THE EFFECTS OF SEGMENTING AND COMPUTATIONAL THINKING IN DIGITAL VIDEO COURSEWARE ON KNOWLEDGE ACHIEVEMENT, SELF-EFFICACY AND MOTIVATION AMONG STUDENTS WITH DIFFERENT THINKING STYLES

WAN NOR ASHIQIN BINTI WAN ALI

UNIVERSITI SAINS MALAYSIA

2023

THE EFFECTS OF SEGMENTING AND COMPUTATIONAL THINKING IN DIGITAL VIDEO COURSEWARE ON KNOWLEDGE ACHIEVEMENT, SELF-EFFICACY AND MOTIVATION AMONG STUDENTS WITH DIFFERENT THINKING STYLES

by

WAN NOR ASHIQIN BINTI WAN ALI

Thesis submitted in fulfilment of the requirements
for the degree of
Doctor of Philosophy

July 2023

ACKNOWLEDGEMENT

"In the name of Allah, the Most Gracious and the Most Merciful"

Alhamdulillahi rabbil 'alamin, first and foremost, praise be to Allah SWT for His showers of blessings, which have provided me with limitless strength and spiritual motivation to complete the research successfully. I would like to express my deepest appreciation to my research supervisor, Professor Dr Wan Ahmad Jaafar Wan Yahaya, for his continuous support of my Ph.D. study and for his patience, empathy, motivation, enthusiasm, and immense knowledge. Being able to work and study under his supervision was a huge honour and privilege. This endeavour would not have been possible without my beloved mother, Wan Jahara Wan Ismail, as my backbone and greatest support, and my siblings, especially my sister, who is unstoppable in giving and supporting me with her love, motivation, and strengths. I must express my very profound gratitude to my loving and supportive husband, Mustamarul Mohamad, for your unwavering love, prayers, support, and never-ending encouragement throughout my study. Furthermore, I am grateful to Dr. Nadia Abdul Wahab and Dr. Aizat Shamsuddin for sharing their knowledge, offering advice, and encouraging me. I also would like to thank the PTPM's staff, internal examiners, and chairperson for their time and the evaluation of my thesis, which helped me improve the manuscript. I would also like to extend my thanks to my Ph.D. friends for their friendship, attentiveness, and encouragement. I also hereby express my sense of gratitude to one and all who, directly or indirectly, have lent their hands to this study. Finally, but most importantly, I would like to thank my university, Universiti Malaysia Perlis (UniMAP), Career Advancement Unit, my faculty, and Ministry of Education Malaysia for their support and financial assistance throughout this study.

TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

LIST OF ABBREVIATIONS

CT	Computational Thinking
CTML	Cognitive Theory of Multimedia Learning
CTSe	CT Self-Efficacy Survey
CVI	Content Validity Index
DVC	Digital Video Courseware
DVC -LS	Digital Video Courseware: Learner-paced Predefined Segment
DVC -SS	Digital Video Courseware: System Predefined Segment
DVLt	Digital Video Learning Material test
HEI	Higher Education Institution
I-CVI	Item Content Validity Index
IMMS	Instructional Materials Motivational Survey
Max	Maximum
Min	Minimum
MOE	Ministry of Education
MTUN	Malaysia Technical University Network
NASA-TLX	NASA Task Load Index
STEM	Science, technology, engineering, and mathematics
SUS	System Usability Scale
TSI	Thinking Styles Inventory
TVET	Technical and Vocational Education and Training
UAT	User Acceptance Testing

KESAN SEGMENTASI DAN PEMIKIRAN KOMPUTASIONAL DALAM KOSWER VIDEO DIGITAL TERHADAP PENCAPAIAN PENGETAHUAN, EFIKASI KENDIRI DAN MOTIVASI DALAM KALANGAN PELAJAR BERBEZA STAIL PEMIKIRAN

ABSTRAK

Kekurangan kemahiran abad ke-21 dalam pengetahuan video digital dan pemikiran komputasional (CT), serta ketidakfleksibelan pelajar untuk mengawal rentak pembelajaran menyebabkan video berkualiti rendah dihasilkan. Oleh itu, pengkaji berhasrat untuk mereka bentuk, membangun dan menganalisis kesan integrasi antara segmen pratakrif pelajar dan pemikiran algoritma CT dalam pembangunan Koswer Video Digital (DVC) terhadap pencapaian pengetahuan, efikasi kendiri dan motivasi dalam kalangan pelajar yang berbeza gaya berfikir. Kajian ini menggunakan reka bentuk kuasi eksperimen menggunakan faktorial 2 x 3. Pembolehubah kajian ini termasuk (i) dua mod rawatan, *"DVC: Learner-paced Predefined Segment (DVC-LS)"* dan *"DVC: System Predefined Segment (DVC-SS)"*; (ii) pencapaian pengetahuan, efikasi kendiri, dan motivasi; dan (iii) gaya berfikir, yang merangkumi perundangan, eksekutif, dan kehakiman. Pelajar sarjana muda dari universiti Rangkaian Universiti-Universiti Teknikal Malaysia (MTUN) dikategorikan kepada dua kumpulan iaitu mod 1: DVC-LS dan mod 2: DVC-SS. Statistik deskriptif dan inferensi (ANOVA dan ANCOVA) digunakan untuk menganalisis data eksperimen. Pengkaji mendapati kesan utama dan interaksi yang ketara daripada segmen pratakrif pelajar pada semua pembolehubah bersandar. Penyelidikan ini meluaskan pemahaman pelajar terhadap kedua-dua bidang multidisiplin CT dan video digital serta meningkatkan pengetahuan video digital dan efikasi kendiri mereka.

THE EFFECTS OF SEGMENTING AND COMPUTATIONAL THINKING IN DIGITAL VIDEO COURSEWARE ON KNOWLEDGE ACHIEVEMENT, SELF-EFFICACY AND MOTIVATION AMONG STUDENTS WITH DIFFERENT THINKING STYLES

ABSTRACT

The lack of 21st-century skills of digital video knowledge and computational thinking (CT), as well as the inflexibility of a student to control the learning pace results in low-quality video being produced. Hence, the researcher aims to design, develop, and analyse the effects of integration between learner-paced predefined segment and CT algorithmic thinking in "Digital Video Courseware (DVC)" development on knowledge achievement, self-efficacy, and motivation in students with different thinking styles. This research used a quasi-experimental design using a 2 x 3 factorial. This study's variables include (i) two treatment modes, "DVC: Learner-paced predefined segment (DVC-LS)" and "DVC: System predefined segment (DVC-SS)"; (ii) knowledge achievement, self-efficacy, and motivation; and (iii) thinking style, which includes legislative, executive, and judicial. The undergraduate students from "Malaysian Technical University Network (MTUN)" university are categorised into two groups which are mode 1: DVC-LS and mode 2: DVC-SS. Descriptive and inferential statistics (ANOVA and ANCOVA) were used to analyse the experimental data. The researcher found significant main and interaction effects of the learner-paced predefined segment on all dependent variables. This research broadens students' understanding of both the multidisciplinary realms of CT and digital video production and enhances their digital video knowledge, and self-efficacy.

CHAPTER 1

INTRODUCTION

1.1 Overview

There are sturdier relationships between government, industries, and educational institutions in addressing and tackling country's skills challenges among university graduates to achieve the Malaysia's mission for high-income status by the year of 2020. The 11th Malaysia Plan (2016 – 2020), foresees the increment of job vacancies require the skills in Technical and Vocational Education and Training (TVET), but not many TVET institutions are not being able to produce the graduates with those skills (Adnan et al., 2021; Affero & Hassan, 2013; Economic Planning Unit, 2015; Ministry of Higher Education, 2017; UNESCO, 2021). Juškevičiene and Dagiene (2018) and Rodgers and LaBoskey (2018) had highlighted that digital competence and computational thinking (CT) are considered as 21st-century skills that should be empowered by university students mostly for technical students.

In 1980, Papert introduced CT as a part of computer science, but Wing (2006) highlighted and promoted CT as a fundamental skills for everyone specifically for students, which more and more research on CT in education has been undertaken. According to Lockwood and Mooney (2017), few countries are still in the progression to adopt CT in curriculum at all levels of education. . They have been emphasised, and instructors are urged to use a variety of techniques and resources to include CT into their lessons. When considering the teaching and learning technique for adopting CT, the most suitable step for educators to take is to build educational technology to represent the learning materials.

Prior research has indicated that learning pace may be used to correctly boost motivation, engage students, and enhance student achievement when constructing learning materials (Stiller et al., 2011; Wang, 2017). Zavgorodniaia et al. (2021) performed research that emphasised Cognitive Theory of Multimedia Learning (CTML) principles in algorithm visualisation, which examined modality effects, segmenting, and system pace in constructing the learning material. They also emphasise in their study limitations that further research should be done to improve student control over learning materials.

Several methodologies were used to demonstrate the benefits of learner-pace learning, which highlighted that learning requires less mental work (Hasler et al., 2007; Roxana Moreno & Mayer, 2007), an increase in knowledge achievement (Hasler et al., 2007; Lusk et al., 2009; Mayer & Chandler, 2001), and less time to achieve skill. According to Stiller et al. (2011), earlier research that give empirical evidence of learner-pace benefits fall short of experimental manipulation in a real-world situation. Furthermore, as the usage of videos in education expands (for example, learning materials, student coursework evaluation, course content presentation, and so on), emphasising learner-pace to empower students' control in learning becomes increasingly important (Biard et al., 2018). Several studies have examined the student's cognitive load and emphasised the student's control (such as play, pause, stop, next module, and control of speed) (Biard et al., 2018; Hasler et al., 2007). Hasler et al. (2007) emphasised how learner-pace is important and should be used in educational technology to enhance instructional approach, whether via predetermined segments or allowing students to control (play or stop) learning materials. They also urged that further research be undertaken in order to better investigate these issues.

According to Brown (2001), the learner-pace boosts the students to actively make their own decision making. Hence, the students' characteristics which can influence their decision making such as thinking styles should be investigated in this study. As a result, given the relevance of digital competence and CT as 21st-century skills, as well as the possibility for both skills to be emphasised among university students, this research intends to promote digital video learning and CT algorithmic thinking in the creation of learning materials. This research also aims to emphasise the significance of the segmenting principle and learner pace in the design of digital video learning material, as well as to evaluate the effects of these factors on students' knowledge achievement, self-efficacy, and motivation.

1.2 Background of the Study

The present worldwide COVID-19 outbreak has shown a broad variety of educator readiness to employ technology to assist students in learning (Pérez et al., 2020). Furthermore, Malaysia seeks to respect and foster both academic and TVET routes equally, using technology-enabled techniques as stated in the Malaysia Education Blueprint 2015-2025's 10 shifts (Higher Education). Malaysia aims to generate high-quality TVET graduates while also revolutionising high-education delivery via globalised online learning facilitated by technology. The pervasiveness of digital technology in today's life has evolved as a consequence of simple access through technological gadgets among teens and young adults. This group of persons is known as having intermediate digital competence. According to Rodgers and LaBoskey (2018), even digital natives in the twenty-first century need be taught and exposed to digital technology. Referring to Juškevičiene and Dagiene (2018), digital competence entails the development of digital content such as photographs, audio, and

video. Self-efficacy and engagement with digital technologies for study and employment constitute digital competence (Juškevičiene & Dagiene, 2018).

McCaslin and Young (2015) also emphasised the relevance of digital video use among university students in technical areas as one of the evaluation techniques. Huang et al. (2020), as well as McCaslin and Young (2015), explored how the usage of digital video among students might give new approaches to motivate them to concentrate on what they are learning and convey it effectively. McCaslin and Young (2015) emphasised that digital video has become an important aspect of undergraduate courses as video report tasks, not just for engineering students but also for students from other disciplines. Mazin et al. (2020) presented digital video as one of the evaluation instruments used to evaluate the abilities of TVET students. They also decided that, in light of technical advancements, digital video was the most effective solution for future TVET student evaluation.

Several studies have examined how digital video can improve knowledge and achievement (Bell & Bull, 2010; Ismail et al., 2017; McCaslin & Young, 2015; Means et al., 2009; Rodgers & LaBoskey, 2018; Shin, 2018; Snelson et al., 2021), promote interest and motivation (Bell & Bull, 2010; Ebrahimzadeh & Alavi, 2017; Forte & Guzdial, 2004; Jsuškevičiene & Dagiene, 2018; Liao et al., 2019; McCaslin & Young, 2015; Shin, 2018; Tiernan & O'Kelly, 2019), as well as the self-efficacy (Juškevičiene & Dagiene, 2018; Shin, 2018) of the young adult students. Shin (2018) discussed that self-efficacy is the subset of the motivation and students' self-efficacy could increase together with the increment of motivation. However, McCaslin and Young (2015) and Rodgers and LaBoskey (2018) claimed that student should be supported and exposed with more knowledge in camera practice, editing, as well the techniques in video

production in order to enhance the learning process. They argued that only few studies have been conducted to highlight the video production knowledge to the students. Snelson et al. (2021) also discussed that little is known about how video production has been used in content-based knowledge and promoting the video as coursework assessment to be done by the students.

The digital video competence has a relationship between CT where both of them were considered as important 21st-century skills for young generation (Juškevičiene & Dagiene, 2018). They are also highlighted that there should be more research needed to discuss on this relationship. Despite the great level of interest in promoting CT among students, there are a few concerns in integrating CT into curriculum. The amount of content such as media, tools, and technology on the internet grows every day and require student to deal with more skills. According to Voogt et al. (2015), it is high potential and beneficial to integrate CT into curriculum and they also highlighted the need of research to be done in order to further the CT agenda in education. Voogt et al. argued that CT is not only being used in programming subjects but it could be applied within subjects beyond computer science and its explanation in other fields need a better attention. They also discussed the CT in the aspects of cognitive development as understanding the CT concepts which do not require any series of necessary conditions to be met as the potential concepts in learning. Denning (2009) and Lu and Fletcher (2009) revealed that students' capacity to think algorithmically in grasping the repercussions of anything is the primary CT skills.

Endeavouring to characterise and define CT, researchers frequently focus on its main components in which algorithm is one of CT component (Juškevičiene & Dagiene, 2018). They also emphasised that more scopes need to be researched in order

to fill the knowledge gaps about CT concepts such as decomposition, abstraction, generalization, and algorithmic thinking. They also have revealed that the interconnection between digital content with algorithm in CT concept. The CT algorithmic thinking also has been highlighted in Catlin and Wollard (2014), in order to study the relationship between CT, student activities, and curriculum subjects. Wing (2008) and Voogt et al. (2015) emphasised the students' ability to think computationally is crucial to conceptual understanding for each field through CT algorithmic thinking. While, Aho (2012) claimed that CT skills involve the computational steps and algorithm as the students' thought process in formulating problems and solutions. According to Barr and Stephenson (2011), the integration of CT across disciplines such as social science could lead to improve computational terminology usage. Voogt et al. (2015) reviewed that numerous education studies of educational technology highlighted and agreed that CT as an essential 21st-century skill. Therefore, the researcher identified that since both are crucial for 21st-century skills among university students, it is imperative to highlight digital video as part of the digital competence skills and CT algorithmic thinking as part of CT skills in this study.

In basic courses at universities, it is common practise to provide instructional technology such as courseware or an online learning approach (Mayer et al., 2019). However, Clark and Mayer (2016) argued that more research is required to discuss on how to design effective online lesson as well as the learning materials. They also emphasised that further study should be conducted to investigate how segmenting principle in course-based online lesson or learning materials. They also discussed that educators should be aware of the risk of cognitive overload induced by extraneous information as well as too fast and concurrent presentation of moving image, text, and

narration in designing educational technology. Seeing the importance of digital video course and the potential of digital video skills to be one of the effective students' assessment tools during the pandemic situation and the emergence of technology, this study aims to promote the basic knowledge of video production via a courseware. Though, Bell and Bull (2010) stated that learning with digital video requires effective teaching and instructional strategy. Recent study conducted by Castro-Alonso et al. (2021) found that, the best practices of instructional strategies related to cognitive load theory and Cognitive Theory of Multimedia Learning (CTML) in producing effective instructional materials. They have highlighted that pace-controlled such as segmenting the materials and using interactive features such as scrollbar (Hatsidimitris & Kalyuga, 2013) or next button (Mayer & Chandler, 2001; Stiller et al., 2009) allows for less temporary information to be managed which resulting in an effective learning. Castro-Alonso et al. (2021) also discussed the positive effects of applying learner-pace on students' achievement. Studies conducted by Hatsidimitris and Kalyuga (2013) and Stiller et al. (2009) show that students using learner-pace learning materials outperformed the students using instructor-pace (can be referred as system-pace). However, Castro-Alonso et al. (2021) argued that students' achievement in both groups are affected from students' expertise and prior knowledge. They claimed that the expert students can perform well using learner-pace while novice students are performing better using instructor-pace.

Castro-Alonso et al. also highlighted that more research should be done to investigate the effects of learner-paced and instructor-paced (system-paced) and applying moderating variable of students' properties such as gender, learning styles, thinking styles, and different modalities on students' psychology measures (e.g. self-efficacy, motivation etc.) and objective measures (e.g. performance, achievement

etc.). According to previous studies, the thinking styles of a student has significant effects on students 'decision making in controlling their learning pace which affected their achievement, self-efficacy, as well as the motivation (Al-Thani et al., 2014; Brown, 2001; Phillips et al., 2016). Hence, researcher found there is a need to study the interaction effects of thinking styles and the integration of learner-paced predefined segment and CT algorithmic thinking in this study.

As a result, the goal of this study is to integrate algorithmic thinking and segmenting principle in order to bridge the gaps of promoting digital video in learning, the claim of algorithmic thinking as the complement skill to the digital competence, and the importance of learner-pace segmenting.

1.3 Preliminary Investigation (PI)

In this study, the researcher conducted PI to validate the dependent variables and research issue. The researcher seeks to look at the learning difficulties of TVET students in Malaysia. Semi-structured interview technique has been chosen to identify the current level of knowledge and awareness of CT among TVET students, problems occurred during current online learning approaches used, issues related to conventional and online teaching and learning as well as technologies or tools used in current online teaching and learning. The researcher has prepared a few questions for the interviewee to respond, as well as given the interviewee the opportunity to voice their ideas. From the semi-structured interview sessions, the researcher can gather information on interviewee's knowledges, behaviours, and views toward digital video learning. A semi-structured interview was utilised by the researcher because it facilitates two-way contact between the interviewer and the interviewee, allowing for a full and comfortable conversation with the students.

Focus group was applied in this study by setting up semi-structured interview with six students who share common characteristics. Focus group was chosen because it is useful to identify and define problems, discuss topics or ideas as well as to gain insights of project deliverables and its impacts (Frechtling et al., 2002, as cited in Randolph, 2008). The semi-structured interviews have also been conducted to content experts and lecturers. During the PI, the researcher interviewed a CT content expert, three lecturers who are expert in digital video production, and six TVET students to gain in-depth understanding regarding these issues. The researcher also conducted a survey to first year students to gather information about their learning experiences.

The students stated several problems occurred during the face-to-face teaching and learning which most of the lecturers still use conventional methods. Students become uninterested with the subject and lose focus during the lecture. Students felt bored because some of the lecturers only read from the slides and too much information in text are presented without having figure, video, animation, or mind mapping. According to one of the students, sometimes there is a limitation for the lecturers to share the idea or when they want to explain something to the students there is no marker or whiteboard being provided. The students also stated that the technical subjects like digital video production which require them to handle devices or software are quite difficult to learn and understand compared to the theory subjects due to the current practice of conventional method teaching styles. Most of the students agreed that it is difficult for them to focus and interact with the lecturer due to the huge number of students per class. The students also stated that, based on their senior confessions, video production subject is quite uninteresting since lecturer always taking one until three weeks to revise the same contents. They did mention that even though some of the lecturers do provide video or use the technology in their teaching, but sometimes

these lecturers tend to move forward or end the video quickly in order to save the lecture time. The videos shown in the class are mostly being watched during the class session and are not provided in the learning materials provided by the lecturers. In addition, the students also stated that the video link provided by the lecturers during online class are mostly being ignored since much Internet data is required to watch it streaming. Moreover, they said that some of the lecturers are giving assignments without proper guidelines and asked the students to explore by themselves. Students also mentioned that completing projects including reports and videos for coursework evaluation makes them feel burdened. Students also mentioned that completing projects including reports and videos for coursework evaluation makes them feel burdened. They had mentioned about how struggle they are to complete a written report and produce a video with limited skill in producing digital video. Furthermore, the interviewed student claims that during the Covid-19 outbreak, they stated it is difficult to contact the lecturer and convey their problems through online classes in order to revise the topics that they have learned.

While, the interviewed lecturers emphasised that students are tend to forget what they have learned easily. Moreover, lecturers stated that these situations frequently happen for the digital video subject. Students frequently faced the problems to forget the technical parts such as the components of the camera, types of shots, angles, and movement that have been taught by the lecturers. Lecturers also revealed that students also lack of skills in producing a good report explaining the activity flow involve in producing digital video. Generally, students tend to use a diagram to illustrate their activity flows. However, neither the graphic nor the description of the diagram in the report depicted their activity flows. Students are simply showing a flowchart, which they commonly refer to as such. These scenarios do not only occur

among first year students, but the final year students specifically who involved in producing digital video, are facing problems in explaining the flow when writing their dissertation. Some of the students can performed well in producing a good digital video, but are lack in writing a good report or dissertation. This is due to the facts that they cannot illustrated a flowchart and explained well the steps involved in the video production. Lecturers stressed that students are feel difficult to understand how to illustrate a flowchart since they are not a computer science student. These situations also supported the statement by the CT content expert, where the knowledge and awareness about CT specifically algorithmic thinking among the non-computer science students in higher education institutions (HEIs) is still at a low level. The CT expert highlighted that, most of the non-computer science students do not aware about the CT concepts and they are lack of CT skills. This argument is also supported by systematic reviews done in investigating the previous studies on theory and learning theory on CT which found out that knowledge and awareness of CT algorithmic thinking in Malaysia's HEIs is still low. The expert opined that CT concepts should be applied in every subject for any education levels, specifically for university students. The CT expert also stressed that CT skills should be nurtured among the university students to ensure they can compete well in the future workplace.

The data gathered from the interviews were analysed using a thematic analysis. The thematic analysis was carried out with the aim of exploring the main data that have been discussed and highlighted in the semi-structure interview. The data gathered from the semi-structured interview was analysed using thematic analysis. Four main themes have been identified in this PI using thematic analysis which are students, lecturers, classroom environment and teaching approach. Based on the thematic analysis findings, the researcher realised that these four themes need to be considered

to avoid the low motivation and self-efficacy among the student which could obstruct the learning process, potentially leading to poor students' achievement.

Taking everything into account, the PI findings revealed that there are a variety of challenges that arise in digital video learning at the university, which affect both students and lecturers. The lack of exposure to CT skills among students, as well as lecturers' traditional teaching methods, are incompatible with the digital world. Given the increased need for digital competence and CT skills among university students, there is a compelling argument to integrate CT concepts specifically the CT algorithmic thinking in the curriculum. As a result, by emphasising digital video learning, this study aims to encourage students' CT algorithmic thinking as well as promoting digital competence.

1.4 Problem Statement

Nowadays, TVET students must be equipped with 21st-century skills (Azid et al., 2019; Mashelkar, 2018; Rodgers & LaBoskey, 2018) which are digital competence and CT skills (Juškevičiene & Dagiene, 2018; Rodgers & LaBoskey, 2018) that empower them to succeed. However, Kafai and Peppler (2011)'s study had highlighted that young adults are lacked of 21st-century skills which included the understanding of media such as digital video. The students' use of digital video could provide new techniques in reaching their attention and motivation on what they are studying, conveying it effectively, and encouraging the digital competence skills (Huang et al., 2020; McCaslin & Young, 2015; Snelson et al., 2021). There are several studies highlighted the importance of digital video in learning which discussed positive effects on knowledge and achievement (Bell & Bull, 2010; McCaslin & Young, 2015; Means et al., 2009; Rodgers & LaBoskey, 2018; Shin, 2018), encourage interest and

motivation (Bell & Bull, 2010; Ebrahimzadeh & Alavi, 2017; Forte & Guzdial, 2004; Juškevičiene & Dagiene, 2018; Liao et al., 2019; McCaslin & Young, 2015; Shin, 2018; Tiernan & O'Kelly, 2019), and the self-efficacy (Juškevičiene & Dagiene, 2018; Shin, 2018) among the students. Ismail et al. (2017) also discussed the use of video in learning improved knowledge achievement and motivation among university students specifically TVET students.

The importance of digital video production in teaching and learning based on previous studies is undeniable, but unfortunately, students are still facing with problems in producing the video in terms of technology device handling and video production skills (Henderson et al., 2010; Hung et al., 2004). Buckingham (2003) highlighted that students' works are lacked of scholarly merit on multimedia (video) production skills. Students are also less motivated and they are producing low quality of video due to the lack of understanding and skills in digital video production concept (Chen, 2018; Hung et al., 2004; Mazin et al., 2020; Miller, 2013). The lack of digital video production knowledge and skills among TVET university students result in low quality of video being produced specifically for coursework assessment (Mazin et al., 2020). The student report in video format has become well-known coursework assessment in online learning among lecturers to the undergraduate students specifically engineering and technical students during Covid-19 epidemic situations worldwide (McCaslin & Young, 2015; Pérez et al., 2020; Snelson et al., 2021).

Several researchers have highlighted that more studies should be conducted to promote digital video production as content-based knowledge, coursework evaluation, and foster critical literacies for university students (Lin, 2020; Rodgers & LaBoskey, 2018; Snelson et al., 2021; Watt, 2019). However, it can be argued that there are few

drawbacks of the online learning that hinder the learning and coursework assessment. The online learning before and during the Covid-19 outbreak is still considered unsuccessful because of the slow internet connection, the students' lack of participation, and the fact that they only have one phone or laptop at home (Pokhrel & Chhetri, 2021; Rouadi & Faysalanouti, 2020). Numerous students at home have experienced emotional and psychological hardship and are unable to participate effectively (Pokhrel & Chhetri, 2021). Pokhrel and Chhetri also identified several related challenges such as accessibility, affordability, as well as the flexibility. Students are burned-out with number of courses with rigid schedules and inability to acquire more flexibility in their learning. The students' flexibility in determining their learning pace also had been discussed in Kopp et al. (2019), where they highlighted pace as one of the factor that hinder the digital transformation in education. Study conducted by Adedoyin and Soykan (2020) also emphasised that the inadequate of instructional delivery approaches, methods and tools, result in hindering the online learning which offer limited students' flexibility in controlling student learning pace. The inability to control the learning pace, result in burned-out, emotional, and psychological distress among the student specifically during the Covid-19 outbreak.

A meta-analysis done by Phillips et al. (2016) found that the thinking styles influenced the strength of thinking process and decision making. Students with different thinking styles have different characteristics in processing the information they gathered during the learning. Phillips et al. also suggest that educators should consider the students' learning flexibility which can suit their thinking styles in order to produce positive learning decision making among the students. Moreover, Al-Thani et al. (2014) discussed that the decision is based on the individual's abilities, learning experience, and environment. They argued that when information is provided in a

manner that is congruent with the individual's favored thinking style, learning and self-efficacy of the students are enhanced. Al-Thani et al. also highlighted that there is lack of empirical studies have been conducted to investigate the thinking styles with knowledge achievement, self-efficacy, and motivation.

These issues were not only discovered in previous studies, but researchers also discovered the related issues in PI findings. Based on the PI findings, students are lack of knowledge in producing digital video which is solely based on the theory that they have learned. They are tending to forget quickly what they have learned during the lecture, which result in producing low quality of digital video. The PI's findings, as well as those from prior studies, revealed that university students are having difficulty making video for their assignments and demonstrating the flow of their assignments and projects which involved the CT skills specifically the CT algorithmic thinking. In order to enhance the learning process, McCaslin and Young (2015) and Rodgers and LaBoskey (2018) suggested that students should be encouraged and exposed to greater expertise in camera practice, editing, and video production skills due to the lack of knowledge, skills, and experiences in digital video. They also emphasised that more researches should be conducted to study the function of educational technology in improving students' knowledge of digital video production. According to Castro-Alonso et al. (2021), in designing effective educational technology, the best practises is by focusing the instructional strategies to cognitive load theory and Cognitive Theory of Multimedia Learning (CTML). Thus, researcher aims to educate students with digital video by developing a courseware and integrating the algorithmic thinking into two modes of courseware presentation (learner-paced predefined segment and system predefined segment). Hence, researcher aims to investigate whether there are interaction effects of thinking styles with the integration of learner-paced predefined

segment and CT algorithmic thinking on knowledge achievement, self-efficacy, and motivation. This study intends to expose students about digital video production knowledge while encouraging the algorithmic thinking among them. As a result, the digital video courseware has the potential to expose students to 21st-century skills (digital competence and CT skills) as well as supporting the 12th Malaysia Plan.

1.5 Purpose of the Study

The purpose of the present study is to study the effects of Digital Video Courseware (DVC) on achievement, self-efficacy, and motivation in learning among TVET students. One independent variable with two modes of presentation, namely (i) Digital Video Courseware: Learner-paced predefined segment (DVC-LS) as Mode 1 and (ii) Digital Video Courseware: System predefined segment (DVC-LS) as Mode 2. Three dependant variables for this study are (i) student's achievement, (ii) self-efficacy, and (iii) motivation. The students' thinking styles (legislative, executive, and judicial) are used as the moderator variable in this study. This study is alienated into two parts as follow:

i. The first part is to highlight the two presentation modes of developed digital video courseware which are learner-pace predefined segment and system-pace predefined segment.
ii. The second part is to integrate algorithmic thinking and segmenting principle as instructional strategies in the development of digital video courseware. The design and development of the treatment conditions are discussed in detail in Chapter 4.
iii. The third part is to study the effects of the digital video courseware with two presentation modes (independent variable) among young adults with different

thinking styles (moderator variable) on knowledge achievement, self-efficacy, and motivation (dependant variables).

1.6 Research Objectives

The objectives of the study are as follow:

i. To develop Digital Video Courseware: Learner-paced predefined segment (DVC-LS) as Mode 1 and Digital Video Courseware: System predefined segment (DVC-SS) as Mode 2 with the integration of algorithmic thinking and segmenting principle as the instructional strategies;

ii. To investigate the effects of two presentation modes of digital video courseware (DVC-LS and DVC-SS) on knowledge achievement among students with different thinking styles;

iii. To investigate the effects of two presentation modes of digital video courseware (DVC-LS and DVC-SS) on self-efficacy among students with different thinking styles; and

iv. To study the effects of two presentation modes of digital video courseware (DVC-LS and DVC-SS) on motivation among students with different thinking styles.

1.7 Research Questions

This study was conducted to address several research questions based on the main effect and interaction effect as follow:

A. What are the effects of two presentation modes of digital video courseware (DVC-LS and DVC-SS) in term of student's knowledge achievement? The subsidiary questions for Research Question A are:

i. Is there any significant difference in term of students' knowledge achievement between the two digital video courseware presentation mode groups (DVC-LS and DVC-SS)?

ii. Is there any interaction effect between digital video courseware presentation mode and thinking styles in term of student's knowledge achievement?

B. What are the effects of two presentation modes of digital video courseware (DVC-LS and DVC-SS) in term of student's self-efficacy? The subsidiary questions for Research Question B are:

i. Is there any significant difference in term of student's self-efficacy between the two digital video courseware presentation mode groups (DVC-LS and DVC-SS)?

ii. Is there any interaction effect between digital video courseware presentation mode and thinking styles in term of student's self-efficacy?

C. What are the effects of two presentation modes of digital video courseware (DVC-LS and DVC-SS) in term of student's motivation? The subsidiary questions for Research Question C are:

i. Is there any significant difference in term of student's motivation between the two digital video courseware presentation mode groups (DVC-LS and DVC-SS)?

ii. Is there any interaction effect between digital video courseware presentation mode and thinking styles in term of student's motivation?

1.8 Research Hypotheses

The hypotheses for this study are formulated as null hypotheses. In this research the researcher will reject the null hypothesis when the *p*-value turns out to be less than the significance level, which is 0.05. The null hypotheses that correspond to the above three major research questions are:

A. The effects of two presentation modes of digital video courseware (DVC-LS and DVC-SS) on student's knowledge achievement. The subsidiary null hypotheses are:

$H_{O.A.1}$ There is no significant difference in knowledge achievement between student who received DVC-LS and those who received DVC-SS.

$H_{O.A.2}$ There is no significant difference in knowledge achievement among students with different thinking styles in the DVC-LS group.

$H_{O.A.3}$ There is no significant difference in knowledge achievement among students with different thinking styles in the DVC-SS group.

$H_{O.A.4}$ There is no significant difference in knowledge achievement among students with legislative thinking style in the DVC-LS group and those in the DVC-SS group.

$H_{O.A.5}$ There is no significant difference in knowledge achievement among students with executive thinking style in the DVC-LS group and those in the DVC-SS group.

$H_{O.A.6}$ There is no significant difference in knowledge achievement among students with judicial thinking style in the DVC-LS group and those in the DVC-SS group.

B. The effects of two presentation modes of digital video courseware (DVC-LS and DVC-SS) on student's self-efficacy. The subsidiary null hypotheses are:

$H_{O.B.1}$ There is no significant difference in self-efficacy between student who received DVC-LS and those who received DVC-SS.

$H_{O.B.2}$ There is no significant difference in self-efficacy among students with different thinking styles in the DVC-LS group.

$H_{O.B.3}$ There is no significant difference in self-efficacy among students with different thinking styles in the DVC-SS group.

$H_{O.B.4}$ There is no significant difference in self-efficacy among students with legislative thinking style in the DVC-LS group and those in the DVC-SS group.

$H_{O.B.5}$ There is no significant difference in self-efficacy among students with executive thinking style in the DVC-LS group and those in the DVC-SS group.

$H_{O.B.6}$ There is no significant difference in self-efficacy among students with judicial thinking style in the DVC-LS group and those in the DVC-SS group.

C. The effects of two presentation modes of digital video courseware (DVC-LS and DVC-SS) on student's motivation. The subsidiary null hypotheses are:

$H_{O.C.1}$ There is no significant difference in motivation between student who received DVC-LS and those who received DVC-SS.

$H_{O.C.2}$ There is no significant difference in motivation among students with different thinking styles in the DVC-LS group.

$H_{O.C.3}$ There is no significant difference in motivation among students with different thinking styles in the DVC-SS group.

$H_{O.C.4}$ There is no significant difference in motivation among students with legislative thinking style in the DVC-LS group and those in the DVC-SS group.

$H_{O.C.5}$ There is no significant difference in motivation among students with executive thinking style in the DVC-LS group and those in the DVC-SS group.

$H_{O.C.6}$ There is no significant difference in motivation among students with judicial thinking style in the DVC-LS group and those in the DVC-SS group.

1.9 Research Framework

This study investigates the effects of two presentation modes of digital video courseware (DVC-LS and DVC-SS) on students' knowledge achievement, self-efficacy, and motivation among university students. The mode of presentation (DVC-LS and DVC-SS) is the independent variable in this study while knowledge achievement, self-efficacy, and motivation act as the dependent variables. The moderator variable is also investigated in this study which is university students' thinking styles (legislative, executive, and judicial). The research framework is demonstrated as in Figure 1.1.

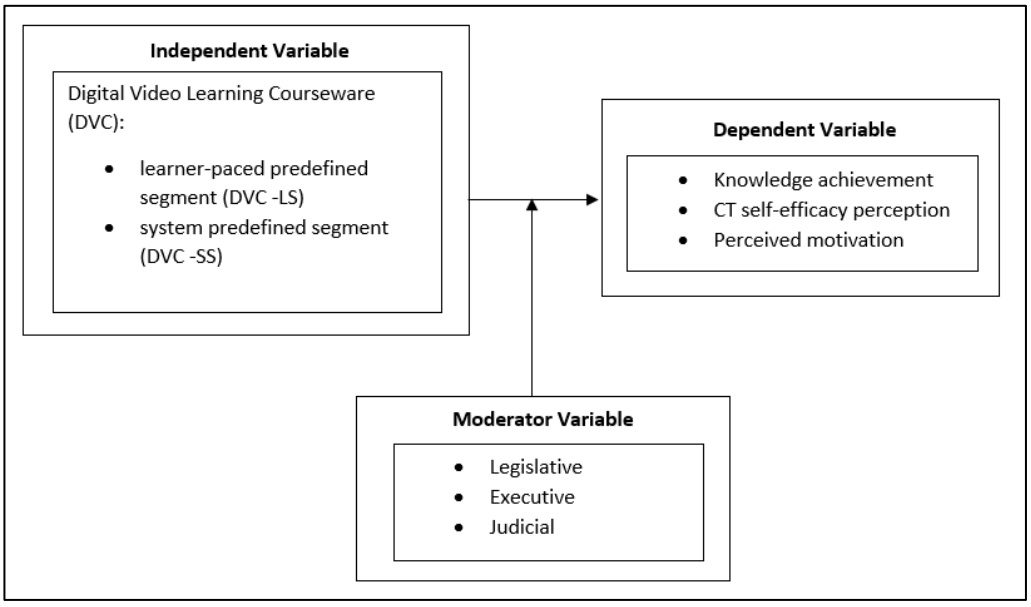

Figure 1.1 Research Framework

1.10 Theoretical Framework

This study adapted the suggestion by Reigeluth et al. (1978) in Patten (1986), which stated that approach used in research design strategy can be applied by combining the macro and micro strategies. The selection, sequences and organisation of related subject or research topics are described and presented as macro strategies.

The macro strategy is also described as the overall strategic plan for a research (Gibbons & Fairweather, 1998).

In addition, micro strategies are concerned and focused with the individual presentations such as their features, inter-relationship and categorisation that are to be demonstrated to the learners. On the other hand, micro strategies are also recognised as presentation strategy as they involved individual presentation details to the learner (Chen, 2006). The researcher utilises the cognitive constructivism learning theory as the environment for this study. The Gagne's Nine Events of Instruction and CTML principles are the macro strategies while learner-paced predefined segment and system predefined segment of segmenting principle, CT algorithmic thinking, and design guidelines for young adults served as the micro strategies for this study. Reigeluth et al. (1978) state that macro strategies focus on the order of selection, and the order of topics to be presented. While micro strategies focus on effective learning content presentation strategies. The research theoretical framework is illustrated in Figure 1.2. All the theories, principles, and techniques applied in this study are described and discussed comprehensively in Chapter 2.

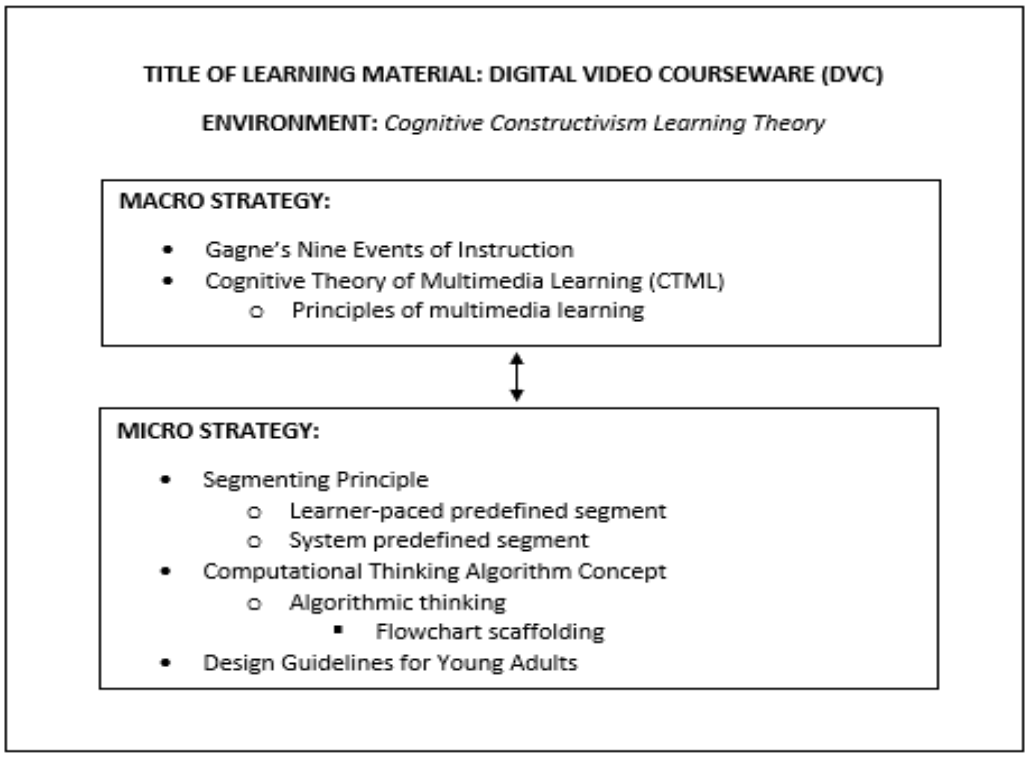

Figure 1.2 Theoretical Framework

1.10.1 Cognitive Constructivism Learning Theory

Constructivism discusses how a learner construct new knowledge based on the experiences or prior knowledge that they have. Constructivism emerged from the extension of cognitivism that highlight learning can be affected through internal mental constructions and the others' influences during the learning. Constructivism can be divided into cognitive constructivism which focuses on individual learning process while social constructivism focuses on language and others' influences toward individual learning (Piaget & Cook, 1952; Powell & Kalina, 2009).

The integration of CT algorithmic thinking concept in digital video courseware is not only to facilitate students with algorithmic thinking in creating digital video, but also to nurture those skill to manage their daily life. There is minimal lecturer's role

for this study since the digital video courseware itself plays the role to accommodate and instruct the students. The lecturer facilitates the students' discovery to the new knowledge by providing enough resources. This situation will benefit students while also assisting the lecturer in implementing a student-centered learning method. Although some students may have some prior knowledge and expertise in digital video, this does not negate the content of the digital video courseware because those are the primary features to be taught. Therefore, the contents in digital video courseware are considered as a new knowledge to the students for them to construct in the prior knowledge schemas or creating a new one. Those facts are strengthened with the concerns of cognitive constructivists toward learners' mental representations which is not only focuses to obtain knowledge, but also aids the learners to create new knowledge from past experiences. Students who have little prior knowledge in digital video will be able to assimilate the new knowledge they gain from the application while students who do not have any prior knowledge will accommodate the knowledge they gain and modify their pre-existing schemas. Unlike the behaviourist theory, students are more intrinsically motivated in cognitive constructivism since it involves with the reformation of the existing cognitive structures (Powell & Kalina, 2009). Hence, this study aims to measure the students' knowledge achievement, self-efficacy, and motivation.

In the aspect of cognitive psychology, learning is conceptualised and defined as the knowledge acquisition and achievement. The learner is considered as an information processor who captivates the information before processing it cognitively and storing it in memory. Unlike behaviourism, cognitivism defines that learner process the stimuli they gain and determine the appropriate responses to it. In 1990, according to Bruner, cognitivism seeks to understand the process of gaining