanced.

Cloud-based m-learning and creative performance

The results of this study showed that cloud-based m-learning had a significant effect on the creative performance of students, particularly on elaboration and novelty. The influence on the usefulness dimension was moderate, because achieving usefulness requires professional know-how pertaining to design and sufficient basic training. The participants used creative thinking software (Mindomo) to jointly draw mind maps, and social networking software (Facebook and Cubie) to engage in real-time creative interactions and, ultimately, to generate new ideas or improve existing ones. Thus, the creative performance of the students improved. A real-time, free, equal, and criticism-free participation environment is a special feature of the cloud-based m-learning environment, which is beneficial for improving creative performance (Chang & Yu, 2015; Karakaya & Demirkan, 2015; Vuletic et al., 2018).

The knowledge-sharing, and constant discussion and revision, made possible by the cloud environment can improve the usefulness of creative performance (Chang & Yu, 2015; Miron-Spektor & Beenen, 2015). This finding was confirmed in the present study. Additionally, cloud-based m-learning can be conducted using updated applications (Chao et al., 2015). Choosing novel applications based on learners' creative cognition and thinking habits, as well as the features that characterise creation in various professions (e.g., product design, architectural design, and fashion design), can enhance creative performance significantly. Furthermore, employing remote physical machines and resources in cloud-based m-learning also greatly influences creative performance (Chao et al., 2015). For example, design products can be produced using cloud-based 3D printing and laser cutting.

The predictability of cloud-based m-learning for creative performance under the mediating effect of motivation

Under the mediating effect of motivation, the predictability of cloud-based m-learning for creative performance exhibited a total effect size of 0.79. Empirical research has also shown that adopting appropriate teaching strategies can effectively improve learners' creativity and motivation (Hong, O'Neil, & Peng, 2016). According to relevant literature, motivation is necessary for creativity and can be used to predict creative behaviour (Amabile, 2012; Gajda, 2016; Hennessey, 2015; Honziková & Krotký, 2017). However, the predictability of motivation for creative performance is not as strong (An et al., 2016). When individuals attempt to predict creative behaviour, the influence of intrinsic motivation (resulting from interest, enjoyment, satisfaction, and the challenge presented by the work itself) outweighs that of extrinsic motivation, although both types of motivation act as mediators (Amabile, 2012). When teachers and researchers use motivation to predict creative performance, they might need to use field knowledge as a mediator (An et al., 2016) or measure the influence of extrinsic motivation (e.g., goal-oriented incentives; An et al., 2016; Soroa et al., 2015). Hence, cloud-based m-learning has significant predictability for learners' creative performance under the mediating effect of motivation. In addition, intrinsic and extrinsic motivations play different and pertinent roles.

Conclusion and recommendations

This study investigated the predictability of cloud-based m-learning for creative performance and the mediating effect of motivation. In summary, the project can conclude that:

- Cloud-based m-learning has a significant positive effect on the motivation of students, with particularly significant effects on expectancy and affect. Teachers should choose appropriate applications with professional features to enable students to understand the value of learning content and learning processes.
- Cloud-based m-learning has a significant effect on the creative performance of students, with particularly significant effects on elaboration and novelty. Teachers can use professional software and cloud-based hardware to improve the usefulness of creative works.

- Cloud-based m-learning has predictability for creative performance and can influence such performance via the mediating factor of motivation. During instructional design, teachers should ensure that the tasks are not excessively difficult. During the process of teaching, teachers can induce intrinsic motivation at the creativity stimulation stage, thus ultimately enhancing creativity. At the product creation stage, teachers can use extrinsic motivation to encourage higher-quality work. Additionally, the “Like” function on social networking software, and the offering of compliments, can engender stronger intrinsic motivation in students.

The results of this study confirmed the effect of cloud-based m-learning in terms of fostering creativity in students. This approach should be widely adopted in schools. Combining the theories of creativity and motivation, and developing software that can be used for teaching at schools, are necessary for promoting creative, cloud-based mobile teaching in the future. Additionally, the learning task used in this study had a digital image design, which differs from actual product design and industrial design in terms of both materials and tools. Future studies should focus on different professional areas to examine the effects of various teaching models. In conclusion, our results could be used to enhance the effect of cloud-based m-learning on the creative performance of students engaged in various fields of study.

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