The Use of Google Solutions in Teaching and Learning: A Case of Vietnam

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ABSTRACT

The use of technology and applications in education has continued to increase over the last few decades, and many studies show the effectiveness of using technology in teaching and learning. The central question in the present research is how Vietnamese teachers and students use Google products, as a new technology solution, to transform teaching and learning as well as to motivate students' learning. By selecting a public school in Ha Noi and a private school in Ho Chi Minh City with 31 teachers and 112 students, the present research investigated students' and teachers' attitudes toward using technology in the classroom as well as their practices using Chromebooks and Google Workspace for their teaching and learning activities. The results showed that both students and teachers had positive attitudes toward using technology in the classroom. One of the most important findings is that teachers and students find Chromebooks and Google Workspace for Education as valuable tools. Teachers expressed their interests in using Chromebooks mostly because Chromebooks consist of many applications that teachers can use for different purposes such as online teaching, assessment and classroom management. Within the scope of the pilot program, teachers also recognised that the use of Google Solutions have a positive effect on students' learning. Students perceived that Chromebooks are great for their learning and they are willing to introduce Chromebooks to their friends. Using Google applications give students more opportunities to collaborate and communicate with their peers as well as to solve the problems during their learning. The result also shows that there are differences in students' motivation to learn Math *before and after the pilot program.*

KEYWORDS: *innovation, technology, Google Solutions, education, Vietnam.*

1. Introduction

Technology plays a significant role in bringing innovation to teaching and learning practices (Akram et al., 2022). Research shows that by using technology in education, students are more interested in their learning, lessons become more interesting, time is saved, interaction and cooperation between students and teachers have developed (Alexiou-Ray et al., 2003; Hüseyin & Faruk, 2020). In terms of students' use, technologies can support students to engage collaboratively to become innovative and creative learners. These technologies can support the creation of new knowledge and the development of new skills (Voogt et al., 2018). In order to support schools,

teachers and students with the use of technology for teaching and learning activities, various technological applications from different providers have been developed, such as applications for education from Microsoft or Google. The present research focuses on the use of Google products for Education, called Google Solutions and how these uses change students' motivation for learning. This section covers the introduction of Google Solutions and the MUSIC model of motivation that was used for the present research. The purpose of the present research was also stated.

1.1. Google solutions

Within the scope of the pilot program, Google Solutions include the hardware Chromebooks and the system Google Workspace for Education. Chromebook is a low-cost portable computer powered by Google's Chrome OS, an operating system inspired by and designed around the Chrome web browser. Instead of a hard drive, Chromebook relies on cloud-based storage. And instead of resident applications, Chromebook uses web-based applications that are accessed and bookmarked through the Google Play store. This provides a faster, simplified, and more secure computing environment than with traditional Windows or Mac computers. Almost everything working on the Chromebook happens in the Chrome web browser (LaFay, 2015).

The services of Google Workspace for Education also allow users to access information from any device, at any time, and from anywhere (Hart-Davis, 2021). Google Workspace for Education contains a list of applications. The core services in Google Workspace for Education include the following: Google Drive, Gmail, Google Calendar, Google Cloud Search, Google Docs, Google Sheets, Google Slides, Google Forms, Google Chat, Google Meet, Google Jamboard, Google Classroom, Google Sites, Google Tasks. Other Google services, such as YouTube, DoubleClick, Google Scholar, Google Contacts and Google News, are also available.

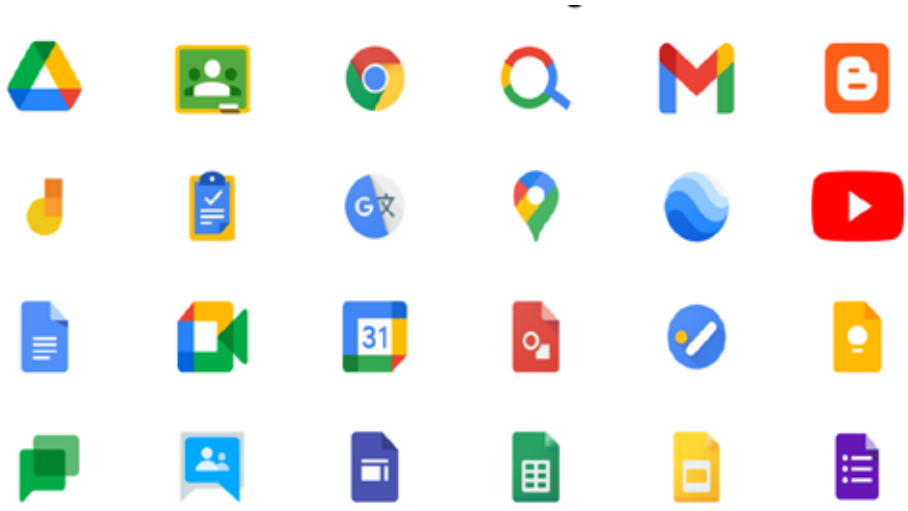

Figure 1. Applications from Google Workspace for Education

Google Workspace for Education and Chromebooks have been widely used around the world for educational purposes. Many guidelines for Google Workspace for Education and Chromebooks have been published to help teachers and students approach these solutions (Hart-Davis, 2018; Hart-Davis, 2021; Iyer, 2022). Researchers have also been interested in investigating the effectiveness of using Google Workspace for Education and Chromebooks in the classrooms. For example, Alia and Hamtini (2019) measured the learners' and teachers' satisfaction levels with Google Classroom which is the most popular learning management system (LMS) platform. The findings show that most of the learners are satisfied with Google Classroom which proves its effectiveness as a learning management system. Iftakhar (2016) also conducted research on the power of Google Classroom, and the author found the potential of Google Classroom in teaching and learning. Previously, Google Solutions have been applied in Korea. The pilot results showed that Google Solutions helped teachers in terms of time efficiency in work and teaching activities and brought positive changes to students' learning activities. Google Solutions also effectively supported class management, feedback and communication (Center for Innovation of Future Education Seoul National University, 2021). Universiti Kebangsaan Malaysia (2022) also investigated how Google Solutions transform teaching and learning, and how teachers implement Google for Education tools in Malaysian classrooms. The results show that Google for Education tools has provided Malaysian teachers with a platform to make online learning easy and efficient. Google Solution tools transformed the classrooms in five aspects; (1) Delivery content, (2) Classroom management, (3) Interaction and engagement, (4) Leadership and (5) Synergy between parents, teachers, university and industry. From Malaysian teachers' perspectives, Google Solution tools are also effective in three aspects; (1) Teaching and learning process, (2) Class control, and (3) Student centredness.

1.2. Students' learning motivation

Research shows the important role of motivation in learning different subjects. For example, children who are motivated tend to be engaged, persist longer, have better learning outcomes, and perform better than other children on standardized achievement tests (Pintrich, 2003). Many researchers have been interested in students' learning motivation. Jones (2009) stated that "Motivation is the extent to which one intends to engage in an activity". He introduced The MUSIC Model of Motivation (Jones, 2009, 2018). This Model is considered a research-based model to explain the relationships among factors that affect people's motivation to engage in activities.

In the MUSIC model, people's motivations to engage in activities are affected by five perceptions (eMpowerment, Usefulness, Success, Interest, and Caring), which work together synergistically to create a motivating climate. These five MUSIC perceptions work together to create a positive motivational climate, which has been defined as "the aspects of the psychological environment that affect students' motivation and engagement within a course" (Jones et al., 2022). Figure 2 shows the MUSIC Model of Motivation.

The author also developed a questionnaire to measure students' learning motivation that can be applied in different levels of education as well as different subjects. The questionnaire consists of 18 items measuring five MUSIC perceptions of the model. In the present research, a questionnaire adapted from his questionnaire was used to measure Vietnamese students' motivation to learn Maths.

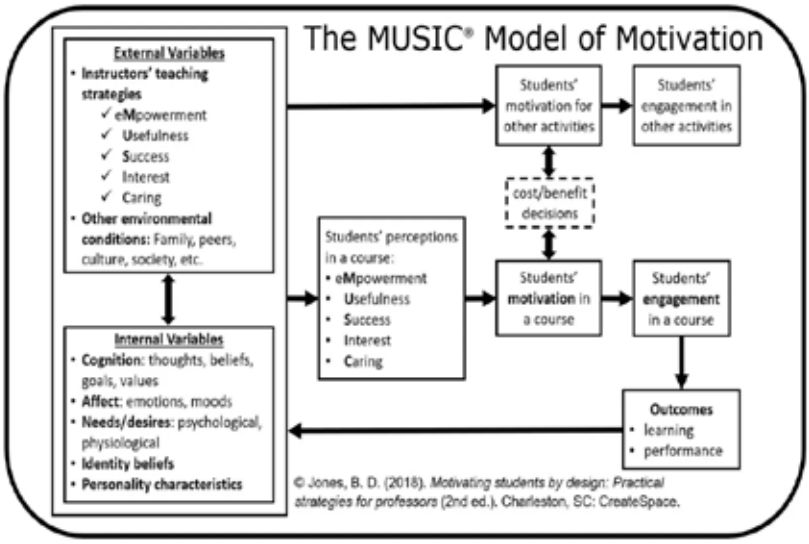

Figure 2. The MUSIC Model of Motivation

The purpose of this research is to explore the use of Google Workspace for Education and Chromebooks by Vietnamese students and teachers to transform teaching and learning as well as to motivate students' learning. More specifically, the present research sought to answer two research questions:

(1) How do Google Solutions transform teaching and learning activities in classrooms in Vietnam?

(2) To what extent does students' motivation to learn Maths change during the use of Google Solutions?

One of the most important assumptions of piloting Google Workspace for Education and Chromebooks (Google Solutions) in Vietnam is that, by using Google Solutions, Vietnamese teachers and students can access and use various Google applications to help them improve their teaching and learning experiences. They use Google Solutions as an ecosystem for learning, teaching and assessment as well as managing classrooms virtually. In the present research, by using different means of methods such as experimental design for pre-survey and post-survey, classroom observations, biweekly meetings with teachers, interviews, some aspects such as the attitudes toward using technologies in the classroom, the use of specific Google Solutions (Chromebooks and Google Workspace for Education) during one semester, students' and teachers' difficulties in using Google products were investigated. Apart from these aspects, students' motivation to learn Math was also included in this research.

2. Methodology

2.1. Participants

Students and teachers from two schools in Ha Noi và Ho Chi Minh City participated in the pilot program. The first one is the Experimental School of Education Sciences (Thuc Nghiem School), under the Vietnam National Institute of Educational Sciences, which was established on September 19, 2018 on the basis of merging three Experimental Primary School, Experimental Secondary School and Experimental High School. The school is a public education institution in the national education system and in the system of high schools of Hanoi city. The school uses the national curriculum of the Vietnam Ministry of Education and Training, and at the same time, the school conducts different experiments with advanced teaching, assessment models and methods, as well as with scientific research of the Vietnam National Institute of Educational Sciences. As a result, the school's educational plan is quite open and diverse, with many options suitable for different types of students. 16 teachers and 37 students from grade 6B in this school participated in the pilot. The second one is Vinschool, a multi-level school system from preschool to high school invested in and developed by Vingroup, aiming to become a Vietnamese school of international standards. Established in 2013, Vinschool is well invested in infrastructure, teacher quality and curriculum, becoming the largest private education system in Vietnam. Vinschool Golden River, a school belonging to the Vinschool education system in Ho Chi Minh City, had 15 teachers and 75 students from grade 6A, 6B, and 6C participating in the pilot program.

2.2. Instruments

In order to achieve the purpose of the research, different types of instruments have been developed. They were pre-survey questionnaires, observation sheets for lessons in the classroom, interview questions used in biweekly meetings and post-survey questionnaires. All these instruments have been developed by the Research Team from the Vietnam National Institute of Educational Sciences to make sure they cover different aspects of implementing Google Solutions (including Chromebooks and Google Workspace for Education) in the Vietnam education context.

Pre-survey

Pre-survey was designed for teachers and students. Students' pre-survey focused on their background, their attitudes toward the use of technology in learning; frequency of using Google Workspace for Education applications; and their views on motivation to learn Math. Teachers' survey consisted of items on their background, their attitudes toward the use of technology in the classroom; their views on school readiness when piloting new technology products; frequency of using Google applications.

Observation sheets

The classroom observation will focus on six different areas:

+ Ease of use for teachers*:* Observation by answering two following questions:

(i) How easy it is for the teacher to use the Google product(s) during instruction; (ii) How challenging it is for the teacher to use the Google product(s) during instruction;

+ Ease of use for students*:* Observation by answering two following questions: (i) How easy it is for the student to use the Google product(s) during instruction; (ii) How challenging it is for the student to use the Google product(s) during instruction;

+ Connection to teacher practice: Describing how the teacher uses the Google product(s) as part of her/his teaching activities;

+ Student engagement*:* Describing the level of student engagement as they are working with the Google product(s), or as they are working on activities that include the Google product(s);

+ Critical questions*:* Any questions that may need to follow-up on with the teacher, Google, or relevant teams;

+ Usability/tech issues for the company: Any urgent tech-related matters.

Interview questions used in biweekly meetings

In order to support teachers and students during the pilot program, a set of questions relating to the teachers' use of Chromebooks and Google Workspace for Education has been developed as follows:

(i) Have you encountered any problems while using Chromebooks (CBs) in teaching? What is the specification? Are you able to handle these problems yourself? Did you find support from others to fix the problem? How specifically?

(ii) Compared to the first week of using CBs and this time, how do teachers generally evaluate the experience in teaching with CBs?

(iii) During class time when using CBs, do teachers find that students interact with the lesson better?

(iv) Which applications from Google Workspace for Education have you used the most? Which applications have the most difficulty in use? Why?

(v) How satisfied are you with the experience of using Google Workspace for Education applications in teaching and learning? Do you use Google Workspace for Education for other activities beyond the regular classes?

Post-survey

Post-survey was also designed for teachers and students. Some items from the pre-survey were reused to explore the changes during the pilot program. In addition, other items were also added in the post-survey. Specifically, students' post-survey included items on their experiences of using Chromebooks and Google Workspace for Education applications in learning; their awareness when using different devices (smartphones, tablets, laptops) for learning and other activities. Teachers' post-survey consisted of items measuring the impact of Google Solutions on their timetable; the impact of Google Solutions on students' learning and their teaching compared to when teachers teach without using Google Solutions technology; teachers'

overall satisfaction with Google Solutions and Chromebooks as part of Google's pilot program; their perspectives and frequency on using Google Workspace for Education in the classroom; the shift from face-to-face to online teaching and the impact of Chromebooks and Google Workspace for Education on teaching; the level of security and safety when teaching via Chromebooks.

2.3. Procedures

The pilot program started with the pre-survey for students and teachers. The main purpose of the pre-survey was to collect the information of participants about their understanding and their awareness of Google Solutions and their attitudes toward using technology in teaching and learning before implementing the pilot program. Then, the training workshops for teachers were organised by AI Education to provide teachers with information about the pilot program, as well as the products from Google Solutions that teachers and students could use for their teaching and learning.

Some basic applications were introduced to teachers in detail such as Google Meet, Google Docs, Google Sheet, Google Slides. Participants were also encouraged to use as many Google applications as they can during the pilot. All teachers and students in the pilot program were provided with new Chromebooks. They were encouraged to use their Chromebooks for teaching and learning activities instead of using their personal laptops or computers.

In order to support and promote teachers and students to use Google Solutions, biweekly meetings and interviews were organised to help them update and share their uses as well as their difficulties during the pilot. During biweekly meetings, experts from AI Education also introduced to teachers other useful Google applications/add-ons and tips to apply them in their teaching practices. Classroom observations in different subjects were also conducted during the pilot to collect additional information from teachers and students. Weekly meetings with school managers were also organised to make sure the pilot went well. At the end of the pilot, the post-survey was delivered to all participants.

2.4. Statistical analysis techniques

Descriptive statistics

Descriptive statistics are brief descriptive coefficients that summarize a given data set. Descriptive statistics are broken down into measures of central tendency and measures of variability. Measures of central tendency include the mean, median, and mode, while measures of variability include standard deviation and variance variables. Descriptive statistics, in short, help describe and understand the features of a specific data set by giving short summaries about the sample and measures of the data. In this research, descriptive statistics have been used to describe variables related to teachers' and students' characteristics, their attitudes toward using technology, their perceptions of using Google Solutions, students' motivation to learn Math.

Reliability analysis

Reliability refers to the extent to which a scale produces consistent results, if the measurements are repeated a number of times. Cronbach's alpha gives us a simple way to measure whether or not a score is reliable. In this research, reliability analysis has been used for students' motivation to learn Math.

t-test

Hypothesis testing uses sample data to evaluate a hypothesis about a population. A t-test is a type of inferential statistic used to determine if there is a significant difference between the means of two groups, which may be related in certain features. In the present research, paired sample t-test was used to examine the differences in students' motivation between pre- and post-results.

3. Results and discussion

3.1. Attitudes toward using technology

At the beginning of the pilot program, teachers stated that their schools support them in applying new technologies in the classroom. For example, over 85% of teachers believed that the school leaders would do whatever it takes to try new Edtech tools and they would support teachers' use of new Edtech tools in the classroom. 87% of teachers agreed that teachers at their school are motivated to try new Edtech tools, and 91% of teachers think that their schools encourage them to incorporate technology in the lessons. In this section, attitudes toward using technology in the classroom from teachers' and students' perspectives will be presented.

Teachers' Attitudes

The information of teachers' attitudes toward using technology was collected during the post-survey. In general, they have good views on the use and the role of technology in teaching and learning. This result was consistent with the findings from other research (Center for Innovation of Future Education Seoul National University, 2021; Khokhar & Javaid, 2016; Mahdum et al., 2019).

Regarding the use of technology, it can be seen that many teachers are familiar with and ready to use technology in the classroom. Specifically, about 66.7% of teachers agree with the statement, "I feel comfortable navigating most of the technology that I encounter at my job" and "I often explore and assess new technology for use in my classroom". This proves that most of the teachers are eager to learn and they want to explore new technology applications. However, only 41.7% of teachers agree with the statement "I frequently experiment with new technology and I am usually the first of my colleagues to try a new digital tool or resource".

Teachers also have the desire to choose the most appropriate and best tools for students, it is necessary to have clear criteria for evaluating the quality of technology products (68.8% of teachers agree or strongly agree with this point of view). Figure 3 shows the results of teachers' use of technology in the classroom.

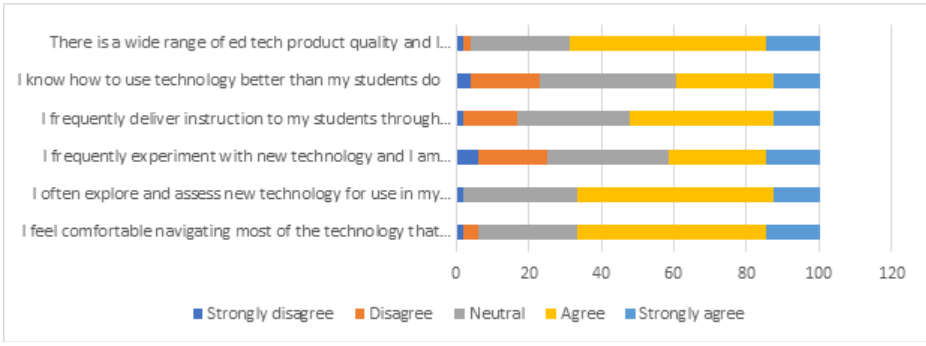

Figure 3. Teachers' opinion on using technology in the classroom

Most teachers believed that technology has many roles in the teaching process, especially during the epidemic period (from 66.7% to 80% of teachers agree with the statements about the role of technology). In which, most teachers agreed that *"To prepare students for the 21st century, they must be digitally literate"; and "I think technology has many benefits and I try to use it when possible".*

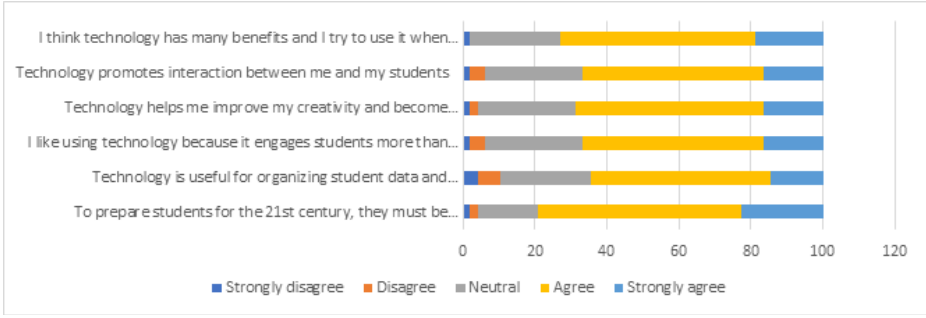

Figure 4. Teachers' opinion on the role of technology in the classroom

Figure 5 shows the results about teachers' opinion on the harm of technology. It can be seen that technology has many benefits for teaching and learning, but it also has some limitations. Nearly 60% of teachers said that technology has many benefits but also has barriers. Also, nearly a third of teachers believed that technology is harmful. They do not see the benefits of technology or they wonder that technology can cause distraction at school.

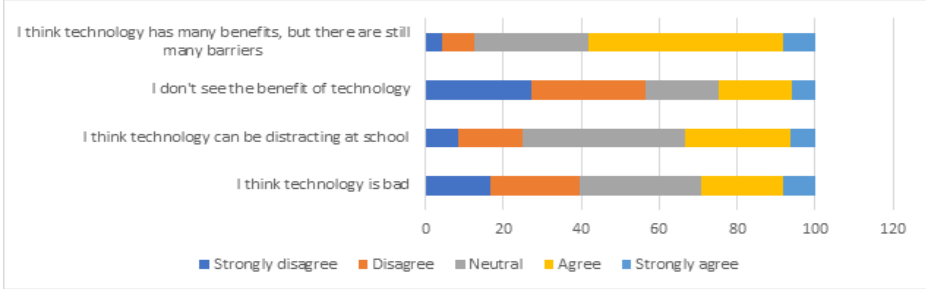

Figure 5. Teachers' opinion on the harm of technology

Students Attitudes

The information about students' attitudes toward using technology was collected in both pre-survey and post-survey. The following figures show that there are positive changes in their views on the interest in technology and the role of technology during the pilot program. From Figure 6, it can be seen that the percentages of students' agreement were increased from the pre-survey to post-survey. For example, before the survey, only 48% of students in the pilot believed that *"the more often teachers use computers, the more I will enjoy school".* However, the percentage of agreement for this statement after the pilot was 67%. In terms of students' views on the role of technology as indicated in Figure 7, students tended to agree more on the important role of technology in learning after they experienced Google Solutions.

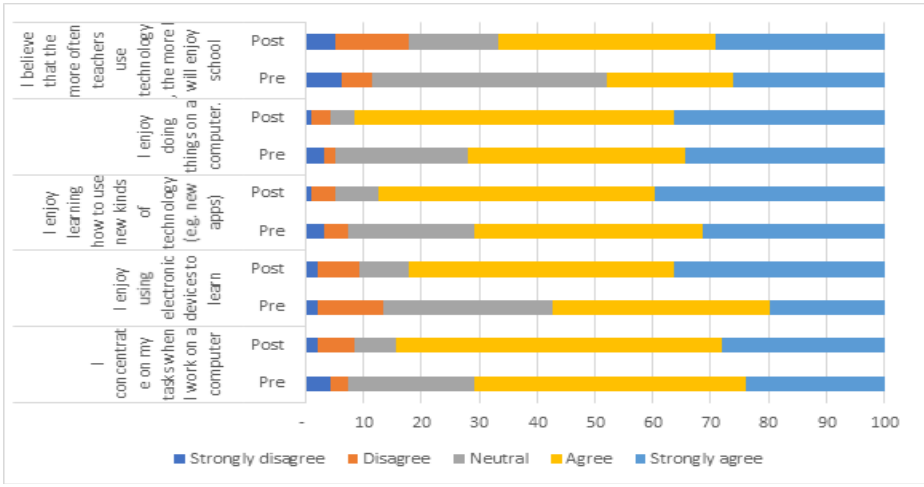

Figure 6. Students' interest in technology

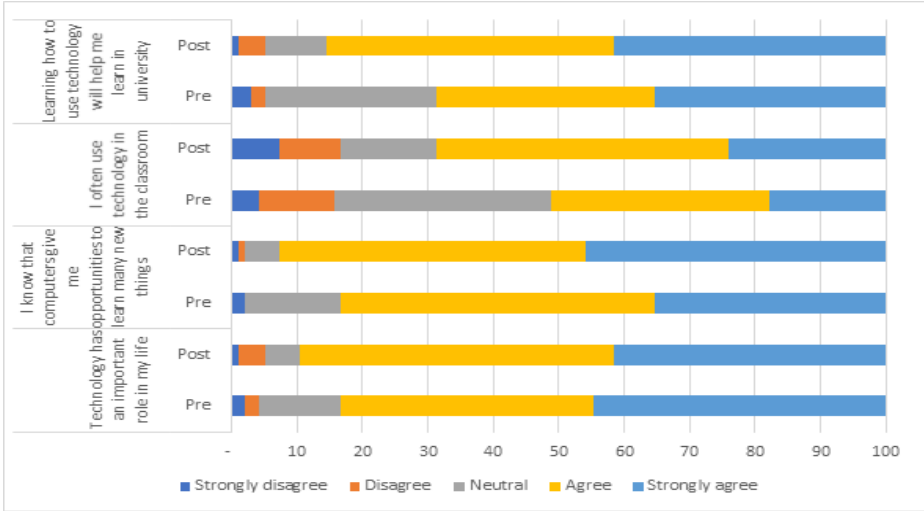

Figure 7. Students' opinion in the role of technology

3.2. How Google Solutions transform teaching and learning activities in classroom

As mentioned earlier, Google Solutions refers to Chromebooks and Google Workspace for Education. In order to explore how Google Solutions is transforming teaching and learning activities in the classroom in the pilot schools, this section provides the results and findings of the uses of Chromebooks and Google Workspace for Education from teachers' and students' perspectives.

The Use of Chromebooks from Teachers' Perspectives

Each teacher received a Chromebook during the pilot. At the end of the pilot program, they were asked to rate how suitable Chromebooks and other devices are for different activities. Figure 8 shows the results that teachers rated for their students' learning in each device. It can be seen that with all students' learning activities on different devices, Chromebooks show higher rates for learning activities such as completing students' homework or focusing students' attention on the learning tasks.

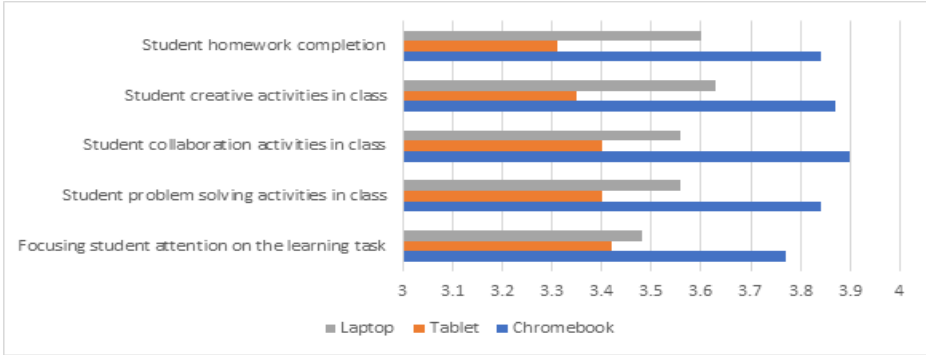

Figure 8. Teachers' rates for their students' learning in different devices

In addition, teachers also rated how suitable Chromebooks and other devices are for their teaching activities in each device. The results shown in Figure 9. Besides, teachers also believed that Chromebooks help them save time in the planning, implementing, and managing each phase of their teaching process.

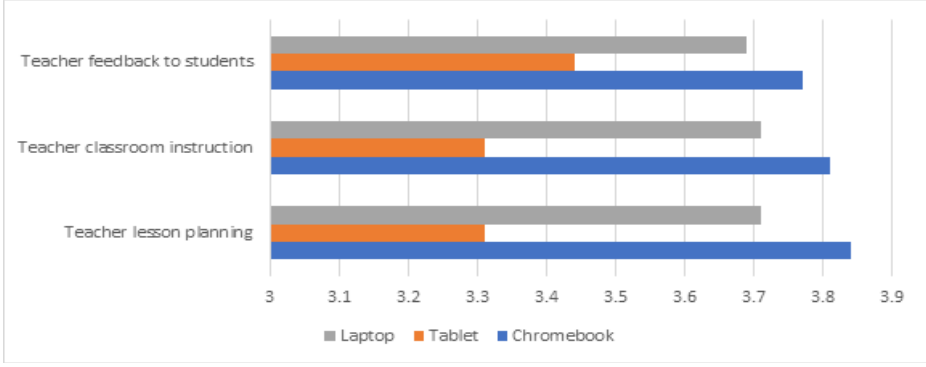

Figure 9. Teachers' rates for their teaching activities in different devices

Overall, many teachers (67.7%) agreed that Chromebooks are perfect for their needs. Some teachers said that they used Chromebooks all time within the pilot program and they will keep using it in the future. Some teachers also said that Chromebook are small, compact, lightweight, and especially with strong batteries, so they are very suitable for teachers to carry during classroom teaching; Chromebooks specialized tools help teachers focus on work goals without distractions. Using a cloud tool makes it possible for teachers to use personal data anywhere and anytime; Chromebook is a suitable laptop and meets the needs of teachers because of the integration and research and creativity from Google and Samsung; Chromebook strengthens the connection between teachers and students, between teachers and parents; Chromebooks save me a lot of time for preparing lessons, assigning, grading, commenting, and correcting students' work. I can observe the work process, the progress of students when working on projects, especially during online learning. Chromebooks have been a great support for education in general and teachers and students in particular. Chromebooks are great for teachers' needs. Figure 10 shows the levels of agreement with the statement "Chromebooks are great for teachers' needs".

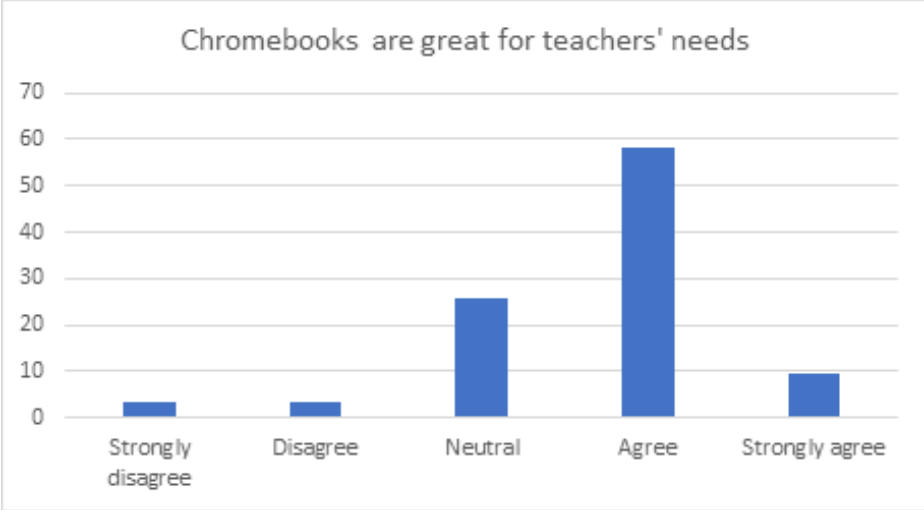

Figure 10. Teachers' agreement on the role of Chromebooks

They also rated a high level for introducing Chromebooks to their peers. The main reasons were Chormebooks save much time in teaching and learning; Chormebooks have rich sources of material; Chromebooks bring many benefits to students and teachers; Chromebooks help colleagues understand more and take advantage of online resources; Google Workspace for Education meets my colleagues' work needs. A teacher also stated that:

"I clearly see the benefits of Google Workspace for Education after participating in testing it, and so I will definitely recommend it to colleagues".

This result is also consistent with the teachers' interview through biweekly meetings. Teachers also think that Chromebooks are suitable for their students' learning. Figure 11 shows that 96.8% of teachers agreed with this statement.

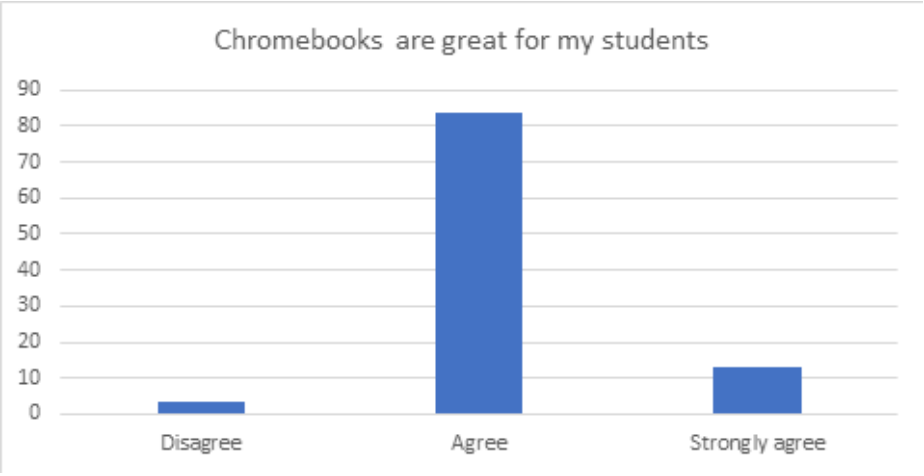

Figure 11. Teachers' agreement on the role of Chromebooks for students

From teachers' perspectives, some of the reasons for this agreement were that students are supported to carry out academic activities under necessary supervision; Chromebooks are small, compact, and lightweight, suitable for students to carry and use during their studies. The use of Chromebooks helps students save a lot of time in finding information and supporting students to self-study; students can easily interact with the teacher and with other classmates. In particular, Chromebooks help students have a safer experience with technology; Chromebooks limit the pages/ websites/applications students can access, restricting inappropriate ones. Students mostly use computers for learning. A teacher also stated that:

"Chromebooks help students develop a number of necessary skills such as: being proactive in searching and processing information, promoting students' activeness, independence, creativity, and improving the spirit of self-study and activity student group anytime, anywhere. The use of Chromebooks helps students facilitate the learning process and effectively use google applications, contributing to reducing the pressure on the number of books students bring to school every day, learning and controlling completion. Student homework becomes more scientific and encapsulated in a Chromebook."

However, some teachers also expressed some difficulties they have faced in using Chromebooks during the pilot. For example, Chromebooks are not very convenient for installing tools and applications to compose content with mathematical formulas and drawings; Chromebooks have small keyboards, as a result, it is difficult to edit texts; there are no flexible drives to familiar devices such as projectors or televisions.

The Use of Google Workspace for Education from Teachers' Perspectives

Teachers in the pilot program were also asked about the impact of Google Solutions on their teaching compared to when you were teaching without using GS's technology. Figure 12 shows the results.

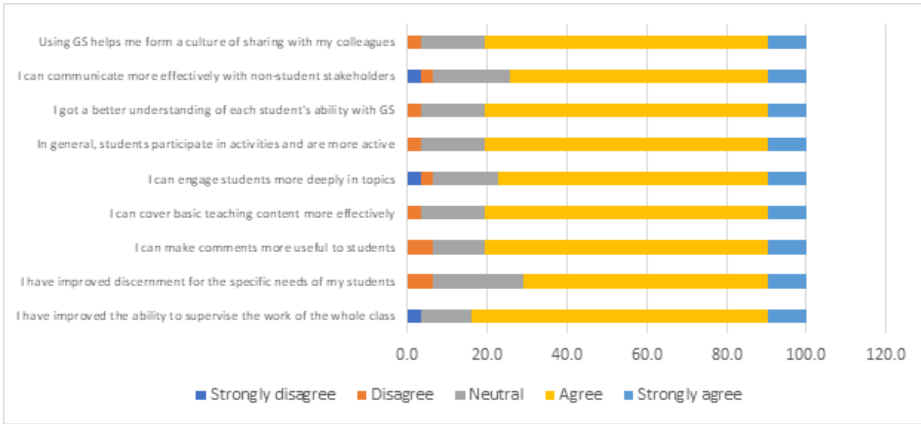

Figure 12. Impact of Google Solutions on teachers' practices

In general, Google Solutions has a great impact on teachers' teaching (over 70% to 82% of teachers agree with the statements we make about the impact of professors). In which, the teacher agrees the most with the view, *"I have improved the ability to supervise the work of the whole class"*. When all the applications used for teaching are in one technology platform, improved classroom monitoring is understandable. In addition, this can also help teachers cover basic teaching content more effectively, give more useful comments to students, and students participate in more active activities.

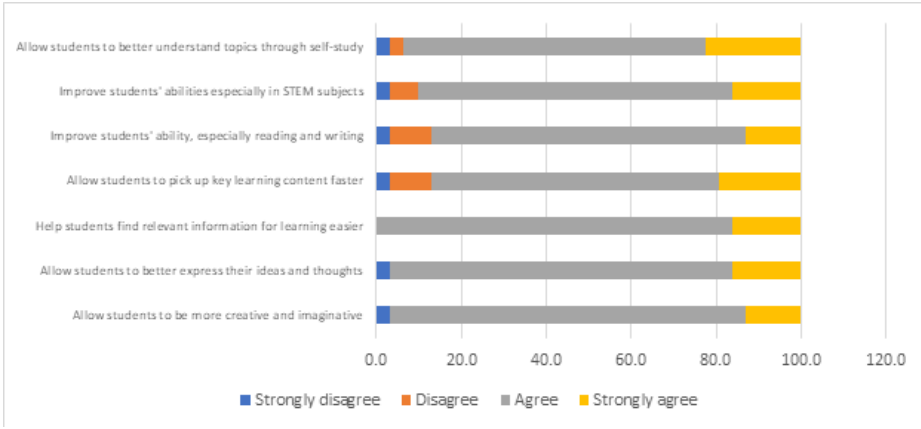

Figure 13. Impact of Google Solutions on students' learning (1)

Google Solutions not only has a great impact on the teaching but also on students' learning. The majority of teachers participating in the survey (from 83% to 98%) agree with the impact of Google Solutions on students' learning such as encouraging students to cooperate more, helping students to complete assignments. faster, helping students achieve better results of the meeting. Figure 13 and Figure 14 shows the results in detail.

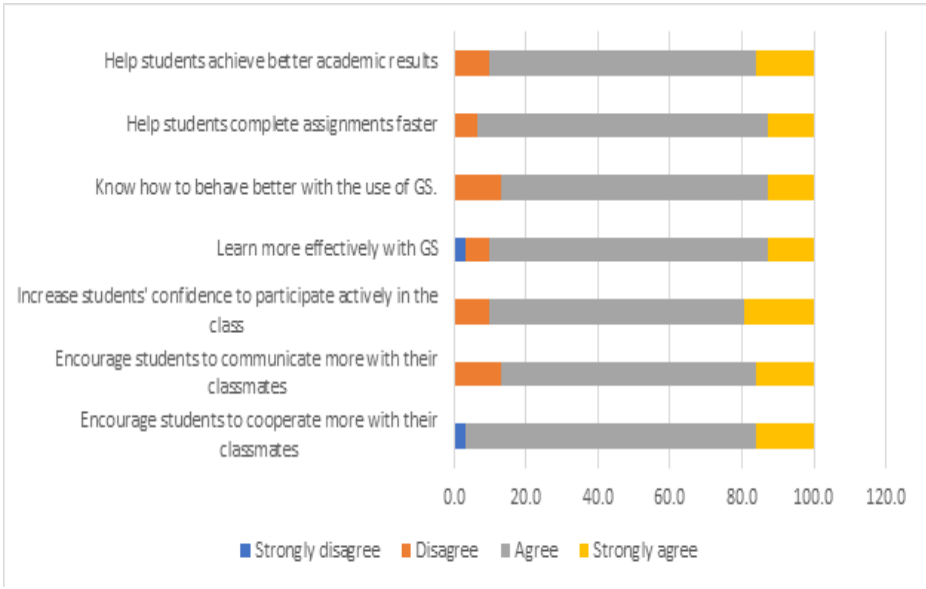

Figure 14. Impact of Google Solutions on students' learning (2)

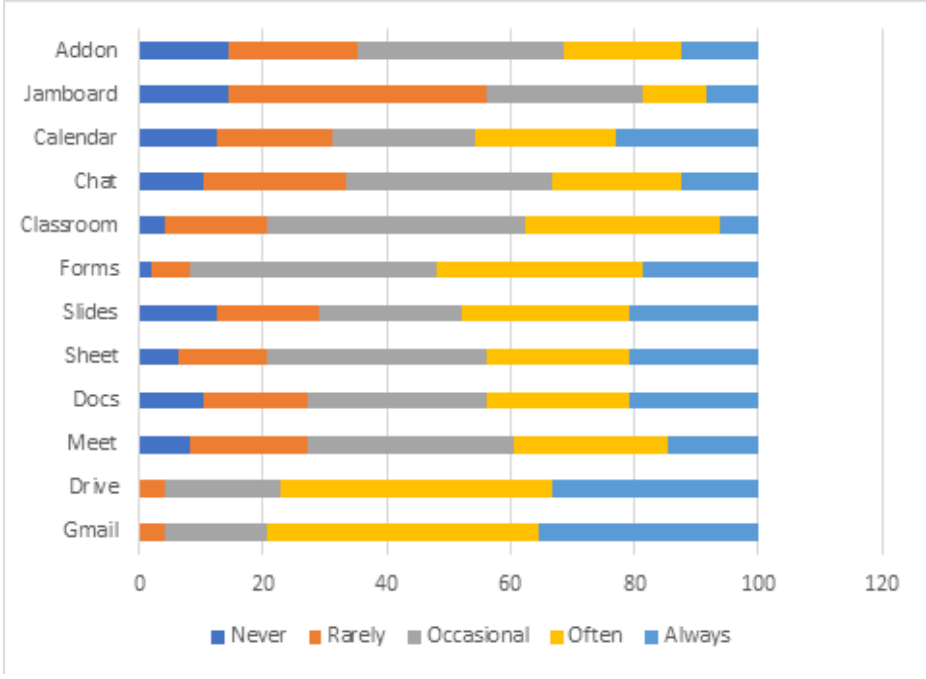

Figure 15. Frequencies of using Google applications from teachers

Many Google's applications were used by teachers. In which, the most used applications by teachers are Drive and Gmail (nearly 80% of teachers participating in the survey have used it regularly and very often). Add-on and Jamboard applications seem to be used the least by teachers, the rest are also used by over 50% to 70%

of teachers regularly and very often. There is also an increase in using Google Workspace for Education from the results of pre-survey and post-survey.

Regarding to the ease of use for teachers, it can be seen from the classroom observations that teachers participating in the pilot program have used different tools of Google Workspace for Education for classroom teaching such as Google Meet, Google Docs, Google Slides, Google Forms, Youtube, Google, Google Scholars, in which Google Meet is used by all teachers, especially in the period of using online teaching. For this application, although in the first stage of use, there were some difficulties in breaking students into smaller rooms, but over a period of use, teachers have proficiently used this function. Some teachers have used Google Slides for presentations and have had almost no difficulty. With Google Docs, some teachers initially used it to assign interactive exercises between students. Google Forms seems to be quite familiar to teachers, so the application of this product is not difficult. However, due to the short pilot implementation, through the observation process, it can be seen that teachers still have not been able to use many GfE applications in their teaching process. Moreover, with the shift to face-to-face teaching, there are not many opportunities for teachers to use GfE applications directly in the classroom.

For example, for Math at the Experimental School, at first, teachers only used the Google Meet application to teach students, and the applications to teach students were mainly on PowerPoint, assessed by multiple choice through the application. However, after observing the next lessons, it can be seen that teachers used Google applications for their lessons such as Google Slides, Google Forms, and combined the features in Google Meet to giving lessons, specifically using Jamboards, dividing groups, etc., to make teaching hours lively and attract more students' participation. Another example from Physics lesson at Vinschool Golden River, initially the teacher mainly used Google meet to show the prepared slides on PowerPoint, and it was difficult for teacher to use and link Google Slides and to divide into groups for students to discuss through Google Meet. However, after a period of teaching, teachers have integrated using other Google applications and some external applications to enrich activities in the lesson such as the teacher asking students to present group work products on Google Docs and Google Slides. They also combine interactive whiteboards to write and explain to students online and in class to understand the lessons.

Regarding the connection to teacher practice, it can be seen that teachers have tried to link the content of the lessons with the use of Google applications. The preparation of lectures (including on PowerPoint or Google Slides) is shared by teachers via Google Slides to convey the content to students. In addition, teachers also recommended students in class to use some applications such as Google Scholars and Google Docs for specific purposes. This helps teachers and students see the usefulness of Google applications. However, through observing the classroom, it can be seen that the teaching is still heavily traditional, when the teacher transmits the knowledge and asks the students to complete the exercises, the lessons are less exciting, and only a handful of Google applications are used.

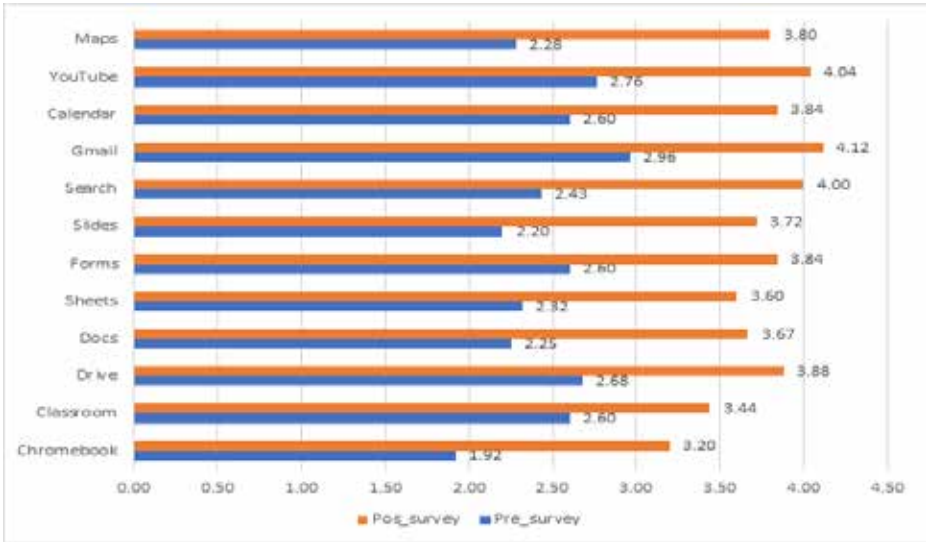

Figure 16. A comparison of level of comfort when teachers use Google applications

After participating in the pilot, the habit of using Google applications has improved. In all Google applications, teachers experience more use before participating in the pilot. Figure 16 provides the details of the differences in using Google applications before and after the pilot program.

The Use of Chromebooks from Students' Perspectives

Each student also received a Chromebook during the pilot. At the end of the pilot, they were asked to rate how suitable Chromebooks and other devices are for their activities. Figure 17 shows the results that students rated for their learning in each device. It can be seen that laptops are still students' favourite devices for different learning activities. However, Chromebooks also have high appreciation from students for learning, especially in finding information in class and completing students' homework.

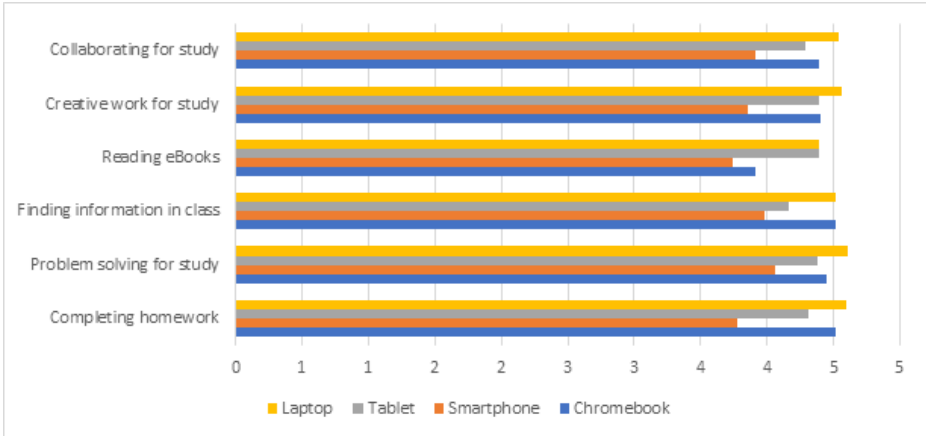

Figure 17. A comparison of level of suitable use for learning activities between devices

In addition, students also rated how suitable Chromebooks and other devices are for their teaching activities in each device. The results shown in Figure 18.

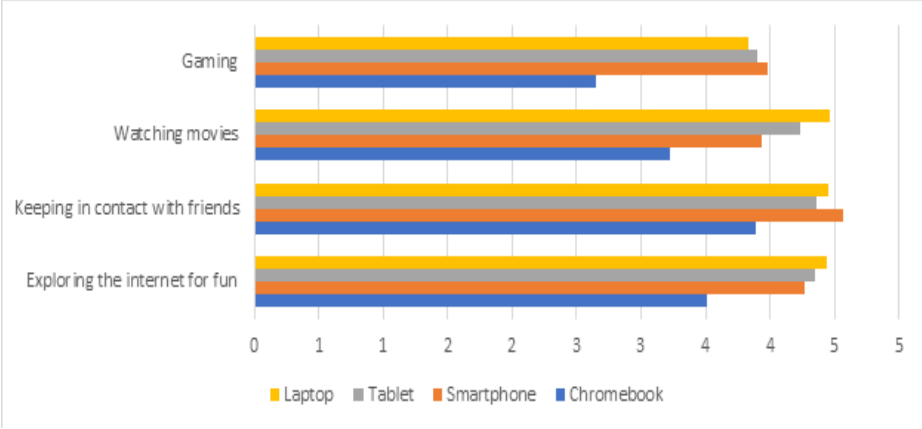

Figure 18. A comparison of level of suitable use for casual activities between devices

Overall, many students (67.7%) considered Chromebooks as a good device for their learning and students have good experience. Some students said that they used Chromebooks all the time during the pilot and they will keep using it in the future.

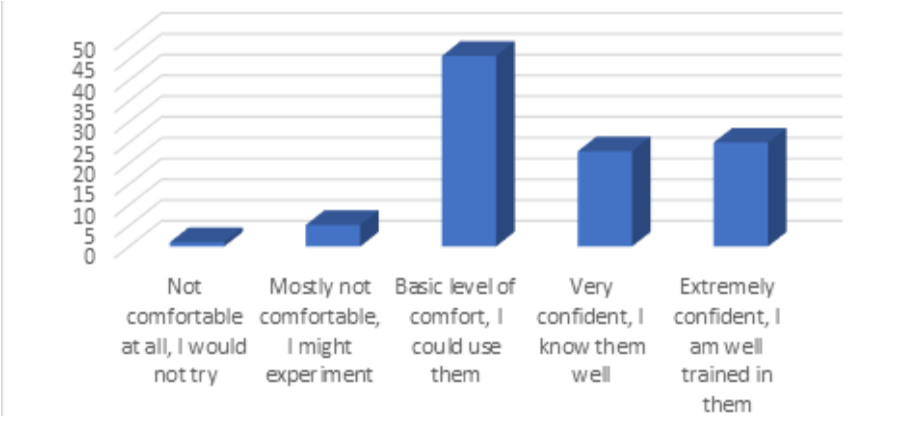

Figure 19. Level of comfort for using Chromebooks from students

Some students also said that Chromebooks are very well optimized and very simple to work with; Chromebooks are great for learning because they can't load other applications like Games so students can focus on their learning. A student also stated that

"I find Chromebooks to be compact computers and very good for learning and it is cheap with stable batteries for normal use".

Figure 19 shows the level of comfort for using Chromebooks from students. In the scale from 1 to 10, the students have an average of 6.71 score to introduce Chromebooks to their peers. Figure 20 and 21 show students' opinion on benefits of having all applications on the Chromebook

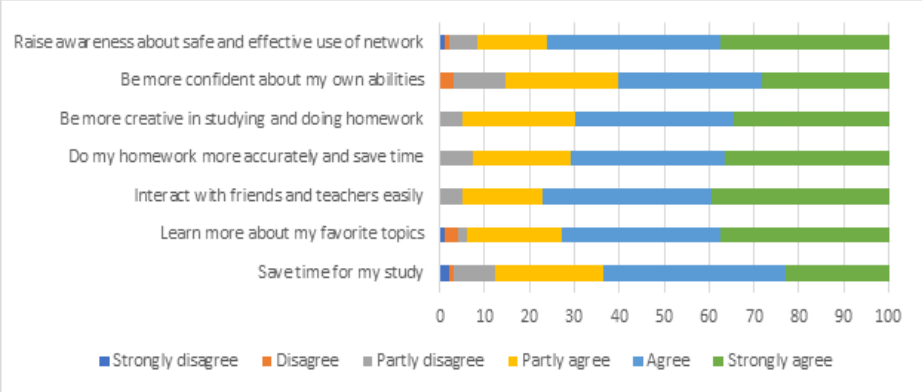

Figure 20. Students' opinion on benefits of having all applications on the Chromebook

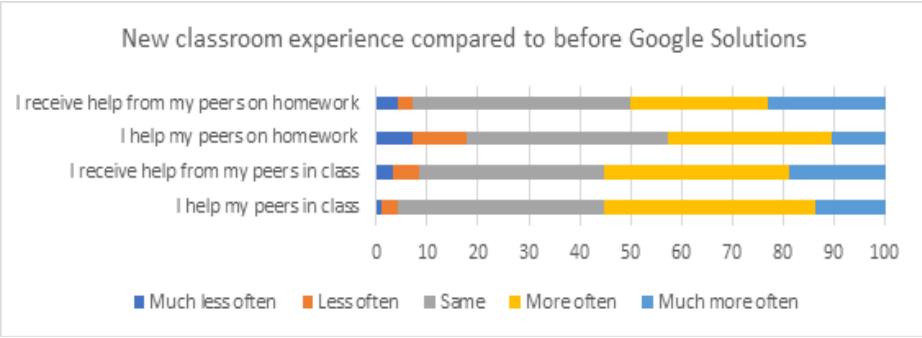

Figure 21. Students' comparison on classroom experience with Chromebook

The Use of Google Workspace for Education from Students' Perspectives

Level of comfort to use Google Workspace for Education (from 1 - Not comfortable at all, I would not try to 5 - Extremely confident, I am well trained in them)

Table 1. Mean and SD of Level of comfort to use Google Workspace for Education

No	App Name	Mean	SD
1	Google Classroom	3.22	1.09
2	Google Drive	3.53	1.03
3	Google Docs	3.66	1.15
4	Google Sheets	3.29	1.13
5	Google Forms	3.73	0.99
6	Google Slides	3.84	1.07
7	Google Search	4.11	0.96
8	Gmail	4.15	0.89
9	Calendar	3.80	1.09
10	YouTube	4.34	0.89
11	Google Maps	3.55	1.17

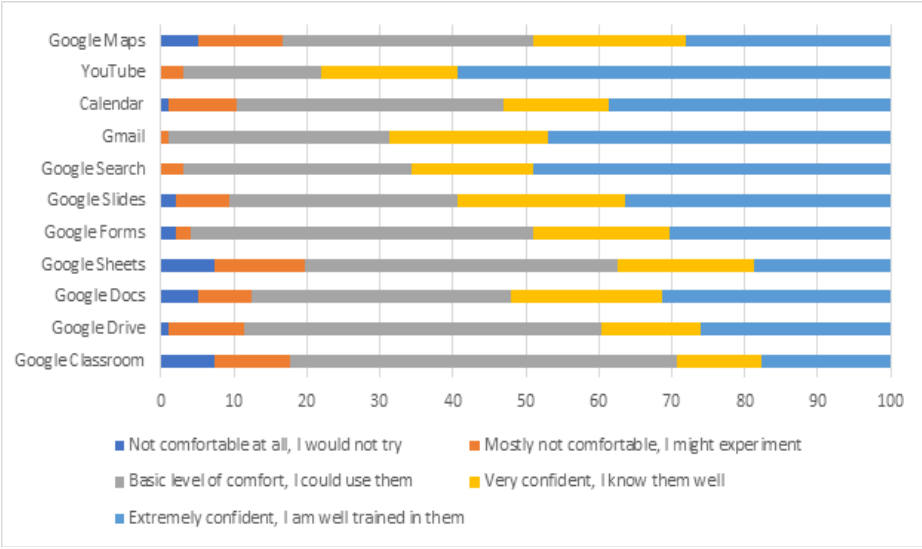

Figure 22. Percentage of comfort level to use Google Applications from students

Table 1 and Figure 22 show the Mean and SD, and the percentages of comfort levels to use Google Workspace for Education from students. Regarding the ease of use for students, they mainly experience Google applications on Chromebooks, in which through the online learning process, the products used by students include Google Meet, Google Slides, Google Docs and Google Forms. For Google Meet, students are quite proficient in operations such as turning on/off microphones, webcams, answering, interacting on chat box, raising hands to express opinions on Google Meet. Students also experienced working on Google Docs to take notes and collaborate; Google Forms for flexible teacher testing or peer-to-peer cross-evaluation. In addition, through some subjects such as Technology, Geography, and Mathematics, students can work in groups through projects assigned by teachers and present to the whole class through Google applications. Through the observation process, it can be seen that students have almost no difficulty with operations on the applications that have been provided to use.

For example, through Literature at Experimental School, students proficiently used Google Meet features, such as being enable/disable screen sharing; enable/disable microphone, camera. They could also use some Google Docs basic features including creating files, typing text, but they did not know how to share files so that group members could work on the files. Another example comes from Geography at Vinschool Golden River, students learned to manipulate applications on Google Meet, Google Slides, Google Documents, Google Forms easily. Specifically, when the teacher called the student's names, the students turned on the microphone in Google Meet and texted the number in the chat section of Google Meet; students could take notes as directed by the teachers and through the whiteboard in Google Meet; students evaluated projects through Google Forms; they also took notes through Google Docs; and presented their projects via Google Slides.

Regarding student engagement, they are quite active in participating in the teachers' lessons. The best evidence for this statement is that most of the students turned on the microphone and camera on Google Meet when teachers called their names, and participated in answering the teacher's questions. In addition, students were also active in participating in classwork activities or following teachers correcting assignments on Google Forms. Besides, they also interacted with each other by working together on Google Docs.

3.3. Students' learning math motivation

As mentioned earlier, students' learning Maths motivation measures were adapted from the Middle School Student version of the Questionnaire. The purpose of questionnaire is to measure the extent to which middle or high school students perceive the presence of each of the MUSIC model components in a class or other learning environment. It can be used by teachers to help them identify areas of strengths and weaknesses related to factors that affect students' motivation and engagement. The questionnaire consisted of 18 items measuring eMpowerment, Usefulness, Success, Interest, and Caring. Table 2 shows the reliability coefficient for each construct. It can be seen that all constructs have good coefficients of reliability.

Table 2. Reliability coefficient for each construct

Construct	Pre-survey	Post-survey
eMpowerment	0.849	0.913
Usefulness	0.858	0.911
Success	0.929	0.954
Interest	0.91	0.943
Care	0.932	0.925

Figure 23 shows the average scores for each construct from pre- and post-surveys. The construct of Care has the highest score for both pre- and post- pilot. It means students have a high level of beliefs that their math teachers care about their learning and themselves. In both pre-survey and post-survey, the construct of Interest has the lowest scores. It means that students have a low level of beliefs that Math is interesting and it is worth learning.

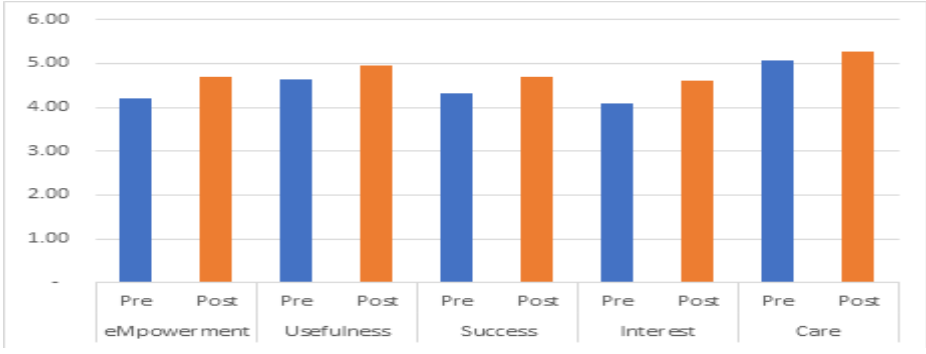

Figure 23. Students' motivation in learning Math by each construct

In order to explore the changes of students' motivation in learning Math for each construct, Table 3 shows the results of paired sample t – test between pre- and post- pilot. This result shows that the differences between pre- and post- pilot in eMpowerment, Success, and Interest are statistically significant. It means there are positive changes in terms of the constructs of eMpowerment, Success, and Interest during the pilot of Google Solutions.

Table 3. Paired sample t – test results between pre- and post- pilot

Variable	Mean	Differences	t	p
Pre_EMP	4.21	-0.49	-2.83	0.01
Post_EMP	4.7			
Pre_USE	4.65	-0.31	-1.76	0.08
Post_USE	4.95			
Pre_SUC	4.31	-0.38	-2.15	0.03
Post_SUC	4.69			
Pre_INT	4.09	-0.51	-2.75	0.01
Post_INT	4.6			
Pre_CAR	5.08	-0.2	-1.32	0.19
Post_CAR	5.28			

This result is consistent with the classroom observations for Math subject. During the pilot program, Math teachers tried to applied many applications from Google Workspace for Education. They recognised their limitations of using these applications, and they tried to improve their skills using Google products during the pilot. From observation, math teachers gave students more opportunities to discuss to each other about the lessons and they encouraged students to participate in different activities using different applications such as Google Docs, Google Slides through Google Meet.

4. Conclusions

The present research focuses on how teachers' and students use Google Solutions in the classroom within the context of Vietnam education system. In terms of teachers' attitudes toward using technology, it can be seen that most of the teachers had a positive approach and they support using technology in the classroom. They appreciated the roles of Google Solutions in teaching and learning. Specifically, many teachers were eager to use Chromebooks as a valuable tool for their teaching practices because of the ease to use. They started applying different Google applications in their teaching practices. Most of the teachers in the pilot program believed that Google Solutions would be suitable tools for teaching and learning and management and they are willing to recommend Chromebooks and Google Workspace for Education to their colleagues. From students' perspective, they recognized that Chromebooks are powerful tools and Chromebooks can give them many benefits for their learning journey. They also agreed that Google applications

are helpful for their learning activities, such as collaboration, communication and problem-solving. The evidence from the research also shows that there are differences in changing students' motivation in Math learning during the pilot.

However, since the sample of the pilot program is quite small and the convenient sampling method was used for the pilot, it is necessary to expand the pilot to wider audiences of teachers, students as well as school managers in order to have more information on the effectiveness of implementing Google Solution in the Vietnamese education context.

Acknowledgments

The research team would like to thank Panl from Google, AI Education, Thuc Nghiem school, and Vinschool Golden River for their support during the research.

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