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A Study of the Effects of Digital Learning on Learning Motivation and Learning Outcome

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ABSTRACT
In the modern society when intelligent mobile devices become popular, the Internet breaks through the restrictions on time and space and becomes a ubiquitous learning tool. Designing teaching activity for digital learning and flexibly applying technology tools are the key issues for current information technology integrated education. In this study, students are tested and proceeded questionnaire survey to understand the opinions about digital learning. To effectively achieve the research objectives and test the research hypotheses, quasi-experimental research is applied in this study. Total 116 students in 4 classes are selected as the research subjects for the instructional research. The research results conclude that 1.digital learning presents better positive effects on learning motivation than traditional teaching does, 2.digital learning shows better positive effects on learning outcome than traditional teaching does, 3.learning motivation reveals significantly positive effects on learning effect in learning outcome, and 4.learning motivation appears remarkably positive effects on learning gain in learning outcome. It is expected to combine with current teaching trend and utilize the advantages of digital learning to develop practicable teaching strategies for the teaching effectiveness.
Keywords: digital learning, learning motivation, learning outcome

INTRODUCTION

In past years, the rapid revolution of the Internet and wireless communication technology has resulted in the emergence of various interactive multimedia networks, such as mobile learning, mobile voice, and instant messaging. Using the convenience and popularity of the Internet for applying digital teaching materials and achieving the objective of national competitiveness would replace traditional teaching. For this reason, a lot of research on mobile learning is proceeded in order to offer higher transmission performance and universal utilization. The technology of handy and portable PDAs and smart phones is getting mature that about everyone has a device in hand. Different from traditional mechanism to browse the

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State of the literature

- Computers and network technology media were applied to learning situations, including synchronous and asynchronous network learning, to break through the restrictions on time, location, and schedule.
- Diverse digital teaching materials are produced, and schools have actively introduced distinct digital teaching platforms to the instruction, expecting to promote students' learning outcome.
- In the era when knowledge and information flow rapidly, the application of digital learning covers different fields and industries. Based on distinct positions or points of view, the definitions are different.

Contribution of this paper to the literature

- Teachers matching with the class teaching to make good use of teaching strategies, according to the class climate and create the learning situation for students being willing to use digital learning so that students bravely propose questions in the discussion and increase the online interactive learning with teachers.
- The key in developing the effectiveness of digital learning on teaching lies in teachers. The promotion of digital learning could provide alternative innovation of class teaching.
- The design of teaching activity and the flexible application of technology tools or digital learning therefore become the primary issues for current information technology integrated education.

Internet, a user could link to the server, through the network, to select proper digital teaching materials for the learning; and the instant tests allow students controlling the contents of digital teaching materials. Accordingly, practical teaching strategies could be developed by combining with current teaching trend and extracting the advantages of digital learning to achieve the teaching effectiveness (Lai et al. 2012).

Under the climate with changing learning modes, the government and businesses have largely invested in the research and development of digital teaching platforms. The software and hardware for many digital teaching platforms have been developed, diverse digital teaching materials are produced, and schools have actively introduced distinct digital teaching platforms to the instruction, expecting to promote students' learning outcome. Utilizing the shared education resources on the computer network for shortening the urban-rural education gap has become a common trend globally. It is inevitable for teachers integrating information technology into subjects to assist in students' learning with teaching materials, teaching methods, and diversified teaching media. It is the common responsibility for educators to have teaching become more efficient, allow students being glad to learn, and cultivate the new generation with creative and rational communication and critical thinking with technologies and network information in the new era. Digital teaching aims to have students actively participate in learning activity to achieve the set learning outcome (Pai & Tu, 2011). The design of teaching activity and the flexible application of technology tools or digital learning therefore become the primary issues for current information technology integrated education.

LITERATURE REVIEW

Digital learning

Yoon et al. (2012) stated that digital learning (E-Learning) was first proposed by Jay Cross in 1999. With the advance and development of technology tools, it appeared different explanations and terminology, such as Internet-based training, web-based training, or on-line learning, network learning, distance learning. Doris Holzberger et al. (2013) regarded digital learning as delivery with digital forms of media (e.g. texts or pictures) through the Internet; and, the provided learning contents and teaching methods were to enhance learners' learning and aimed to improve teaching effectiveness or promote personal knowledge and skills. Basically, computers and network technology media were applied to learning situations, including synchronous and asynchronous network learning, to break through the restrictions on time, location, and schedule, and to achieve the learner-centered individualized learning (Kaklamanou et al., 2012). In the era when knowledge and information flow rapidly, the application of digital learning covers different fields and industries. Based on distinct positions or points of view, the definitions are different. The most representative one is the definition proposed by American Society of Training and Education (ASTD). It defines e-learning as the process learners applying digital media to learning. Digital media contain the Internet, corporate network, computers, satellite broadcasting, audiotapes, videotapes, interactive TV, and compact disks. The application includes network-based learning, computer-based learning, virtual classrooms, and digital cooperation. Anttila et al. (2012) regarded digital learning as a digital tool to acquire digital teaching materials for online or offline learning activity through wire or wireless networks (Hockly, 2012).

Current literatures therefore reveal different explanations of digital learning among domestic and international researchers. By comprehensively analyzing the viewpoints of several researchers, digital learning could be divided into four parts (Keane, 2012).

(1) Digital teaching materials: It emphasizes that learners could learn by extracting some digital teaching material contents. The so-called digital teaching material contents refer to e-books, digitalized data, or contents presented with other digital methods.

(2) Digital tools: It stresses on learners proceeding learning activity through digital tools, such as desktop computers, notebook computers, tablet computers, and smart phones.

(3) Digital delivery: It emphasizes that learners' learning activity could be delivered through the Internet, e.g. intranet, internet, and satellite broadcasting.

(4) Autonomous learning: It focuses on learners engaging in online or offline learning activity through digital learning by themselves. It stresses on personal autonomous learning and requires the participation of learners with autonomous learning to precede learning activity.

Learning motivation

Block et al. (2013) mentioned that the beginning and bottleneck stages of learning could be guided by extrinsic motivation. Once it became autonomous, extrinsic incentives would be unnecessary, but turned to autonomous learning. Both intrinsic and extrinsic motivation would complement one another. On the other hand, learning also requires some driving force and extrinsic motivation as it is common to learn for parent expectation, added objectives, and acquisition of some incentives. Learning motivation is a mediator between stimulation and reaction. In other words, learning motivation is a learner's individual opinions about affairs, and learners would present different knowledge acquisition needs because of distinct opinions. Karim (2012) regarded learning motivation as the inherent belief to guide individual learning goal, induce learning behaviors to make continuous efforts, reinforce cognition history, and strengthen and improve the learning outcome. Gruzd et al. (2012) argued that students would expect to receive incentives from others for the behaviors; in this case, learning was purposive, but could possibly be transformed from extrinsic into intrinsic motivation. Although students might not be autonomous, the acquisition of some achievement motivation or the transformation into the needs for self-growth in the learning process would be a good motivation internalization process. Ones with intrinsic learning motivation did not need incentives, could independently make decisions, and acquired fun and sense of achievement in the process. Extrinsic motivation, on the other hand, was the learning motivation induced by others' rewards or punishment and identity to certain behavioral value. Intrinsic motivation might be more autonomous and persistent with high value, but environmental factors could also influence motivation that incentives and external support were necessary (Im et al., 2011). Koff & Mullis (2011) regarded learning motivation as student intention or desire to participate in and make efforts on learning, which was performed on student choice of specific learning activity and the efforts on such activity. Learning motivation therefore is defined, in this study, as guiding students' continued learning and efforts on the learning goal set by teachers in the learning process. Chou et al. (2012) also proved that students preferred independently solving problems on certain work (the behaviors were driven by intrinsic motivation), but would be helped by teachers to solve some learning problems (the behaviors are promoted by external stimulation). In learning, students' intrinsic interests and teachers' or parents' extrinsic rewards could be cooperated to form the learning motivation. According to above research, intrinsic motivation and extrinsic motivation are used as the measure dimensions of learning motivation in this study.

Learning outcome

Katz et al. (2011) indicated that the words academic performance, learning outcome, academic achievement, or learning achievement expressed the same ideas, i.e. students' academic learning outcome, or the persistent result through learning history. Learning outcome is an indicator to measure learners learning effect (Lubega et al., 2014) as well as a major item for the evaluation of teaching quality. Learning outcome would be affected by learning mode, curriculum design, and teaching (Jude et al., 2014) that a lot of researchers

discussed the effects of personal characteristics or learning behaviors on learning performance. For example, Mostafa & Esmaeel (2012) discussed the effects of learning style on learning performance of medical students, and the relationship. Kristen (2011) explored the effects of ability, self-efficacy, and personal goal on effectiveness and discovered that learning outcome could indeed be affected by learner traits. Chesser (2011) discussed the effects of training methods, computers self-efficacy, and learning mode on learning outcome and found out higher learning performance of learners in favor of abstract concepts. Martin & Herrero (2012) also found out the significant differences between learning mode and learning outcome, but the effect of learning mode on learning outcome became insignificant after using multimedia assisted teaching materials. Hsu (2012) pointed out two dimensions in learning outcome.

(1) Learning effect—including test result, time for schedule completion, and academic achievement.

(2) Learning gain—containing learning satisfaction, achievement, and preference.

Learning effect and learning gain are therefore utilized as the measure dimensions of teaching effectiveness in this study.

Comparison between traditional teaching and digital learning

McKiernan (2011) pointed out various differences in teaching material contents, learning channels, and practice methods between traditional teaching and digital learning. For instance, learning contents focusing on convenience and flexibility were suitable for digital learning, while traditional teaching was better for courses which required practical operation or teamwork. Although digital learning could not completely replace traditional teaching, it could achieve the best teaching effect and have learners be glad to learn by reinforcing traditional teaching with digital learning and comprehensively practicing both methods in teaching activity. Yien et al. (2011) pointed out the difference between digital learning and traditional teaching in learning environment and persons. Traditional teaching, with "lecture" in classrooms, was the most traditional and representative teaching method. In short, it referred to instructors delivering teaching materials in the teaching activity to learners through interpretation. With the long history, it has been broadly applied and is still one of favorable teaching methods of instructors.

Sebastian et al. (2012) regarded digital learning as the learning mode the most rapidly developed in past years as well as the learning mainstream in the future. In addition to the time background, it was rapidly developed because it broke through traditional teaching modes and presented various strengths. Miyoshi et al. (2012) organized the advantages of digital learning for the comparison with traditional teaching. (1) Learning no problem: Digital learning allowed learners not being restricted on time and space as traditional learning so that learners could select the time and location for online learning and had no pressure and obstacle of time and space through the instructors' online interaction mechanism (Jude et al., 2014). (2) Rich network resources: The Internet covers rich and diverse information that learners could acquire data simply by searching key words. When a digital learning platform was able to

organize relevant resources for the use or connection of learners, network resources would be effectively applied through digital learning, and instructors or learners could acquire richer information beyond teaching materials in the curriculum to enhance the learning effect (Im et al., 2011). (3) Digital learning contents and tailored learning schedule: Learners were equally treated in traditional teaching for same teaching schedule and contents, regardless of learners' level. However, the curriculum design and the production of teaching materials for digital learning were digital contents that learners could freely select different courses and teaching materials, according to the level and preference, to achieve the tailored learning outcome (Sun et al., 2012). (4) Complete records of learners' learning history: A good digital learning platform should be able to completely record learners' learning history so that instructors could understand learners' learning conditions and learners could clearly realize the level or learning outcome for adjustment and improvement. (5) Interactive learning: Digital learning was self-learning that the production of teaching materials should cover more media pictures, sound, or images than traditional ones to generate more attractive and lively teaching materials. Moreover, digital teaching platforms would provide interactive functions like chat room and discussion for more two-way communication between learners and instructors and among learners (Hockly, 2012). (6) Reduction of teaching costs: The teaching material contents utilized in a digital teaching platform were kept as digital files that the completed teaching materials could be repeatedly utilized. In other words, the teaching material contents made by instructors before lessons allowed learners using for several times and learning repeatedly. Traditional teaching required all learners gathering at the same time and same place for the instruction that the teaching costs were increased. (7) Effective accumulation of knowledge: The digital learning mode could systematically and completely record all online teaching materials and learners' learning history. For learners, it could efficiently and step by step accumulated personal knowledge. For instructors, the teaching material contents could be effectively organized and accumulated through a digital learning platform and rapidly delivered to learners for effectively implementing knowledge management (Jude et al., 2014). (8) Enhancement of learning interests: Instruction could be more vivid and lively through information technology and the presentation of various media to enhance learners' interests, make learning more efficient, and promote learners' learning persistence (Kaklamanou et al., 2012). (9) Simultaneous new technology learning: Digital learning stressed on learners learning distinct knowledge and new technologies of computers and network with digital tools to promote the ability of using information technology (Shin et al., 2011). In summary, digital learning is attractive because the contents would not change with media or standards so that learners could easily operate to learn and break through the restriction on time and space for thorough learning and successful learning. Learning motivation allows students preparing for learning and would enhance the attention to and absorption of new knowledge. Consequently, in order to make the best efficiency in learning, Kuo (2011) proposed the model of motivation affecting effectiveness by understanding students' learning motivation to explain the relationship between motivation and effectiveness. Şahbaz (2012) revealed that students with

higher learning motivation would present higher learning outcome, i.e. positive correlations between learning motivation and learning outcome.

The following hypotheses are therefore proposed in this study.

H1: Digital learning shows better positive effects on learning motivation than traditional teaching does.

H2: Digital learning reveals better positive effects on learning outcome than traditional teaching does.

H3: Learning motivation presents significantly positive effects on learning effect in learning outcome.

H4: Learning motivation appears remarkably positive effects on learning gain in learning outcome.

RESEARCH METHODOLOGY

Measure of research variable

Learning motivation

Referring to Chou et al. (2012), learning motivation is divided into (1) intrinsic orientation and (2) extrinsic orientation in this study.

Learning outcome

Referring to Hsu (2012), (1) learning effect and (2) learning gain are contained.

Research subject and sampling data

To effectively achieve the research objective and test the research hypotheses, nonequivalent pretest posttest control group design is utilized for the quasi-experimental research. Total 116 students in 4 classes are selected as the research subjects, where 2 classes (58 students) in the experimental group are proceeded digital learning and the other 2 classes (58 students) in the control group remain traditional teaching method of lectures. The 32-week instructional research is preceded for 3 hours per week (total 96 hours). The computer statistics software SPSS is used for the data analysis, and Factor Analysis, Reliability Analysis, Regression Analysis, and Analysis of Variance are applied to test various hypotheses.

Analysis method

Analysis of Variance is applied in this study to discuss the effects of digital learning on learning motivation and learning outcome and Regression Analysis is further used for understanding the relationship between learning motivation and learning outcome.

Table 1. Variance analysis of digital learning on learning motivation

	Variable	F	P	Scheffe post-hoc
Digital learning	Intrinsic orientation	9.38	0.000*	digital learning (4.12)>traditional teaching (3.31)
	Extrinsic orientation	11.46	0.000*	digital learning (4.75)>traditional teaching (3.53)

* stands for p<0.05

Table 2. Variance analysis of digital learning on learning outcome

	Variable	F	P	Scheffe post-hoc
Digital learning	Learning effect	13.42	0.000*	digital learning (3.95)>traditional teaching (3.15)
	Learning gain	15.16	0.000*	digital learning (4.27)>traditional teaching (3.38)

* stands for p<0.05

ANALYSIS RESULT

Reliability and validity analysis

With Factor Analysis, learning motivation is extracted two factors of "intrinsic orientation" (eigenvalue=3.263, α=0.88) and "extrinsic orientation" (eigenvalue=2.841, α=0.83). The covariance accumulated achieves 81.623%.

Learning outcome, with Factor Analysis, is extracted two factors of "learning effect" (eigenvalue=2.533, α=0.86) and "learning gain" (eigenvalue=2.375, α=0.82). The covariance accumulated reaches 84.283%.

Effects of digital learning on learning motivation and learning outcome

1. Variance analysis of digital learning on learning motivation

Applying Analysis of Variance to discuss the difference of digital learning in learning motivation, **Table 1**, digital learning shows significant differences in intrinsic orientation (4.12), and is higher than traditional teaching (3.31); and, digital learning reveals remarkable differences in extrinsic orientation (4.75), and is higher than traditional teaching (3.53).

2. Variance analysis of digital learning on learning outcome

Analysis of Variance is utilized for discussing the difference of digital learning in learning outcome. From **Table 2**, digital learning appears notable differences in learning effect (3.95) and is higher than traditional teaching; and, digital learning shows significant differences in learning gain (4.27), and is higher than traditional teaching (3.38).

Correlation analysis of learning motivation and learning outcome

(1) Correlation analysis of learning motivation and learning effect

To test H3, the analysis results, **Table 3**, reveal remarkable effects of intrinsic orientation (β=2.136**) and extrinsic orientation (β=1.838*) on learning effect that H3 is supported.

Table 3. Analysis between learning motivation and learning outcome

Dependent variable→	**Learning outcome**			
Independent variable↓	**Learning effect**		**Learning gain**	
Learning motivation	**β**	**Beta**	**β**	**Beta**
Intrinsic orientation	2.136**	0.202	1.916*	0.182
Extrinsic orientation	1.838*	0.173	2.386**	0.217
F	28.46		36.25	
Significance	0.000***		0.000***	
R2	0.342		0.388	
Adjusted R2	0.031		0.036	

Note: * stands for p<0.05, ** for p<0.01.
Data source: Self-organized in this study

(2) Correlation analysis of learning motivation and learning gain

To test H4, the analysis results, **Table 3**, present notable effects of intrinsic orientation (β=1.916*) and extrinsic orientation (β=2.386**) on learning gain that H4 is supported.

CONCLUSION

The investigation reveals that students agree with the assistance of digital learning in the subject learning. Particularly, the increasing learning time for students with digital learning relatively enhances the learning performance.

It relies on teachers matching with the class teaching to make good use of teaching strategies, according to the class climate and create the learning situation for students being willing to use digital learning so that students bravely propose questions in the discussion and increase the online interactive learning with teachers. Integrating digital learning into class teaching does not simply benefit students, but teachers would also have different gains. In addition to the promotion of personal professionalism, teachers could perceive that students realize teachers' efforts and passion on teaching.

SUGGESTION

Aiming at above research results, the following suggestions are proposed in this study.

The teaching effectiveness could be enhanced merely when the system functions are rich and diverse to be close to user perception and attract students logging in the system for learning. In regard to the dilemma encountered in the mixed digital learning, the administration of schools could provide teachers with software and hardware support and assistance, according to the needs, to reduce the doubt of digital learning and, with encouragement, integrate teachers with interests to form an organization similar to professional communities to promote digital learning. After all, cooperation of a group could better prolong the management of digital teaching than an individual to significantly develop the teaching effect. When there is not a computer assisted teaching team to develop software, teachers could collect relevant resources from the Internet and self-develop software or make

web pages to achieve the information assisted teaching effect. What is more, the promotion of team teaching among teachers for collaborative development and promotion of learning web pages would be more productive and could benefit more students.

The key in developing the effectiveness of digital learning on teaching lies in teachers. In other words, the promotion of digital learning could provide alternative innovation of class teaching. Making changes in traditional teaching modes would encounter some difficulties, but such difficulties would be overcome when teachers often exchange teaching experiences with peers or experts or sharing and learning through web communities to advance the teaching methods and improve the classroom management as well as to present he professionalism and self-development. With the advance of information technology and the relevant technologies, digital learning would be accepted by students and teachers. It is the goal and task of teachers to have students receive systematic knowledge through network and possess correct use concepts.

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