



# The Relationship Between Twenty-First-Century Learning Model (4Cs), Student Satisfaction and Student Performance-Effectiveness

Pongsakorn Limna,<sup>1</sup> Supaprawat Siripipatthanakul,<sup>2</sup> Bordin Phayaprom,<sup>3</sup>  
Sutithev Siripipattanakul<sup>4</sup>  
Asia eLearning Management Center, Singapore,<sup>1,2,3</sup>  
Kasetsart University, Thailand<sup>4</sup>

palmlimna@gmail.com<sup>1</sup> (Corresponding Author)  
ake@aemcenter.com.sg<sup>2</sup> alex@aemcenter.com.sg<sup>3</sup> fedustt@ku.ac.th<sup>4</sup>

## ABSTRACT

This study investigates the relationship between the twenty-first-century learning model (4Cs) and student performance-effectiveness through the mediating effect of student satisfaction. A stratified random sampling of 512 students in Thailand was used for the quantitative approach. The collected data were analysed using the PLS-SEM program and SPSS Version 27. The results reveal that student satisfaction is the significant mediator between the twenty-first-century learning model (communication, creativity, critical thinking, and collaboration) and student performance-effectiveness. It indicates that communication, critical thinking, collaboration, and creativity significantly influence student satisfaction. Moreover, communication has the most significant influence on student performance-effectively, followed by collaboration and creativity. Only collaboration learning does not considerably influence student performance-effectiveness. The educational leaders, program directors and teachers should pay attention to the twenty-first-century model (4Cs) to increase student satisfaction and performance-effectiveness.

**Keywords:** *Twenty-First Century, 4Cs-Learning Skill Management, Student Satisfaction, Student Performance, Effectiveness*

## 1. INTRODUCTION

### 1.1. Background of the Research

The future depends on learning (Reaves, 2019). In this era, higher education institutions continue to expand the number of courses offered in traditional and blended, and online formats (Weldy, 2018). The demand for online and blended programs in higher education is growing as the student population in the United States becomes more non-traditional (Betts & Heaston, 2014). Furthermore, a growing number of academic leaders believe that offering online courses is critical to their institution's long-term strategy. The majority believe that the learning outcomes for online

education are now equal to or superior to those for face-to-face instruction (Allen et al., 2007). Mitchell College of Business students' preferences for different course formats are various such as traditional, online, or blended, at the University of South Alabama in the United States. It was discovered that traditional courses were preferred over web-based classes and a more positive experience with formal methods over online courses. And online courses over blended courses. However, fall short of explaining the dramatic increase in web-based course enrollment. One explanation could be the tools and techniques used to deliver web-based courses. The need to self-teach the material may outweigh the convenience of online classes (Weldy, 2018).

Traditional and web-enhanced instructional approaches have different effects on course outcomes and student satisfaction. However, there was no difference in technical ability and learning outcomes. Students in the face-to-face section reported a better ability with more basic skills such as word processing. However, students in the web-enhanced environment found better-advanced skills such as Internet searches. Students in the web-enhanced section were satisfied with the course, citing benefits such as greater scheduling flexibility, less travel, and greater independence and self-pacing of content (Salyers, 2005). As education evolves and changes, the system must be designed to meet students' global needs to compete and succeed in a twenty-first-century economy. The school site administrators must provide the necessary skills and training to establish systems and create a twenty-first-century environment for teachers and students (Miller, 2016). Mastering skills (4Cs) of critical thinking, communication, collaboration, and creativity has emerged as a priority in twenty-first-century learning and education based on 4.0 revolutions (Rusdin & Ali, 2019).

As businesses become more global, the educational focus has shifted to ensure students learn the top twenty-first-century skills, known as the 4Cs model (communication, creativity, collaboration, and critical thinking). It is equally essential for instructional teachers and leaders to receive professional development to implement these skills (Miller, 2016). As the twenty-first century unfolds, education will emphasise acquiring the skills required to learn and sustain learning. However, this emphasis will not meet the needs of contemporary students because the curriculum was not designed to meet the demands of society. As a result, education should develop the 4Cs model, including critical thinking, communication, collaboration, and creativity, to prepare the next generation to harness digital technologies' power (Trilling & Fadel, 2009).

## **1.2 Problem Statement**

Education in the twenty-first century briefly provides students with necessary skills that they can acquire and practice to succeed in a globalised world (Bedir, 2019). There is an urgent push to implement twenty-first-century skills in the education instructional setting. However, academic institutions in Thailand are still operating under an antiquated education model that does not prepare students to become global citizens in the twenty-first century. Thus, Thailand needs education reform (Wittayasin, 2017). As higher education institutions continue to expand the number of traditional, blended, and online courses, it is critical to investigate student perceptions and experiences related to the various variables (Weldy, 2018). There are few studies to support the relationship between twenty-first-century skills and outcomes. This study investigates the effect of the twenty-first-century learning model (4Cs) on student performance-effectiveness through student satisfaction as a mediator. It may be beneficial for universities or program directors to develop an appropriate strategy to respond to the needs and expectations of students who wish to enrol in any graduate program and further. The outcome is focused on a student at the centre. Thus, this study could better understand the effectiveness and student performance by improving

twenty-first-century skills in the education instructional setting and student satisfaction to respond to the student centre approach.

### **1.3 Research Objective**

This study examines the relationship between the twenty-first-century learning model and student performance-effectiveness through the mediating role of student satisfaction.

### **1.4 Research Question**

How is the relationship between the twenty-first-century learning model, student satisfaction, student performance-effectiveness?

## **2. LITERATURE REVIEW**

### **2.1 Twenty-First-Century Students' Skills**

Many institutions have advocated for all students to learn twenty-first-century skills (Dede, 2009). The skills of the twenty-first century are divided into three categories. Learning and innovation skills refer to the mental processes required to adapt to and improve a modern work environment. Literacy skills, also known as IMT skills (Information Literacy, Media Literacy, and Technology Literacy), are concerned with how individuals discern facts, publishing outlets, and technology. Life skills are the intangible aspects of every individual's daily life, including personal and professional qualities (Pardede, 2020). Besides, developing twenty-first-century competencies in young people is critical globally. It is essential to comprehend how the evolution of twenty-first-century competencies reproduces or creates new knowledge divides within and across countries and cultures (Voogt et al., 2013).

### **2.2 Student Satisfaction**

Student satisfaction was defined as students' assessment of the services provided by universities and colleges, including the quality of teaching and academic services, support facilities, physical infrastructure, and social climate, among other factors (Wiers-Jenssen et al., 2002). Learning satisfaction is a student's overall positive assessment of their learning experience. Satisfaction can be measured only after learning (Nagy, 2008). Moreover, student satisfaction occurs when performance surpasses students' expectations (Darawong & Sandmaung, 2019). Higher education administrators must have a solid understanding of the factors influencing expectations and how they affect satisfaction (Appleton-Knapp & Krentler, 2006). Student satisfaction is critical in developing more accurate and higher-quality services for educational institutions. This concept has been widely tested in the academic literature to improve student perception and attitudes in many different aspects, such as student retention and student success. Student satisfaction is a potential indicator for evaluating the service quality of higher education providers (Darawong & Sandmaung, 2019).

### **2.3 Student Performance-Effectiveness**

Performance has always been the focus of every organisation, including educational institutions, to measure achievement and program effectiveness according to the goals set (Amtu et al., 2020). Gilbert (2019) examined student performance on criterion and norm-referenced measures linked with teacher and student communication orientations. The study employed a pre-post design to determine if the process education model differed in student performance. The findings indicated that connecting with teachers' preferred delivery and communication styles appears to be related to student performance. Students perform better when they are more like their teachers. It is

recognised that reinforcing new knowledge and skills is an essential component. If better connecting with students is linked to performance, teachers who learn to shift their delivery methods may foster better outcomes. Besides, consideration should be given to how stress affects teacher performance, particularly when interacting with students whose communication preferences differ from their own (Gilbert, 2019). Additionally, there is a correlation between the impact of personality, learning style, and satisfaction on specific educational outcomes, namely the academic performance and transferable skills covering student's communication, collaboration, and interactivity (Vasileva-Stojanovska et al., 2015).

## **2.4 Twenty-First-Century Learning Model (4Cs Model)**

Education in the twenty-first century places a greater emphasis on acquiring the necessary skills to learn and sustain learning, which does not meet the needs of contemporary students because the curriculum was not designed to meet the demands of society. Education must also aim to develop a generation of people who will acquire knowledge and skills to harness the digital technologies to broaden their opportunities to obtain the 4Cs (Trilling & Fadel, 2009). The aspects of teaching and learning were deemed the most important (Douglas et al., 2006). The twenty-first-century learning model (4Cs) and innovation skills refer to the curriculum that will be essentially required, which students should master to prepare for life after graduation. (Pardede, 2020; Supena et al., 2021). Every educator wishes to see their students succeed in life. However, what was considered a good education 50 years ago is now insufficient for success in college, career, and citizenship in the twenty-first century. Therefore, to compete in today's global society, students must also be skilled communicators, creators, critical thinkers, and collaborators (Sohaya, 2020). Supena et al. (2021) suggested that the 4Cs learning model requires students to learn through discussions and dialogues, empowering critical and creative thinking and improving students' scientific mastery. The 4Cs learning model would influence the students' learning outcomes. Rusdin & Ali (2019) also confirmed that it is necessary to expend significant effort on teaching and learning to ensure that the process of fostering the 4Cs model occurs optimally and that students can master the skills effectively.

### **2.4.1 Creativity Learning**

Creativity was defined as students' ability to generate and refine solutions to complex problems or tasks through synthesis, analysis, and combining or presenting what they have learned in new and unique ways (Revitz, 2014). Also, creating new ideas is synonymous with creative thinking, and creative thinking is essential for students in all aspects of educational studies (Piaw, 2010). Creativity is one of the 4Cs skills (Pardede, 2020). The concept of creativity is explained by demonstrating how an educator cannot rely solely on material books but must also use technology such as devices to become more creative and avoid being bogged down by administrative tasks. The ability to fail and create a safe environment is critical for increasing creativity (Sunardi & Doringin, 2020). The teacher is essential for designing and developing learning programs to empower this skill. Creative thinking relates to implementing a new approach to solving a problem and being innovative. This skill is a unique new action, personally and culturally (Facione, 2011). Hadiyanto et al. (2021) studied the effect of blended learning in course application on students' twenty-first-century skills and GPA. By exploring ideas creatively, students were pleased, and their grades improved. Therefore, creativity learning significantly impacts student satisfaction and performance-effectiveness (Hadiyanto et al., 2021). Besides, to succeed in all aspects of their academic studies, students must think creatively (Piaw, 2010). Thus, creativity is one of the 4Cs identified as an essential key of the twenty-first-century learning model and related to student

satisfaction and student performance-effectiveness (Hadiyanto et al., 2021; Pardede, 2020; Piaw, 2010). Thus, creativity learning is related to student satisfaction and student performance-effectiveness.

*H1: Creativity learning has a significant impact on student satisfaction.*

*H2: Creativity learning has a significant impact on student performance-effectiveness.*

#### **2.4.2 Critical Thinking Learning**

Critical thinking is a deliberate, self-regulatory judgment that results in interpretation, analysis, evaluation, and inference. Also, it explains the evidential, conceptual, methodological, or contextual considerations that underpin that judgment. Critical thinking is essential, and it is a liberating force in education and a valuable resource in one's personal and civic life (Facione, 2011). Critical thinking is a process that aims to make wise decisions about what people believe and do. It is a higher-order thinking skill stage (Supena et al., 2021). One cannot learn well unless one thinks well, so the link between critical thinking and education is self-evident. Critical thinking is essential for professional success and academic success. It is a mental activity used to formulate or solve problems, make decisions, understand certain things, and find answers to questions (Johnson, 2002). Peer discussion improves understanding even when none of the students in a discussion group knows the correct answer at the outset of critical thinking learning in the discussion group (Smith et al., 2009). Students were satisfied with their critical thinking abilities and thought of themselves as having strong critical thinking and problem-solving skills (Rodzalan & Saat, 2015). Also, critical thinking skills are required for students to identify the source of a problem and the appropriate solution to improve their performance (Supena et al., 2021). Thus, critical thinking is one of the 4Cs acknowledged as a part of the leading 21st-century learning model and related to student satisfaction and student performance-effectiveness (Pardede, 2020; Supena et al., 2021). Thus, critical thinking learning is related to student satisfaction and student performance-effectiveness.

*H3: Critical thinking learning has a significant impact on student satisfaction.*

*H4: Critical thinking learning significantly affects student performance and effectiveness.*

#### **2.4.3 Collaboration Learning**

Collaboration was defined as students' ability to work together to solve problems or answer questions, work effectively and respectfully in teams to achieve a common goal, and accept shared responsibility for task completion (Revitz, 2014). Collaboration is one of the 4Cs acknowledged as part of the twenty-first century (Pardede, 2020). Collaboration is the commitment to work skillfully with others in groups. Collaborators influence groups by setting goals, sharing ideas and workload, acting as facilitators and contributors, sharing power and decision-making, and engaging in productive conflict (Bedir, 2019). Collaboration has generally been accepted as a necessary skill for achieving meaningful and effective results. However, due to globalisation and the rise of technology over the last decade, it has become increasingly clear that collaboration is essential and necessary for students and employees (Sohaya, 2020). Häkkinen et al. (2017) investigated the educational pedagogical framework for twenty-first-century learning practices. A finding revealed that collaboration was an essential aspect of learning. When students worked in

groups, they improved their performance on tasks (Häkkinen et al.,2017; Zhu, 2021). Thus, collaboration learning is related to student satisfaction and student performance-effectiveness.

*H5: Collaboration learning has a significant impact on student satisfaction.*

*H6: Collaboration learning significantly affects student performance and effectiveness.*

#### **2.4.4 Communication Learning**

Communication was defined as the ability of students to organise their thoughts, data, and findings and effectively share them through various media and orally, and in writing. Humans are social beings who are constantly interacting with one another. Thus, communication is one of the most critical aspects of social success (Revitz, 2014; Sohaya, 2020). Communication is a crucial component in establishing a positive work environment. In this age of globalisation, when people from various cultures are constantly mixing and interacting, all educators should help their students develop essential communication skills by providing space and opportunities to practice interpersonal communication skills (Liliane & Colette, 2009; Lawley et al., 2014). Hadiyanto et al. (2021) investigated the effects of blended learning in course application on students' 21st-century skills and GPA. Students can communicate and solve problems using information and communication technology. Students were satisfied, and their grades improved. As a result, communication learning style significantly influences student satisfaction and performance-effectiveness of students (Hadiyanto et al., 2021). Effective communication between students and teachers affects students' learning performance, achievement sharing, and a positive classroom environment (Shan et al., 2014). Lim et al. (2006) discovered variances in student satisfaction, and learning outcomes based on learner characteristics and instructional and learner variables influence on advanced learning course outcomes. Giving students frequent feedback and facilitating alternative communication experiences can help to motivate students and maintain healthy and productive levels of student satisfaction. Häkkinen et al. (2017) examined the educational pedagogical conceptual model for the twenty-first-century learning techniques. A finding revealed that interaction and communication between teachers and students significantly impact students' performance-effectiveness. Besides, communication greatly influences student satisfaction (Lim et al., 2006; Lim, 2004). It was recommended that the challenge now is to educate next-generation communication skills as they are an essential skill in the twenty-first century (Häkkinen et al., 2017; Lim et al., 2006; Sohaya, 2020). Thus, communication learning is related to student satisfaction and student performance-effectiveness.

*H7: Communication learning has a significant impact on student satisfaction.*

*H8: Communication learning significantly affects student performance and effectiveness.*

#### **2.5 Student Satisfaction and Student Performance-Effectiveness**

In general, student performance and effectiveness were statistically associated with satisfaction ratings in various institutional areas (Anagnostopoulou et al., 2015). Oja (2011) discovered a relationship between student satisfaction and performance-effectiveness (grades or persistence). Students who received excellent grades and performed well were found to be satisfied. Students with lower grades, on the other hand, were found to be less satisfied (Oja, 2011). Student satisfaction is crucial in building more accurate and higher-quality educational services. This

concept has been extensively tested in academic literature to improve student perceptions and attitudes in various areas, including student performance and effectiveness (Darawong & Sandmaung, 2019). The twenty-first-century learning model (4Cs) is the practice of working together to achieve a goal, and it is becoming particularly crucial for educational performance (Dede, 2009). Furthermore, students in mathematics class have a high level of interest in activities based on the twenty-first-century learning model (4Cs). There was a very high level of interest in communication, critical thinking, collaboration, and creativity. Students were satisfied and agreed on a high median wage level (Rusdin and Ali, 2019). Thus, student satisfaction is related to the twenty-first-century learning model and student performance-effectiveness.

*H9: Student satisfaction has a significant impact on student performance-effectiveness.*

*H10: Student satisfaction is a significant mediator between the twenty-first-century learning model and student performance and effectiveness.*

## 2.6 Conceptual Framework

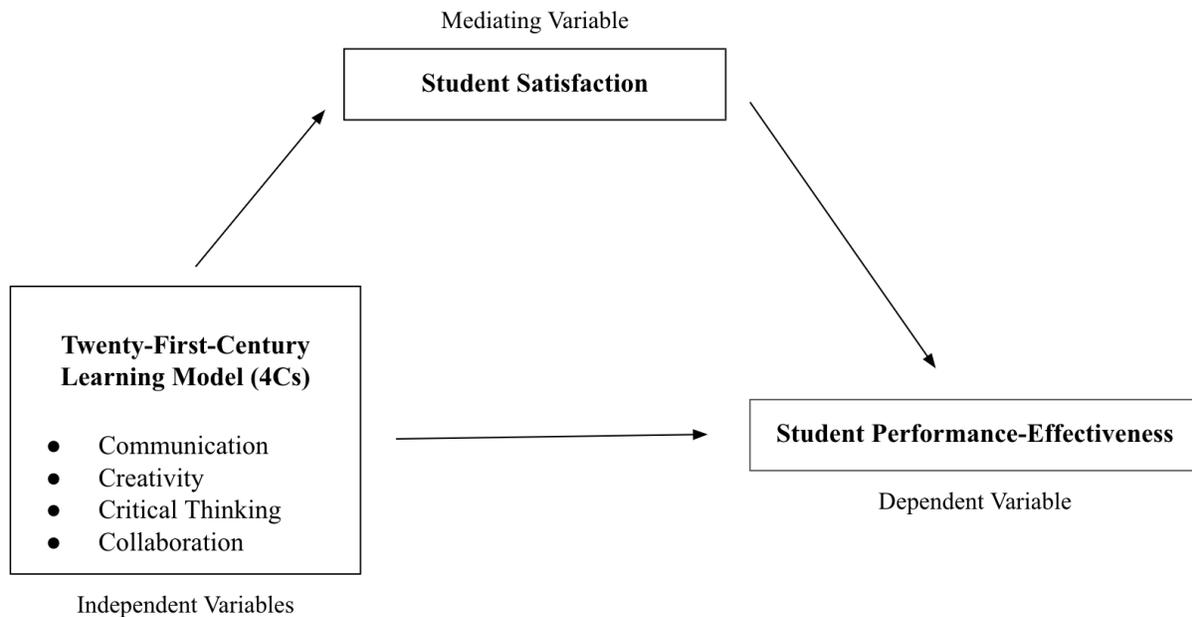


Figure 1: Conceptual Framework

## 3. RESEARCH METHODOLOGY

### 3.1 Research Method

The information was gathered through closed-end questionnaires (Likert's Rating Scale). The reliability and validity of measuring instruments were assessed. It is critical to understand that validity refers to how well a tool measures the researcher's concept (Zikmund, 2003). A five-point Likert Scale was employed to evaluate the main variables in this study from 5 (strongly agree) to 1 (strongly disagree). The demographics of those who answered the survey questions were derived from a survey conducted by Siripipatthanakul (2021). The questionnaire items in creativity

learning were based on Pardede (2020), Piaw (2010), Sunardi & Doringin (2020) and Limna et al. (2021). The questionnaire items in critical thinking learning were based on Dede (2009), Johnson (2002), Kumar (2010), Pardede (2020), and Limna et al. (2021). The questionnaire items in collaboration learning were based on Dede (2009), Pardede (2020), Sunardi & Doringin (2020), and Limna et al. (2021). The questionnaire items in communication learning were based on Lim et al. (2006), Lorenzo (2012), Pardede (2020) and Limna et al. (2021). The questionnaire items in student satisfaction were based on Rusdin & Ali (2019) and Limna et al. (2021). Finally, the questionnaire items in student performance-effectiveness were based on Dede (2009), Johnson (2002), Sohayya (2020) and Limna et al. (2021).

### 3.2 Population and Sample

The study's target population was an unknown number of Thai higher education students. Samples were then bachelors, masters and doctoral degree students whose age was over 18 years old. A standard survey usually has a confidence level of 95% (Zikmund, 2003). A minimum of 385 samples at  $p=0.5$  using probability sampling (Stratified Random Sampling) with a sample error of 5% and a precision level of 95% are required to collect data. The study's sample size was five hundred and twelve (512) respondents.

### 3.3 Data Collection

The researchers collected the data using self-administered questionnaires and employed stratified random sampling from five regions of Thailand (Northern, Eastern, North-Eastern, Central and Southern-Western). Before distributing online questionnaires, the researchers explained the study's objective to the respondents and solicited their participation.

### 3.4 Data Analysis

The SPSS program Version 27 was used to analyse the collected data. The respondents' demographic characteristics were investigated using descriptive statistics (frequency and percentage). Each variable and its questionnaire items were calculated using mean analysis and standard deviation. The reliability of the data was determined using Cronbach's Alpha reliability coefficient. The factor loadings were used to determine the validity of the measurements. The completed data were analysed using a structural equation model (SEM) to test the hypotheses.

## 4. RESULTS

Five hundred and twelve higher education Thai students ( $n=512$ ) completed questionnaires coded and analysed. The questionnaires' nominal, ordinal, and interval data were analysed using the SPSS version 27 program. PLS-SEM was used to examine the hypotheses. The results revealed that most respondents were female (58.4%), ranging between 18 and 25 years old (61.6%), single (89.7%), and earned monthly income between 10,001 and 20,000 baht (35.4%). Most respondents were higher education students with bachelor's degrees (75.8%) and studied blended learning (45%). Most of them had learned in business administration (28.8%).

### 4.1 PLS-SEM Results

Table 1: Construct Operationalization ( $n=512$ ).

| Construct | Type of Outer Model | Number of Indicators | Predefined Reliability |
|-----------|---------------------|----------------------|------------------------|
|-----------|---------------------|----------------------|------------------------|

|                               |                          |   |        |
|-------------------------------|--------------------------|---|--------|
| Critical Thinking             | Latent Variable (Mode A) | 4 | 1.0000 |
| Creativity                    | Latent Variable (Mode A) | 4 | 1.0000 |
| Collaboration                 | Latent Variable (Mode A) | 4 | 1.0000 |
| Communication                 | Latent Variable (Mode A) | 4 | 1.0000 |
| Student Satisfaction          | Latent Variable (Mode A) | 4 | 1.0000 |
| Performance and Effectiveness | Latent Variable (Mode A) | 4 | 1.0000 |

Table 2: Item loadings, Cronbach's Alpha and Average Variance Extracted (n=512).

| Items  | Factor Loadings | Cronbach's Alpha | Average Variance Extracted (AVE) |
|--|-----------------|------------------|----------------------------------|
| <b>Creativity</b>  |                 | 0.8359           | 0.6707                           |
| Creativity is a critical skill for twenty-first-century learners. (mean=4.70, SD=0.41)   | 0.8043          |                  |                                  |
| Twenty-first-century students must think creatively to succeed in all aspects of their academic studies. (mean=4.43, SD=0.68)                      | 0.8403          |                  |                                  |
| Twenty-first-century students can express their creativity through projects, performances, assignments, and other activities. (mean=4.52, SD=0.60) | 0.7795          |                  |                                  |
| Creativity is related to educational expression or academic performance for twenty-first-century students. (mean=4.46, SD=0.72)                    | 0.8498          |                  |                                  |
| <b>Critical Thinking</b>   |                 | 0.8235           | 0.6539                           |
| Twenty-first-century classes with an interactive learning environment may contribute to self-direction and critical thinking. (mean=4.47, SD=0.75) | 0.7808          |                  |                                  |
| Critical thinking is an essential skill for twenty-first-century students. (mean=4.60, SD=0.54)  | 0.8293          |                  |                                  |
| Twenty-first-century students have skills to use technology, learn content and think critically. (mean=4.60, SD=0.54)                              | 0.8135          |                  |                                  |
| Critical thinking is essential for professional and academic success for twenty-first-century students. (mean=4.70, SD=0.40)                       | 0.8102          |                  |                                  |
| <b>Collaboration</b>   |                 | 0.8770           | 0.7306                           |
| Collaboration learning is an essential skill for twenty-first-century students. (mean=4.65, SD=0.45)   | 0.8555          |                  |                                  |

|   |        |        |
|---|--------|--------|
| Twenty-first-century students have technological skills to learn new information with collaboration. (mean=4.61, SD=0.45)   | 0.8430 |        |
| Collaboration skills are essential for twenty-first-century students' effectiveness. (mean=4.60, SD=0.49)   | 0.8767 |        |
| Flexibility and willingness to help or compromise to achieve goals through collaboration skills are essential for twenty-first-century students. (mean=4.58, SD=0.53) | 0.8433 |        |
| <b>Communication</b>  | 0.8412 | 0.6782 |
| Communication has an impact on the course outcomes of twenty-first-century students. (mean=4.71, SD=0.40)   | 0.8415 |        |
| Providing twenty-first-century students with facilitating alternative communication experiences can help to motivate student outcomes. (mean=4.65, SD=0.38)           | 0.8368 |        |
| Communication is an essential skill for twenty-first-century students. (mean=4.70, SD=0.38)   | 0.8448 |        |
| Feedback, communication, and rewards contribute to higher retention rates and positive learning outcomes for twenty-first-century students. (mean=4.51, SD=0.57)      | 0.7686 |        |
| <b>Student Satisfaction</b>   | 0.8707 | 0.7213 |
| Creativity learning style makes me satisfied. (mean=4.58, SD=0.48)  | 0.8878 |        |
| Critical thinking learning style makes me satisfied. (mean=4.59, SD=0.48)   | 0.8612 |        |
| Collaboration learning style makes me satisfied. (mean=4.47, SD=0.66)   | 0.7860 |        |
| Communication learning style makes me satisfied. (mean=4.56, SD=0.43)   | 0.8588 |        |
| <b>Student Performance-Effectiveness</b>  | 0.8759 | 0.7291 |
| Creativity learning style improves the performance-effectiveness (educational outcome) of twenty-first-century students. (mean=4.57, SD=0.46)                         | 0.8599 |        |
| Critical thinking learning style improves twenty-first-century students' performance-effectiveness (educational outcome). (mean=4.56, SD=0.49)                        | 0.8687 |        |
| Collaboration learning style improves the performance-effectiveness (educational outcome) of twenty-first-century students. (mean=4.53, SD=0.56)                      | 0.8102 |        |
| Communication learning style improves the performance-  | 0.8753 |        |

effectiveness (educational outcome) of twenty-first-century students. (mean=4.58, SD=0.43)

Table 4: Overall Model (n=512)

### The Goodness of Model Fit

|                 |             |
|-----------------|-------------|
| Saturated Model | SRMR=0.0565 |
| Estimated Model | SRMR=0.0565 |

Table 5: Total Effects Inference (n=512)

| Effect  | Original Coefficient | Standard Bootstrap Results |                |         |                   |                   | Percentile Bootstrap Quantiles |         |        |        |
|---|----------------------|----------------------------|----------------|---------|-------------------|-------------------|--------------------------------|---------|--------|--------|
|   |                      | Mean Value                 | Standard Error | T-Value | P-Value (2-Sided) | P-Value (1-Sided) | 0.5%                           | 2.5%    | 97.5%  | 99.5%  |
| Critical Thinking -> Student Satisfaction         | 0.1939               | 0.199                      | 0.0656         | 2.9568  | 0.0032            | 0.0016            | 0.0348                         | 0.0708  | 0.3349 | 0.3781 |
| Critical Thinking -> Performance-Effectiveness    | 0.0298               | 0.040                      | 0.0703         | 0.4239  | 0.6717            | 0.3359            | -0.133                         | -0.0997 | 0.1756 | 0.2170 |
| Creativity -> Student Satisfaction                | 0.1541               | 0.157                      | 0.0505         | 3.0496  | 0.0024            | 0.0012            | 0.0365                         | 0.0643  | 0.2666 | 0.3100 |
| Creativity -> Performance-Effectiveness           | 0.2215               | 0.209                      | 0.0519         | 4.0726  | 0.0001            | 0.0000            | 0.0842                         | 0.1059  | 0.3101 | 0.3444 |
| Collaboration -> Student Satisfaction             | 0.1415               | 0.143                      | 0.0575         | 2.4608  | 0.0140            | 0.0070            | -0.015                         | 0.0316  | 0.2520 | 0.2854 |
| Collaboration -> Performance-Effectiveness        | 0.2274               | 0.231                      | 0.0645         | 3.5261  | 0.0004            | 0.0002            | 0.0546                         | 0.0950  | 0.3521 | 0.3924 |
| Communication -> Student Satisfaction             | 0.4317               | 0.423                      | 0.0665         | 6.4918  | 0.0000            | 0.0000            | 0.2382                         | 0.2850  | 0.5413 | 0.5729 |
| Communication -> Performance-Effectiveness        | 0.4461               | 0.436                      | 0.0746         | 5.9811  | 0.0000            | 0.0000            | 0.2407                         | 0.2890  | 0.5752 | 0.6203 |
| Student Satisfaction -> Performance-Effectiveness | 0.4493               | 0.447                      | 0.0632         | 7.1108  | 0.0000            | 0.0000            | 0.2675                         | 0.3237  | 0.5695 | 0.5996 |

Communication learning can predict student satisfaction at  $\beta=0.432$ , and  $p<0.01$  (Two tails at 0.000 and one tail at 0.0000). Creativity learning can predict student satisfaction at  $\beta=0.154$ , and  $p<0.01$  (Two tails at 0.0024 and one side at 0.0012). Critical thinking learning can predict student satisfaction at  $\beta=0.194$  and  $p<0.01$  (Two tails at 0.0032 and one tail at 0.0016). Collaboration learning can predict student satisfaction at  $\beta=0.141$ ,  $p<0.05$  (Two tails at 0.0140 and one side at 0.0070). Communication learning can predict student performance-effectiveness at  $\beta=0.252$ , and  $p<0.001$  (Two tails at 0.0000 and one tail at 0.0000). Creativity learning can predict student

performance-effectiveness at  $\beta=0.142$ , and  $p<0.01$  (Two tails at 0.0001 and one side at 0.0000). Critical thinking learning has no significant effect on student performance-effectiveness at  $\beta= -0.057$  (multicollinearity), and  $p<0.01$  (Two tails at 0.6717 and one side at 0.3359). Collaboration learning significantly predicts student performance-effectiveness at  $\beta=0.164$ , and  $p<0.01$  (Two sides at 0.0004 and one at 0.0002). Student satisfaction can predict student performance-effectiveness at  $\beta=0.449$ , and  $p<0.001$  (Two tails at 0.0000 and one tail at 0.0000). Overall, student satisfaction is a significant mediator between the twenty-first-century learning model (4Cs) and student performance-effectiveness by about 75.49% ( $R^2=0.7549$ ).

Table 6: Summary of Hypothesis Testing.

| Hypotheses   | Results                                    | Actions  |
|--|--|----------|
| H1: Creativity learning has a significant impact on student satisfaction.  | $\beta=0.154$<br>at $p<0.01$               | Accepted |
| H2: Creativity learning has a significant impact on student performance-effectiveness.   | $\beta=0.142$<br>at $p<0.01$               | Accepted |
| H3: Critical thinking learning has a significant impact on student satisfaction.   | $\beta=0.194$<br>at $p<0.01$               | Accepted |
| H4: Critical thinking learning has a significant impact on student performance-effectiveness.  | $\beta= -0.057$<br>at $p>0.05$             | Rejected |
| H5: Collaboration learning has a significant impact on student satisfaction.   | $\beta=0.141$<br>at $p<0.05$               | Accepted |
| H6: Collaboration learning has a significant impact on student performance-effectiveness.  | $\beta=0.164$<br>at $p<0.01$               | Accepted |
| H7: Communication learning has a significant impact on student satisfaction.   | $\beta=0.432$<br>at $p<0.001$              | Accepted |
| H8: Communication learning has a significant impact on student performance-effectiveness.  | $\beta=0.252$<br>at $p<0.001$              | Accepted |
| H9: Student satisfaction has a significant impact on student performance-effectiveness.  | $\beta=0.449$<br>at $p<0.001$              | Accepted |
| H10: Student satisfaction is a significant mediator between the twenty-first-century learning model (4Cs) and student performance-effectiveness. | $R^2=0.698$<br>$R^2=0.755$<br>at $p<0.001$ | Accepted |

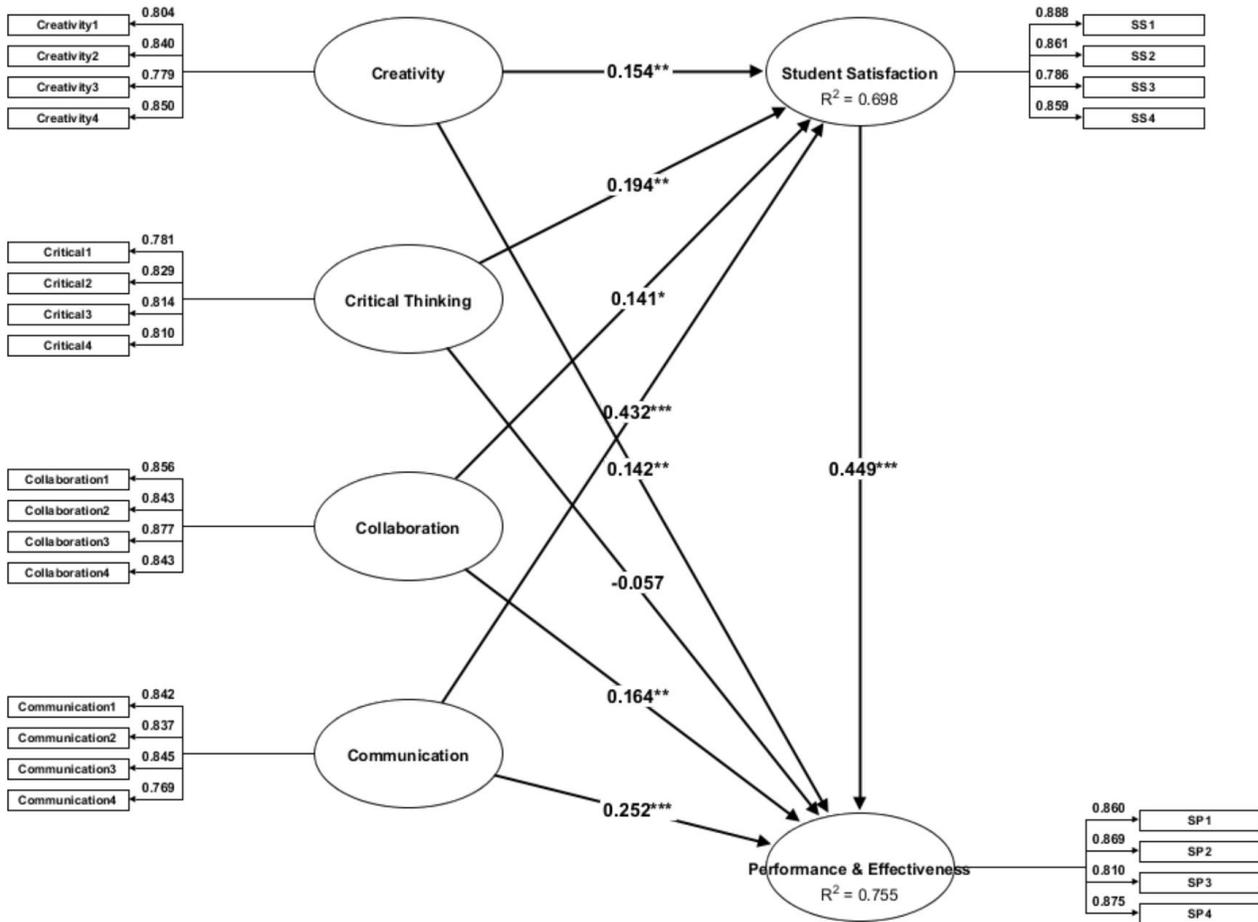


Figure 2: PLS-Structural Equation Model of the Study

## 5. DISCUSSION AND CONCLUSION

### 5.1 Discussion

The study’s objective was to investigate the effect of the 21st-century learning model (4Cs) on student performance and effectiveness through student satisfaction as a mediator. The findings revealed that creativity, critical thinking, collaboration, and communication learning significantly impact student satisfaction. Creativity, collaboration, and communication learning greatly influence student performance-effectiveness, whereas critical thinking learning has no significant impact. The findings also revealed that student satisfaction is a potent mediator between the twenty-first-century learning model and student performance-effectiveness. The results supported previous research of Hadiyanto et al. (2021), Pardede (2020) and Piaw (2010) that creativity learning is an essential skill for the twenty-first century and affects student performance-effectiveness. It also confirmed Sunardi and Doringin (2020) that creativity learning significantly affects student satisfaction. The findings supported Pardede (2020) and Supena et al. (2021) research that critical thinking learning significantly affects satisfaction among students. It also confirmed Rodzalan and Saat (2015) that students were satisfied with critical thinking learning and thought of themselves as having strong critical thinking and problem-solving skills. However, critical thinking learning in this study has no significant impact on student performance and

effectiveness. It is a need for more effective critical thinking learning methods among Thai students. According to Muali et al. (2018), students subjected to self-directed online learning based on rich internet applications (RIA) had better critical thinking skills than students who studied using traditional methods. The findings supported previous research of Häkkinen et al. (2017), Sohaya (2020) and Zhu (2021) that collaboration was a critical part of the learning process. Students' task performance improved when they worked in groups. It also supported Rusdin and Ali (2019) that students were satisfied and had a high level of interest in activities based on collaboration learning in classes. The findings supported previous research of Hadiyanto et al. (2021), Häkkinen et al. (2017), Lim et al. (2006), Rusdin and Ali (2019), and Sohaya (2020) that communication skills are an essential skill in the twenty-first century. Students were satisfied and showed a high interest in communication skills-based activities in class. It also supported Häkkinen et al. (2017) that when students communicated effectively, their task performance improved. The findings supported previous research of Darawong and Sandmaung (2019) that student satisfaction has a positive impact on student performance-effectiveness. It also endorsed Appleton-Knapp and Krentler (2006) that students whose educational performance exceeded their expectations were more satisfied with their learning environment than students whose performance did not meet their expectations. Besides, it confirmed Appleton-Knapp and Krentler (2006), Darawong and Sandmaung (2019), Oja (2011) and Vasileva-Stojanovska et al. (2015) that student satisfaction is a significant mediator between twenty-first-century learning style and student performance-effectiveness.

## **5.2 Conclusion**

The empirical findings show that creativity, critical thinking, collaboration, and communication learning significantly impact student satisfaction. Creativity, collaboration, and communication learning significantly impact student performance-effectiveness, whereas critical thinking learning has no effect. Furthermore, student satisfaction is the mediator between the twenty-first-century learning model (4Cs) and student performance-effectiveness. It is recommended to improve twenty-first-century learning, especially communication, because, among the 4Cs of the twenty-first-century learning model, communication has the most influence on student satisfaction and performance-effectiveness.

## **5.3 Research Implication**

Generally, this study indicates a positive relationship between twenty-first-century learning styles, student satisfaction, and student performance-effectiveness. It may be advantageous for universities or program directors to develop an appropriate strategy to respond to the needs and expectations of students who wish to enrol in any graduate program and beyond. The outcome is centred on a student.

## **5.4 Theoretical Implication**

This study contributes to the current literature on the 4Cs of the twenty-first-century learning model in the academic context. The findings of this study will help academics expand the study by including other potential factors. Furthermore, the questionnaires from this study can be used to guide them in conducting additional research on the 4Cs of twenty-first-century learning styles, student satisfaction, and student performance-effectiveness.

## **5.5 Limitations and Recommendations**

This study is a self-administered questionnaire. Qualitative research, such as interviews, could provide more insight into future research. Furthermore, numerous studies support the antecedents of student satisfaction and student performance-effectiveness. Other factors such as the social process of quality teaching (Kim et al., 2019), educational multimedia and learning style preferences (Tayo & Oluwakemi, 2015), positive teacher-student relationship and motivation model learning (Yunus et al., 2011), and learning management system (Chandra & Napitupulu, 2021) are recommended for further study.

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