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Effects of artificial intelligence on learning achievement

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Abstract: *Along with the advance of 3C technology and the promotion of education reform, multimedia video information equipment is largely combined in education scene for student-centered course teaching. Including multimedia video in instruction for curriculum design provides students with diverse teaching and learning methods. It is expected to enhance students' learning attitude and achievement through vivid and active multimedia video situations as well as to guide students' interests and achievement in learning. Taking 188 college students in Guangdong Province as the experimental objects, the 16-week (3 hours per week for total 48 hours) multimedia video integrated STEM experimental teaching research is preceded for this study. The research results show that 1.students present positive learning attitude as they expect to understand more of the taught content from multimedia video integrated STEM curricula, 2.multimedia video integrated STEM curricula provide students with effective learning, and 3.the use of multimedia video provides more opportunities and information for students understanding STEM related information, and the assistance of multimedia video could enhance their willingness to learn and creativity in STEM curricula. According to the results to propose discussions and suggestions, it is expected to provide students with diverse learning methods and build students' learning concept without restricting learning to time and place.*
Keywords*: multimedia video, STEM, learning attitude, learning achievement, learning gain*

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Introduction

In the time with education reform and changing technology development, education and life are changed by technology. Traditional teaching styles are no longer favored by students; especially in science, teachers have to constantly update information or apply multimedia to enrich teaching content and connect to technology development in the world. Information technology is therefore definitely required as the spirit of many courses in different learning areas to expand the learning and cultivate basic competence for modern citizens with life experience as the key point. Including information into course teaching activities is essential in modern teaching sites as well as one of teachers' teaching abilities. In modern teaching sites, ppt presentation, Internet information, e-books, electronic whiteboards, and uploading assignment with cloud become the best resources to assist teachers' teaching. It does not simply change past teaching model, but could also enhance students' learning achievement, makes teaching sites more lively, and allows students' creative works or design combining with real life. In sum, education directs life-centered instruction, rather than textbooks delivered with single texts. Guiding students' learning through technological information is the key issue for teachers' discussions and thinking. Since the USA promotes STEM education, other countries like British, Germany, and Mainland China also announce relevant regulations and policies as well as invest in budget for the promotion. It therefore becomes the global educational trend

STEM is the abbreviation of science, technology, engineering, and mathematics. STEM education is the integrated instruction of such four areas. The key of technology education lies in the course content integrating computational thinking, social technology, mathematics, natural technology, and art in various areas for students solving life issues in life situation as the core of STEM education. STEM education emphasizes the spirit of interdisciplinary integration and is divided into six fields of body movement & health, cognition, language, society, emotion, and aesthetic perception. The abilities in the fields are connected and preceded simultaneously among fields, based on interdisciplinary integration, to support students' comprehensive development and learning in the social cultural activities participation process. The curriculum mapping takes care of students' unique needs in different stages and concerns about the connection among learning stages. Teachers' professional teaching abilities are the key in opening students' diverse learning interests, and the major teaching responsibility also bears the expectations from parents and society [1]. In this case, integrated planning and design of courses in different fields is the professional ability of teachers. Teachers are the helmsmen to implement professional preschool education; both indoor teaching and outdoor activity reveal the influence on students' future learning [2]. The effect of multimedia video integrated STEM curricula on learning attitude and learning achievement is therefore discussed in this study, expecting to provide diverse learning

methods for students. More importantly, learning is not restricted to schools, students could learn at home as well as watch and learn through computers, mobile phones, and tablet computers at any time anywhere to build the learning concept.

Literature review

The development of multimedia technology in past years is gradually applied to lessons. The pictures & texts, sound & light effect, dynamic & static combination, and interactive & communication largely enhance people's perception and comprehension of abstract affairs and process to the brand-new realm [3]. Multimedia instruction should cover multimedia instruction tools and application software. Multimedia instruction application software is designed according to instructional objectives to present specific teaching content and inspire students' learning. It could be used for storing, delivering, and integrating teaching message for students' operation, practice, exchange, and interaction as well as evaluating students' learning outcome [4]. Li et al. [5] explained the characteristics of multimedia instruction, as followings.

Vivid content and novel style to induce learning interests: Multimedia instruction, covering information of texts, pictures, sound, and images, provides students with visual and audial stimulation so that dull language teaching becomes vivid and abstract concepts are easily comprehended to largely enhance students' learning motivation and interests.

Rich content and open vision to enhance teaching efficiency: Teachers, according to syllabus and content, could collect large teaching materials through Internet information or platforms to highlight the points and difficulties as well as make explanations and demonstrations with vivid examples to promote students' comprehension and application of teaching content. It also largely promotes teaching quality and efficiency.

Repeated learning and interactive learning without being restricted to areas: Multimedia instruction provides rich pictures & texts and easy-operation human-computer interaction environment. Students could select learning content according to personal basis and rhythm as well as utilize networks or open platforms for sharing and communicating with classmates and teachers to fully develop the objectives of self-directed learning, repeated practice, and communication improvement. The popularity of network and multimedia tools allows students preceding effective learning during movement, after class, at home, or outdoors. With multimedia instruction, schools and teachers are no longer the sole learning route. When learning is not restricted to sites, the door for learning would be widely opened.

Lin et al. [6] mentioned that cultivating students' learning interests and enhancing learning efficiency were urgent problems required for teachers' solutions. Traditional "blackboard+chalk" teaching style was gradually replaced by multimedia instruction. Liu et al. [7] stated that the unique "comprehensive, multi-aspect, multi-layer, and changeable" demonstration function of multimedia video integrated STEM curricula presented many advantages which traditional teaching style lacked. 1. Vividness, novelty, and intuition. Overcoming dull, abstract, and difficult traditional teaching, reinforcing students' question comprehension, and enhancing willingness to learn could achieve the effect of "combining education with entertainment". 2. Enhancing efficiency and saving time. Saving time for making teaching content, presenting neat and clear "blackboard writing", and increasing information in multimedia video integrated STEM classes could largely enhance teaching efficiency. 3. Reducing tiredness and pollution: Most chalk erasers could be replaced with multimedia tools or mobile devices to reduce teachers' tiredness and students' copying as well as dust pollution [8].

Chen et al. [9] indicated that, along with the rapid development of technology, the use of computer assisted instruction (CAI) and multimedia could effectively help teachers solve the curriculum design in STEM education. Teachers could change plain textbooks into dynamic and active form through multimedia, combine texts, pictures, and sound & light effect, and collect teaching materials through the Internet as the complement. Students, through distance teaching, not being restricted to time and number of times, and learning according to personal schedule could acquire the best learning achievement in STEM curricula (Johnson et al., 2020). Under the multimedia interaction system, students could decide the learning content and speed, according to personal needs, to fully satisfy individual needs. Under high participation, students would enhance the attention and cultivate the active learning of STEM curricula to reach higher learning achievement [10].

Zhen et al. [11] considered that lesson plans should be made according to the teaching content in STEM curricula, rather than using multimedia for multimedia; otherwise, the effect of STEM course teaching would not be effective. Van Diemen et al. [12] explained that, with traditional teaching style, students completing the notes during teachers' blackboard writing; however, under multimedia instruction, blackboard writing was not necessary, teachers appeared faster rhythm, but students might not be able to take notes. Providing STEM syllabus for students' preview could largely enhance the learning effect. Multimedia video integrated STEM curricula was student-centered that any lesson plans required teaching design [13]. In addition to basic subject knowledge, teachers had to promote the multimedia application skills to complement each other. Multimedia video integrated STEM curricula should be further intellectualized to intelligently diagnose students' levels, analyze causes of students' mistakes, and make analytic statistics of all students' mistakes for

corrections of next learning content and suggestions [14].

Hong et al. [15] pointed out willingness as the intrinsic process of an individual conscious, purposive, and even planned approach to the pursued objectives which particularly stressed on awareness. Students with higher willingness to learn might continuously participate in learning activity to enhance personal ability [16]. Sun et al. [17] mentioned that current multimedia video integrated STEM education scene focused on didactic instruction where the one-way learning model resulted in students' low willingness to learn. Although education departments kept promoting diverse learning and nurture by nature and teachers tried to promote diverse learning methods in STEM education scene, a lot of parents still considered academic performance being more important than diverse learning and even encouraged children to focus on subject learning to result in more learning pain. Shiau et al. [18] explained learning attitude as "happy learning"; people being happy to use multimedia video integrated STEM curricula would actively learn STEM or search STEM related information. It would reinforce students' self-learning attitude and cultivate the thinking habit.

Li et al. [19] pointed out the important role of learning attitude and willingness to learn in learners' learning achievement. When learners were not being willing to interesting teaching, either didactic instruction, apprenticeship teaching, or multimedia instruction would be meaningless. Learners' willingness to learn was induced by instructors' collection and selection of teaching data. Learners' age, preference, and ability as well as hardware equipment in teaching environment should be taken into account in material design to enhance students' learning attitude and willingness to learn. They would be the factors in learning achievement [20].

According to above literatures, the following hypotheses are proposed in this study.
H1: Multimedia video integrated STEM curricula would affect learning attitude.
H2: Multimedia video integrated STEM curricula would influence learning achievement.
H3: Learning attitude presents significant and positive effects on learning achievement.

Methodology

3.1. Measurement of research variable

3.1.1.Learning attitude

Referring to Shu & Huang [21], two dimensions are proposed in this study for learning attitude.

Intrinsic motivation: including learners' individual need, desire, impulse, affection, and emotion. Intrinsic motivation refers to the motivation to engage in the work in order to acquire sense of achievement or satisfaction from the value of the work.

Extrinsic motivation: containing incentive, objective, interest, and ambition in the environment. Extrinsic motivation refers to the motivation to engage in the work in order to acquire benefits irrelevant to the value of the work (rewards, appraise, and order).

3.1.2. Learning achievement

Referring to Gao et al. [22], the following dimensions are proposed in this study for learning achievement.

Learning effect: covering test performance, time for completion schedule, and term performance.

Learning gain: including learning satisfaction, achievement, and preference.

3.2. Research object and sampling data

Total 188 college students in Guangdong Province, as the experimental objects, are preceded the 16-week (3 hours per week for total 48 hours) experimental research on multimedia video integrated STEM curricula. The data are analyzed with SPSS, and factor analysis, reliability analysis, regression analysis, and analysis of variance are applied to test various hypotheses.

3.3.Course activity design

Multimedia video integrated STEM curricula are the research objective. The curriculum design is practiced for 18 weeks, when the experimental group is preceded STEM with multimedia video and the control group is preceded with traditional teaching. The detailed content and explanations at various stages are listed in Table 1.

Table 1 Course activity design

Weeks	Activities per each week	Brief description of the activities
1-2	This stage stresses on the introduction and understanding of STEM related concepts.	The experimental group is preceded STEM curricula with multimedia video, and the control group is introduced with ppt presentation as in traditional teaching.
3-7	This stage focuses on the integration of relevant technology and information, assisted with the learning and creation in STEM curricula.	Students in the experimental group are guided to apply distinct multimedia video related information and reminded of operation points and application. The students could randomly use various multimedia video

		devices to collect necessary information and inspiration. The control group are introduced with ppt presentation as in traditional teaching.
8-12	The stage stresses on students' application and practice.	The experimental group finds out the required information or inspiration with various multimedia video to complete the practice in STEM curricula. The control group precedes practice according to taught knowledge.
13-17	This study focuses on respecting and appreciating others' opinions and feelings as well as being willing to correct and combine personal creation to match other's ideas.	Students present the clothing design and tell the inspiration source. Classmates make discussions in groups to vote ones with excellent performance on practice. The experimental group applies distinct multimedia video, and the control group is preceded with traditional teaching.
18	Experimental result	Teachers evaluate students' practice capability according to the works and test the learning attitude and learning achievement.

Analysis method

Analysis of variance is utilized for discussing the difference of multimedia video integrated STEM curricula in learning attitude and learning achievement, and regression analysis is further applied to understand the relations between learning attitude and learning achievement.

Results analysis

4.1. Reliability and validity analysis

Learning attitude, through factor analysis, is extracted two factors of "intrinsic motivation" (eigenvalue=2.166, α=0.83) and "extrinsic motivation" (eigenvalue=1.836, α=0.85). The cumulative covariance explained achieves 72.641%.

Learning achievement, through actor analysis, is extracted two factors of "learning effect" (eigenvalue=4.253, α=0.90) and "learning gain" (eigenvalue=3.571, α=0.93). The cumulative covariance explained reaches 87.592%.

4.1.1. Effects of multimedia video integrated STEM on learning attitude and learning achievement

Difference analysis of multimedia video integrated STEM curricula in learning attitude

According to analysis of variance to discuss the difference of multimedia video integrated STEM curricula in learning attitude, i.e. analysis and explanation of teaching methods, Table 1 shows higher intrinsic motivation in multimedia video integrated STEM curricula (4.07) than in traditional teaching (3.62) and higher extrinsic motivation in multimedia video integrated STEM curricual (4.16) than in traditional teaching (3.78). H1 is then supported.

Table 1 Difference analysis of multimedia video integrated STEM in learning attitude

variable		F	P	Scheffe post hoc
multimedia video integrated STEM	intrinsic motivation	31.183	0.000**	multimedia video(4.07)>traditional teaching(3.62)
	extrinsic motivation	35.261	0.000**	multimedia video(4.16)>traditional teaching(3.78)

Note: * stands for $p<0.05$, ** for $p<0.01$.

4.1.2. Difference analysis of multimedia video integrated STEM in learning achievement

According to analysis of variance to discuss the difference of multimedia video integrated STEM curricula in learning achievement, i.e. analysis and explanation of teaching styles, Table 2 reveals higher learning effect with multimedia video integrated STEM curricula (4.24) than with traditional teaching (3.69) and higher learning gain with multimedia video integrated STEM curricula (4.33) than with traditional teaching (3.51). Accordingly, H2 is supported.

Table 2 Difference analysis of multimedia video integrated STEM in learning achievement

variable		F	P	Scheffe post hoc
multimedia video integrated STEM	learning effect	26.371	0.000**	multimedia video(4.24)>traditional teaching(3.69)
	learning gain	33.128	0.000**	multimedia video(4.33)>traditional teaching(3.51)

Note: ** for $p<0.01$.

4.2. Correlation analysis of learning attitude and learning achievement

4.2.1. Correlation analysis of learning attitude and learning effect

To test H3, Table 3 shows significant and positive effects of intrinsic motivation (β=2.042**) and extrinsic motivation (β=2.153**) on learning effect.

4.2.2. Correlation analysis of learning attitude and learning gain

To test H3, Table 3 reveals remarkable and positive effects of intrinsic motivation (β=2.189**) and extrinsic motivation (β=2.267**) on learning gain. As a result, H3 is supported.

Table 3 Analysis of learning attitude to learning achievement

dependent variable→	learning achievement			
independent variable↓	learning effect		learning gain	
learning attitude	β	Beta	β	Beta
intrinsic motivation	2.042**	0.194	2.189**	0.207
extrinsic motivation	2.153**	0.204	2.267**	0.215
F	23.657		29.739	
significance	0.000***		0.000***	
R2	0.243		0.281	
adjusted R2	0.225		0.264	

Note: * stands for $p<0.05$, ** for $p<0.01$.

Data source: self-organized in this study.

Discussion

Teachers could guide students to precede STEM curricula through multimedia video. Giving lessons and guiding students to use mobile devices for browsing lesson data in the class allows students instantaneously collecting and saving relevant STEM course content for operation in free time or assignment reference. Teachers who teach non-specialized subjects could learn with multimedia video and cooperate with teachers in relevant fields to increase STEM teaching activities and promote students' learning attitude and learning achievement. In STEM curricula, students are often grouped for teaching activities to present the teamwork performance. During multimedia video integrated STEM teaching process, students, in groups, discuss the teaching data in multimedia video with classmates and are encouraged to share the searched multimedia data, browsed webpages, or interesting App programs to broaden the learning. Multimedia video integrated STEM curricula requires network connection, while many classrooms or students not having Internet slows down the teaching speed; not being able to immediately download or upload relevant information results in frustration of instructors or learners. For this reason, the execution of multimedia video integrated STEM curricula requires school support for equipment and administration.

Conclusion and Suggestion

The research findings show that multimedia video integrated STEM curricula could enhance students' learning attitude. The result matches the research results of Johnson et al. [23]. Apparently, students expect to understand more of taught content from multimedia video integrated STEM curricula that students' learning attitude is positive. Multimedia video integrated STEM curricula could provide students with effective learning that students' learning achievement is positive. The result matches the research results of Zhen et al. [11]. Multimedia video integrated STEM curricula could enhance students' learning attitude. The use of multimedia video provides more opportunities and information for students understanding STEM related information and books not being the only source for learning information. In this case, the use of multimedia video is helpful for STEM instruction, and students enjoy the use and operation. Especially, the assistance of multimedia video could enhance the willingness to learn and creativity of students without their own opinions. Such a result matches the research results of Sun et al. [17].

According to the research conclusions, the following suggestions are proposed in this study.

Teachers, in multimedia video integrated STEM teaching, should encourage students to participate in class discussions, offer opportunities for students giving opinions, guide students to analyze, explain, or comment problems or events, accept students' various opinions, and patiently wait for students' answers. Furthermore, teachers should often use opportunity education in multimedia video integrated STEM curricula, give some news or issues, and guide students to discuss and propose personal opinions so that students could cultivate the analysis and criticism ability in daily life education.

Issues in which students are interested should be taken into account for multimedia video integrated STEM

curriculum design. A topic or issue combined with several relevant fields for integrated teaching could save teaching time and students could acquire the integrated concept and knowledge. Activity and opportunity for planning self-directed learning could assist students in solving real life problems with the learned knowledge to enhance the willingness to learn and learning achievement.

Teamwork, team discussion, and collaborative experiment design are stressed in multimedia video integrated STEM curricula. In the learning process, team students would provide various opinions for discussing a problem, designing an experiment, or collaboratively making a scientific work to make final decisions. It conforms to the process of STEM education. The integration of multimedia video therefore could enhance STEM curricula.

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