DECLARATION OF ORIGINAL AND OWNERSHIP

DIGITQUEST: ADDITION AND SUBTRACTION SKILLS FOR 5-YEARS-OLD WITH INTERACTIVE LEARNING TOOL

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ABSTRACT

Mathematics is the study of numbers, quantities, shapes, patterns, and their relationships. On October 7th, 2024, the nation was alarmed by the revelation that more than 100,000 Year One pupils still lacked essential 3M skills—reading, writing, and counting. Education Minister Fadhlina Sidek attributed this issue to learning loss during the COVID-19 pandemic, poverty, and the needs of special children. This project, DigitQuest, aims to achieve two main objectives; (i) to establish DigitQuest as an educational tool, (ii) to make DigitQuest a teaching aid for teachers and parents of 5-year-olds. The majority of the project involved the use of a laser cutting and engraving machine, with minimal use of a table saw, from sketches to the prototype and final product. Data was collected using both qualitative (interviews) and quantitative (surveys) methods. The results indicate that DigitQuest has successfully achieved its objectives, though some recommendations from the participants will be considered for future improvements. The tool will continue to be refined to address its limitations and enhance its overall functionality.

Keywords: *mathematics, education, interactive learning tool, 3M skills, early childhood education, laser cutting and engraving, teaching aid for 5-years-old, COVID-19 learning loss.*

ABSTRAK

Matematik ialah kajian mengenai nombor, kuantiti, bentuk, corak, dan hubungan antara elemen-elemen tersebut. Pada 7 Oktober 2024, negara dikejutkan dengan pendedahan bahawa lebih daripada 100,000 murid Tahun Satu masih kekurangan kemahiran asas 3M—membaca, menulis, dan mengira. Menteri Pendidikan, Fadhlina Sidek, mengaitkan isu ini dengan kehilangan pembelajaran semasa pandemik COVID-19, kemiskinan, dan keperluan kanak-kanak istimewa. Projek ini, DigitQuest, bertujuan untuk mencapai dua objektif utama; (i) untuk menjadikan DigitQuest sebagai alat pembelajaran, (ii) untuk menjadikan DigitQuest sebagai alat bantu mengajar untuk guru dan ibu bapa kanak-kanak berusia 5 tahun. Sebahagian besar proses projek melibatkan penggunaan mesin pemotong dan ukiran laser, dengan sedikit penggunaan gergaji meja, bermula dari lakaran hingga ke prototaip dan produk akhir. Data dikumpulkan menggunakan kaedah kualitatif (temu bual) dan kuantitatif (tinjauan). Hasilnya menunjukkan bahawa DigitQuest berjaya mencapai objektifnya, walaupun beberapa cadangan daripada peserta akan dipertimbangkan untuk penambahbaikan di masa hadapan. Alat ini akan terus diperbaiki untuk mengatasi kekurangannya dan meningkatkan fungsinya.

Kata kunci: *matematik, pendidikan, alat pembelajaran interaktif, kemahiran 3M, Pendidikan awal kanak-kanak, pemotongan dan ukiran laser, alat bantu mengajar untuk kanak-kanak 5 tahun, kehilangan pembelajaran COVID-19.*

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LIST OF ABBREVIATIONS

BOM	Bill of Materials
CAD	Computer-aided Design
COVID-19	Coronavirus disease 2019
IEA	International Association for the Evaluation of Educational Achievement
KPM	Kementerian Pendidikan Malaysia (Ministry of Education)
KSPK	Kurikulum Standard Pra-sekolah Kebangsaan (National Pre-school Curriculum Standard)
LINUS	Literacy and Numeracy Screening
MCO	Movement Control Order
PDPc	Falsafah Pengajaran dan Pemudahcaraan (teaching and facilitation process)
PPE	Personal Protective Equipment
PVA	Polivinyl acetate
SARS-CoV-2	Severe acute respiratory syndrome coronavirus 2
SSPS	Statistical Package for Social Sciences
TIMMS	Trends in International Mathematics and Science Study
TTDI	Taman Tun Dr Ismail
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Generally, mathematics is the study of numbers, quantities, shapes, and patterns, as well as the relationships between them (Cambridge Dictionary, n.d). It involves logic, reasoning, problem-solving, and the formulation of abstract concepts. Mathematics is a fundamental tool in various fields such as science, engineering, economics, and social sciences. Mathematics is considered a foundational knowledge area that children begin to learn and develop skills in from kindergarten. Early exposure to mathematical concepts helps children develop critical thinking, problem-solving, and analytical skills (French, 2013). Additionally, learning mathematics from a young age helps children develop a strong numerical sense and lays the groundwork for future academic success in mathematics and other related fields.

Although children can acquire, understand, and apply early mathematical knowledge through various methods such as homework, number books, and classroom activities, statistics show that they are particularly adept at learning through games. Games provide a fun and engaging way for children to explore mathematical concepts, often without even realizing they are learning (Connie Shin @ Connie Cassy Ompok, & Juppri Bacotang. 2019).

1.2 PROBLEM STATEMENT

Despite mathematics being a fundamental knowledge area, it is often perceived as a difficult subject by students. The primary issue lies in the lack of mastery of concepts, which is identified as the leading factor contributing to why mathematics is

considered challenging by students (Mamat & Wahab, 2022). Given the challenges posed by the pandemic, Mustapah and Rosli (2021) highlight that learning mathematics online has not been conducive due to the inability of students to directly interact with teachers during the teaching and facilitation process (PdPc). This lack of direct interaction may hinder students' understanding and mastery of mathematical concepts, further complicating an already perceived difficult subject.

COVID-19 pandemic hits Malaysia in late January 2020. COVID-19 is an infectious disease caused by the SARS-CoV-2 virus (World Health Organization, 2024). Historically, it was first identified in December 2019 in Wuhan, China, and is primarily spread through respiratory droplets from an infected person. The initial cases were reported on January 25, 2020, when three Chinese tourists, who had entered Malaysia via Singapore, tested positive for the virus. To limit the spread of the virus, the Malaysian government implemented the Movement Control Order (MCO) starting on March 18, 2020, which restricted travel, social gatherings, and many public services (Ministry of Health Malaysia, 2020).

The education sector in Malaysia was heavily impacted by MCO, with pre-schools and other institutions being forced to close during lockdowns. This disrupted education for millions of students across the country. Yun (2023) stated that digital readiness in adopting online learning approach is one of the many challenges educational institutes faced during pandemic. Despite educational sector has started implemented digital technologies, there are some areas that needed necessary review for improvements. Inadequate digital infrastructure or access to reliable internet, and poor digital skills, may turn education matter to be great learning loss both in the short and long run.
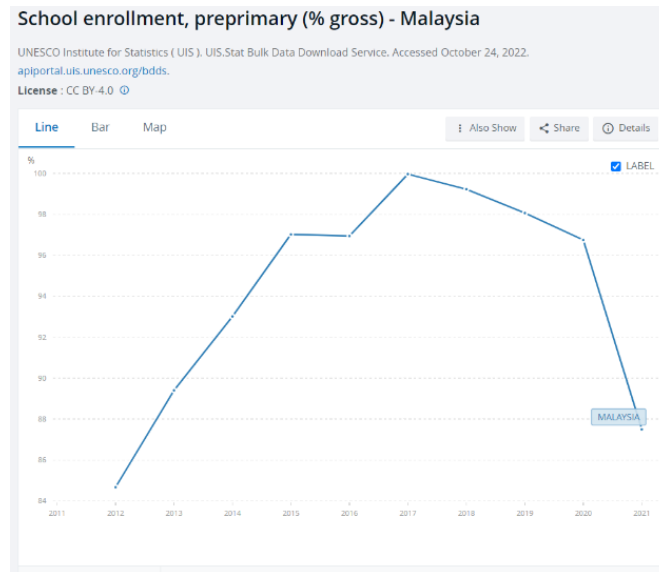
Figure 1.1 School enrolment statistics for pre-primary in Malaysia (as of 2022)

The statistics from the World Bank on school enrolment for pre-primary education in Malaysia (as shown in Figure 1.1) indicate a significant decline after 2017, which marked a peak with 100% enrolment. Subsequent years showed a gradual decrease, with a 1% decrease in 2018, another 1% decrease in 2019, and a further 1% decrease in 2020, bringing the enrolment rate to 97% by that year. However, the following year, 2021, saw a sharp decline, with enrolment plummeting to 87%. This decline can be attributed to the impact of the COVID-19 pandemic, which disrupted traditional schooling methods and prompted a shift towards online learning. Given the challenges posed by the pandemic, Juwairiah and Roslinda (2021) highlight that learning mathematics online has not been conducive due to the inability of students to directly interact with teachers during the teaching and facilitation process (PdPc). This lack of direct interaction may hinder students' understanding and mastery of mathematical concepts, further complicating an already perceived difficult subject.

	1st MCO	2nd MCO	3rd MCO	4th CMCO	5th CMCO	6th RMCO	7th RMCO
Period	18 Mar–31 Mar 2020	1 Apr–14 Apr 2020	15 Apr–28 Apr 2020	29 Apr–12 May 2020	13 May–9 June 2020	10 June–31 Aug 2020	1 Sept–31 Dec 2020
Economy Activities							
Agricultural	As usual	As usual	As usual	As usual	As usual	As usual	As usual
Mining & Quarrying	Ordered to close	Ordered to close	50% of workforce allowed to operate	100% workforce allowed to operate	Normal operation with SOP	Normal operation with SOP	Normal operation with SOP
Construction							
Manufacturing	Food production only	Food production only					
Services	Allowed to operate: - Food - Water - Energy - Telco & Internet - Security & defense - Solid waste, sewerage, public cleaning management - Healthcare & medical - Banking & finance - Public transports - Logistics - E-commerce	Allowed to operate - Food - Water - Energy - Telco & Internet - Security & defense - Solid waste, sewerage, public cleaning management - Healthcare & medical - Banking & finance - Public transports - Logistics - E-commerce	Allowed to operate - Food - Water - Energy - Telco & Internet - Security & defense - Solid waste, sewerage, public cleaning management - Healthcare & medical - Banking & finance - Public transports - Logistics - E-commerce	All services allowed except cinemas, gymnasium, and salons	All services allowed except cinemas, gymnasium, and salons	All services allowed to operate with SOP	All services allowed to operate with SOP
Social Activities							
Education	Ordered to close	Ordered to close	Ordered to close	Ordered to close	Ordered to close	Only higher institutions remain closed	Only higher institutions remain closed
Religious	Ordered to close	Ordered to close	Ordered to close	Ordered to close	Ordered to close	Allowed to open with SOP	Allowed to open with SOP
Travel	Allowed only within the district	Allowed only within the district	Allowed only within the district	Only interdistrict allowed	Only interdistrict allowed	Restriction only to overseas	Restriction only to overseas
Sports	Not allowed	Not allowed	Not allowed	Only nonphysical contact allowed effective 4 May 2020	Only nonphysical contact allowed	Physical contact sports allowed with SOP	Physical contact sports allowed with SOP
Social gathering	Not allowed	Not allowed	Not allowed	Not allowed	Not allowed	Allowed in less than 250 attendees with SOP	Allowed in less than 250 attendees with SOP

MCO—Movement Control Order; CMCO—Conditional Movement Control Order; RMCO—Recovery Movement Control Order; SOP—Standard Operating Procedure. Sources: [18,19].

Figure 1.2 Seven phases of Movement Control Order (MCO) from 18 March 2020 to 31 December 2020 for every sector

From an economic perspective, COVID-19 severely impacted the sector. The Malaysian government took various steps to control the spread of the virus, including implementing seven phases of the Movement Control Order (MCO) from 18 March to 31 December 2020 (Khair, N. K. M., Lee, K. E., & Mokhtar, M., 2021). The government provided flexibility for the economic sector to continue operations, but unfortunately, this was not the case for the education sector. However, the positive development came in the last two phases of the MCO, which allowed the reopening of schools and the resumption of regular learning sessions, except for higher education institutions.

As of October 7th, 2024, the nation was alarmed by the revelation that more than 100,000 Year One pupils still lack essential 3M skills — reading, writing, and counting. Education Minister, Fadhlina Sidek attributed this issue to learning loss during the COVID-19 pandemic, poverty, and the needs of special children during a press conference after officiating the Tekad Reformasi Pendidikan programme. The intervention programme, which began implementation in August, aims to assist students in acquiring these critical 3M skills (Bernama, 2024).

1.3   OBJECTIVES

Interactive learning tools are designed to cater to various educational levels, from preschool to high school. Our focus, however, is specifically on the subject of mathematics and its basic operations. As the saying goes, "melentur buluh biarlah dari rebungnya", 5-year-olds are at the age where they are eager to explore the world around them. Strategically, this project aims to achieve two main purposes:

i.   To establish "DigitQuest" as an educational tool.
ii.   Making DigitQuest a teaching aid for teachers and parents of 5-year-old.

1.4   SIGNIFICANCE OF THE STUDY

According to Bánfai et al. (2018), children aged 5 to 6 years can learn basic concepts of first aid through lively engagements, demonstrating that even complex topics can be understood at a young age. While the study focused on first aid, it highlighted the importance of playful teaching methods in improving children's knowledge and helping behaviour. This is supported by Ompok & Bacotang (2019), who identified learning through games as the most effective tool for teaching, followed by worksheets and number books.

Teachers' beliefs, knowledge, and attitudes toward technology directly and indirectly affect students' awareness, motivation, and engagement. Positive attitudes toward technology in education result in increased student engagement, improved learning outcomes, and more personalized learning experiences. However, some teachers have raised concerns about the potential negative effects of technology on young children, including over-reliance on screens and reduced social interaction. A significant challenge is that many existing digital educational aids are not suitable for young children and do not align with the curriculum, requiring teachers to adapt them, which can be time-consuming and difficult (Alotaibi, 2023).

To address this gap, tangible and playful educational tools for preschoolers are often overshadowed by digital educational aids. Additionally, by today's standards, children are expected to master the 3M skills (reading, writing, and counting) before entering primary school. This highlights the potential of developing DigitQuest as a tangible, interactive learning tool that focuses on early mathematics — addition and subtraction targeted at 5-year-olds.

1.5   SCOPE

Due to the wide-ranging issues surrounding the understanding of mathematics, its impact is likely to affect both present and future generations. The aim of this study is to establish DigitQuest as an effective educational tool and teaching aid for kindergarten teachers and parents. The study focuses on preschool children aged 5 years, with observations from kindergarten teachers taking place before, during, and after the study.

Several limitations were identified in the project. First, the shape and dimensions of the product are calendar-shaped, lightweight, and not too small, which may limit its adaptability to other formats. Second, in terms of data collection, we only conducted an interview with Mrs. Joyce, which resulted in a significant portion of ideas, materials, shapes, and additional insights being derived from her input. As a result, the product may be somewhat biased toward meeting her specific standards and preferences.

Additionally, the product is designed for 5-year-old children who already possess basic numerical skills, including addition and subtraction. Another limitation lies in the materials used—our product was constructed using 3mm plywood, which may affect its durability. In terms of tools, the only equipment used were a table saw and a laser cutting and engraving machine available at the workshop and incubator room. Lastly, the product was developed over a period of 8 weeks (from week 2 to week 10), which constrained the time available for further refinements.

CHAPTER 2

LITERATURE REVIEW

2.1 NUMERACY

2.1.1 Definition of Numeracy

According to National Numeracy (n.d.), the term 'numeracy' is more than just the ability to perform mathematical operations; it encompasses a deeper understanding of how mathematics is applied in real-world situations. It involves the ability to interpret data, charts, and diagrams, process information, solve problems, verify solutions, and articulate reasoning behind decisions. Dieckmann (2008) affirmed that numeracy is defined as the ability to understand and use numbers. He also agreed that basic understanding of numerical concepts is arguably as important for informed decision making as reading ability.

As cited by Harun et al. (2017), in Malaysia, the term 'numeracy' was first introduced in mathematics education in 2010 through a national program called LINUS (Literacy and Numeracy Screening). The program aimed to assess the numerical proficiency of students in Year 1 to Year 3. According to the Ministry of Education Malaysia (2010), numeracy is defined as the 'ability to perform basic mathematical operations, understand simple mathematical concepts, and apply mathematical knowledge and skills in daily life.' Unfortunately, the LINUS program was discontinued by the Ministry of Education (KPM) in 2019 and replaced by programs at the school level (Nasbah, 2023; BeritaHarian, 2023). The report also highlighted that children are now considered a 'lost generation' due to the use of technology as a medium for teaching sessions following the effects of the spread of COVID-19. On top of that, Ministry Education, Fadhlina Sidek reveals more than 120,000 Year One pupils still lack the foundation of 3M – reading, counting and writing during a press conference (Bernama, 2024).

2.1.2 The Importance of Early Numeracy

The focus on developing numeracy skills from an early age has become a global priority, highlighted by organizations like the International Association for the Evaluation of Educational Achievement (IEA) through assessments such as the Trends in International Mathematics and Science Study (TIMSS). TIMSS 2019 emphasizes that early education has a lasting effect on academic achievement levels. This effect can be seen whether children engage in literacy and numeracy activities at home, or attend pre-primary education. Hence, students gain confidence and achieve higher academic success when they learn and acquire literacy and numeracy skills at an early age.

Early exposure to mathematical concepts helps children mastering problem-solving, and critical thinking skills from observation and everyday plays (French, 2013). Additionally, learning mathematics from a young age helps children develop a strong numerical sense and lays the groundwork for future academic success in mathematics and other related fields.

2.1.3 Contents of Early Numeracy in Malaysia for 5-years-old

The Malaysian education system aligns with international standards by placing a greater emphasis on early childhood education. Research conducted by the Ministry of Education Malaysia indicates that investing in children's early years yields long-term benefits for both the government and society. As a result, in 1996, preschool education was integrated into the national education system, marking a significant milestone. Subsequently, in 2003, the first National Preschool Curriculum was introduced, aimed at enhancing early childhood development. After a thorough review and five years of implementation, the curriculum was revised, leading to the development and implementation of the National Preschool Curriculum Standard (KSPK) in 2017. This curriculum is now implemented across all government and non-government preschools in Malaysia (Harun et al., 2017).

The following section will discuss the content of early numeracy in Malaysia for 5-year-old based on KSPK as of implementation in 2017. Early mathematics provides early math experiences including pre-number concepts, number concepts, number operations, value and weight, concepts of time, and shape and space to preschool students. The objectives to be achieved by the National Preschool Curriculum Standard (KSPK) (2017) require students to (i) cultivate interest in mathematics through various daily activities and experiences, (ii) master basic mathematical concepts, and (iii) enhance thinking skills and problem-solving abilities. As part of the KSPK 2017 learning standards for 5-year-old, children need to master; matching objects based on colour, shape, and size. Students can count and write numbers sequentially ascending and descending. In contrast, according to the findings of KSPK 2010 by Harun et. al (2017), 5-year-old children only need to master counting numbers from 1-10 and 6-year-old children are only exposed to addition and subtraction operations. Therefore, the updated KSPK (2017) provides exposure for 5-year-old children to learn numbers beyond 10 and to learn addition and subtraction operations.

2.2 INTERACTIVE LEARNING TOOL

2.2.1 Introduction

An interactive learning tool is any educational resource designed to actively engage learners by involving them in the learning process through hands-on activities, problem-solving, or real-time feedback. These tools can be digital (e.g., apps, educational software) or physical (e.g., toys, games, puzzles, number books, worksheets).

The method and strategy of teaching are not confined to a fixed form, as stated in the KSPK (2017). However, it is also emphasized that teachers need to wisely use various teaching strategies that can ensure the development, and interests of students in the teaching process so that the learning process is effective and more efficient. The

application of teaching aids in the teaching method is a new breath to attract the interest of students, including children, in learning.

According to a study by Connie & Juppri (2019), three teaching methods, namely games, number books, and worksheets, can improve the early achievement of preschool children in mathematics. The researchers found that the use of games as a teaching medium has a significant effect on the understanding of early mathematics for preschool children, followed by worksheets and number book methods. Therefore, the teaching method do not necessarily have to be games, but they must have interactive and engaging elements for a meaningful learning process.

2.2.2   The Relevance of Digital Teaching Aids After COVID-19

The study sample of Plowman et al. (2008) revealed that parents are concerned about their children's well-being when they notice that children spend more time indoors than outdoors. Parents fear the risks of exposure to unsuitable content and are concerned about children's health, particularly the risk of obesity.

Currently, this issue is also a concern for the Ministry of Education of Malaysia, as Minister Fadhlina Sidek revealed that more than 100,000 Year One pupils still lack the essential 3M skills—reading, writing, and counting. She attributed this severity of the "learning loss" phase during the COVID-19 pandemic (Bernama, 2024). Moreover, another case was also reported by Berita Harian (2023) in an article written by Nasbah (2023), where interviewees expressed concerns about their children's lack of proficiency in 3M skills. The Movement Control Order (MCO) confined the nation to continuing education through online sessions. The report also highlighted worries about the discontinuation of the 2019 LINUS 2.0 programme before COVID-19, which was replaced by a school-level program. This new program monitors students' progress in mastering literacy skills according to each school's individual 'school model'.

2.3 PERSONAL PROTECTIVE EQUIPMENT (PPE)

Personal protective equipment (PPE), as defined by OSHA (n.d.), refers to equipment worn to minimize exposure to hazards that could result in serious workplace injuries and illnesses. PPE includes items such as gloves, safety glasses, safety shoes, earplugs or muffs, hard hats, respirators, and full-body protective gear such as coveralls or vests. Several types of PPE were used during the process of making the prototype and final product. Sehsah et al. (2020) found that 64.3% of workers experienced at least one accident in the previous 12 months. This highlights the importance of acknowledging and practicing proper PPE use in any work environment, including the Incubator Room / Maker Space (for Laser Cutting and Engraving machine at Politeknik Sultan Salahuddin Abdul Aziz Shah, Shah Alam). Furthermore, Sehsah et al. (2020) referenced a previous study by Lette et al. (2018), which indicated that a lack of safety training and improper PPE use significantly increases the risk of injuries among construction workers. Therefore, the high prevalence of work-related accidents can be reduced through proper safety training and consistent PPE use by all workers (Sehsah et al., 2020).

Figure 2.1 Example of Personal Protective Equipment (PPE) for any workplace

2.4   MATERIALS USED

2.4.1   Plywood

Figure 2.2 Various sizes of plywood

Plywood is a panel product primarily constructed from sheets of veneer, known as plies, which are arranged in layers. These layers are constructed with an odd number of plies, with the grain direction of adjacent layers positioned perpendicular to one another (Laboratory, 2019). For DigitQuest, plywood with a 6mm thickness is used, adjusted from its initial 3mm thickness to meet the prototype's specific needs. Plywood offers significant bending strength both along and across the panel, making it a suitable material for DigitQuest. Its minimal edge-swelling adds to its durability, making it an excellent choice for this project.

2.4.2   Steel Plate

Figure 2.3 Steel plates

Steel plates were inserted between two 3mm plywood sheets (glued together to form a 6mm plywood) in the construction of DigitQuest. These steel plates allow

magnets to adhere to the board, making it easier to organize components and reduce clutter during use. This feature helps maintain a tidier and more efficient learning environment.

2.4.3 Binder Rings

Figure 2.4 Binder rings with 30mm diameter

Binder rings are essential components in the functionality of DigitQuest, these rings serve as a practical solution for keeping the number-based elements of DigitQuest organized and secure. By using binder rings, the numbers are held in place, preventing them from getting lost or misplaced during use. Additionally, the use of binder rings adds a level of convenience, as it allows for easy flipping and rearranging of the numbers, enhancing the overall usability 9 and effectiveness of DigitQuest in teaching mathematical concepts to young learners.

2.4.4 Magnets

Magnets play a crucial role in enhancing the interactive aspect of DigitQuest. In addition to the number-based elements, DigitQuest includes basic shapes such as rectangles, triangles, and circles. This hands-on approach not only reinforces the concept of addition and subtraction but also stimulates tactile and visual senses, making learning more enjoyable and effective for young learners.

2.5 TOOLS USED

2.5.1 Clamps

Figure 2.5 Spring clamp and Quick-release clamp

Spring clamps and quick-releasr clamps were used during the making of the prototype and the product. Clamps is a type of fastening device used to hold or secure objects tightly together to prevent movement or separation through the application of inward pressure (RS, n.d).

2.5.2 Wood Glue

Figure 2.6 Titebond wood glue

PVA glue or Polyvinyl acetate is known for its strong adhesive properties, making it ideal for woodworking projects like DigitQuest. By using PVA glue, we can ensure that DigitQuest is sturdy and durable, capable of withstanding the rigors of everyday use in educational settings.

2.5.3   Wood Filler

Filler may be a paste or liquid, natural or colored (Laboratory, 2019). Teak color filler was used for the whole project. After the filler dries thoroughly, lightly sand it before finishing the wood.

2.5.4   Wood Varnish
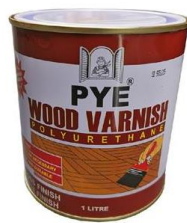
Figure 2.7 Wood varnish (250ml)

Transparent film-forming finishes, such as varnish, provide excellent performance on indoor wood surfaces. These finishes, including varnish or lacquer, create a smooth and cleanable surface (Laboratory, 2019). For the DigitQuest project, varnish is the ideal solution to highlight and enhance the natural wood grain, giving the product a polished and aesthetically pleasing appearance.

2.5.5   Spray Paint

Primary-colored spray paints were used to highlight the key points for addition and subtraction on DigitQuest, making the learning process more visually engaging for children. After the paint was applied, a layer of varnish was added to ensure the colors are long-lasting and to protect the surface, enhancing durability and maintaining the tool's aesthetic appeal over time.

2.5.6　Knife cutter and Scissors

A knife cutter and scissors were used as precision cutting tools for general manual work purposes during the production of DigitQuest. These tools were primarily utilized before the finishing steps, specifically for crafting the "numbers" part. The precision ensured that the final product had clean, sharp edges, contributing to an aesthetically pleasing and professional outcome.

2.5.7　Masking Tape

Although masking tape is typically used for adhering items, its primary function in the making of DigitQuest was to cover specific parts of the "numbers" to protect them during the finishing process. This allowed the original wood grains from engraved to remain intact and stand out, enhancing the visual appeal of the engraved areas by showcasing the natural wood texture.

2.5.8　Sandpaper

Sandpaper is available in a range of grit sizes and is used to remove material from surfaces to make them smoother. In the making of the DigitQuest prototype and final product, various grits were used, including 150P, 180P, 220P, and 3000P. These grits helped achieve progressively smoother finishes, ensuring a refined and polished surface suitable for the smaller areas and final stages of production.

2.5.9　Palm Sander

Palm sander was used in the making of DigitQuest to facilitate the sanding process. By using a palm sander, the sanding process became quicker and more

consistent compared to manual sanding, particularly when working with larger areas or for achieving even surface finishes before applying varnish or paint.

2.5.10   Sponge

Sponges were used in place of a brush for applying wood varnish during the making of DigitQuest. The sponge allowed for a more even and smooth application of the varnish, ensuring that the wood grain was highlighted without streaks or uneven coatings. Using a sponge also helped to control the amount of varnish applied, making the finish cleaner and more consistent, contributing to the overall polished appearance of the product.

2.5.11   Mitre saw

Figure 2.8 Mitre saw

Mitre saw was primarily used for cutting the steel plates during the construction of DigitQuest. This tool ensured precise, clean cuts, allowing the steel plates to fit seamlessly between the plywood layers, which was essential for the overall structure and functionality of the product.

2.5.12   Cloth

A piece of cloth was used to wipe off the laser ashes on the plywood after the laser cutting process. This helped clean the surface and free of residue, so that the product is ready for further processing, such as sanding or varnishing. The cloth was also used after sanding to wipe away dust and debris. This step was essential to prepare the plywood for the next stages, such as varnishing or spray painting, ensuring the finish would adhere properly and look smooth and polished.

2.5.13   AutoCAD
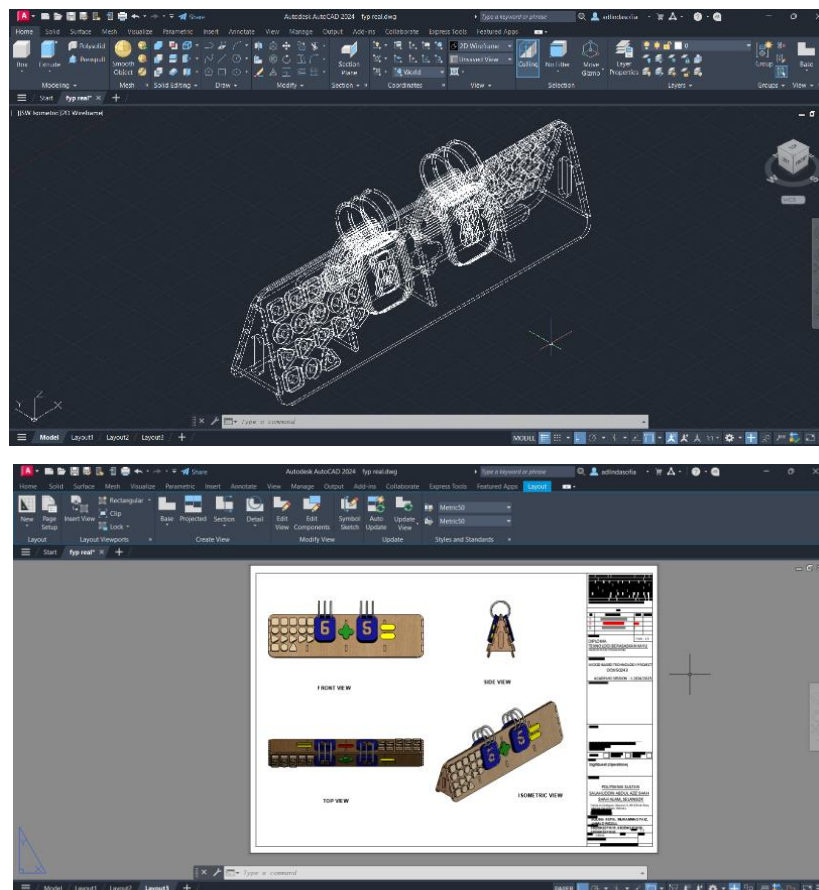
Figure 2.9 Overview of AutoCAD display and title block plotting

AutoCAD software was utilized from the beginning to create detailed designs in DWG files. These files included top, side, front, and isometric views, along with complete dimensions, which were displayed for presentation purposes. For the laser cutting and engraving process, 2D drawings were saved in DXF format and transferred into specialized software that controlled the laser cutting and engraving machine. Additionally, AutoCAD allowed for precise measurements and design adjustments, ensuring accuracy and efficiency throughout the prototyping and production stages. This seamless integration between design and manufacturing helped streamline the entire process.

2.6   MACHINES USED

2.6.1   Table saw

Figure 2.10 Table saw

Table saw was used in the early stages of the process for both the prototype and final product. It was primarily used to cut the base, which has a larger dimension than the other parts and did not require the same level of precision, as it would later be refined with laser cutting. Under the guidance of Tew, the cutting process went smoothly, ensuring that the base was properly shaped for the next steps in production.

2.6.2 Laser Cutting and Engraving

Figure 2.11 Laser cutting and engraving machine

The laser cutting and engraving machine was used for nearly 100% of the process for both the prototype and the final product of DigitQuest. Since DigitQuest required a high level of precision, laser cutting and engraving proved to be the ideal choice, surpassing the accuracy and suitability of CNC machines for this project. With the assistance of Alif and Sir Fahmi, the entire process ran smoothly. Their guidance and advice, particularly with the engraving components, were invaluable to achieving the desired quality and detail in the final product.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

In this chapter, detailed process was recorded, to create both the prototype and final product of DigitQuest. We planned to develop a prototype first, as this allowed us to gather feedback and identify areas for improvement before proceeding with the final product. To collect feedback, we used both qualitative and quantitative data through interviews and surveys.

The survey results for the prototype were significant, with all 23 respondents (100%) agreeing that DigitQuest could be established as an educational tool and used as a teaching aid for 5-year-olds, which aligns with our project's two main objectives. Based on these responses, we then created an initial Bill of Materials (BOM), estimated cost, and cutting list for both the prototype and final product.

During the semester break, we conducted further research, purchased materials, and then proceeded with creating the prototype and product. Approximately 95% of the production process relied on a laser cutting and engraving machine, with the remaining 5% utilizing a table saw. After completing the prototype, we presented it to the panels and incorporated their feedback and suggestions for improvement into the final product.

Once the final product was completed, we conducted another round of interview (qualitative data) to gather further feedback. Throughout the entire process, all steps were meticulously recorded and reported for thorough documentation. Further details, refer to **APPENDIX A** and **APPENDIX B**.

3.2 FLOWCHART

This flowchart illustrates the step-by-step process of creating DigitQuest, from the initial idea to the final product. Each step highlights a critical part of the project's development, showing how we moved from concept to execution. Both diagrams help visualize the workflow and demonstrates the organized approach taken throughout the project, from concept to completion. Another detailed flowchart may refer to **APPENDIX C**.
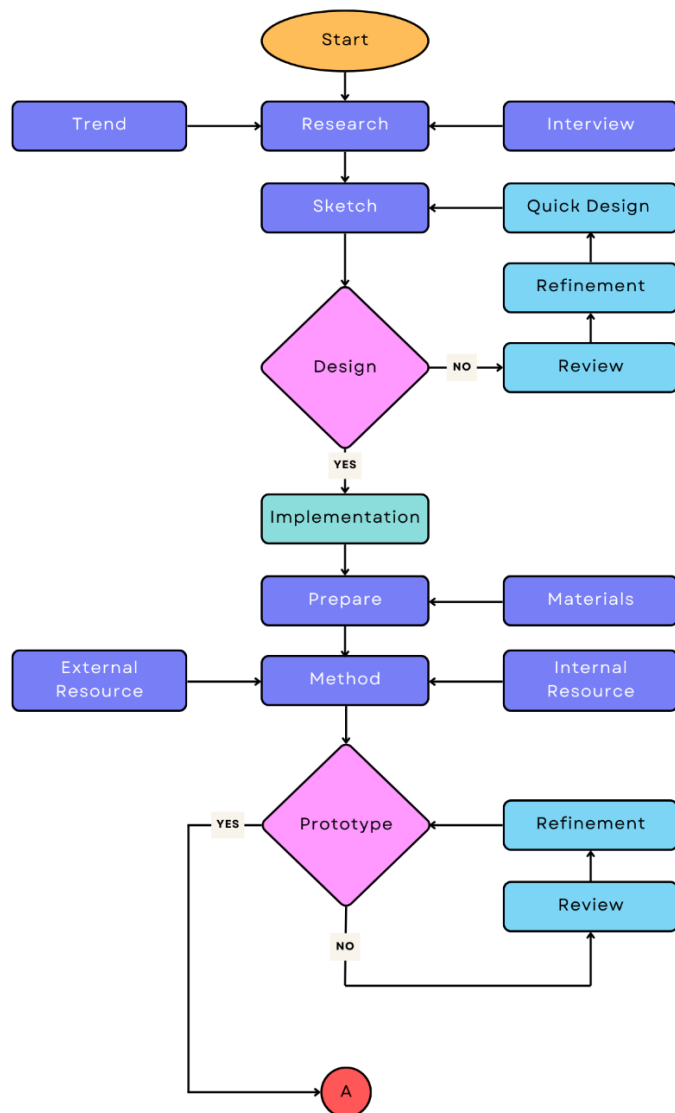
Diagram 3.1 Flowchart of process for the making DigitQuest
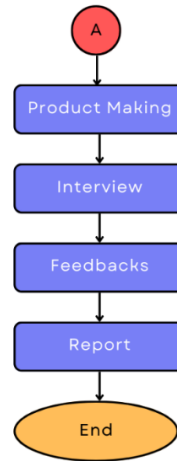
Diagram 3.2 Continuation of flowchart of process for the making DigitQuest

3.3 RESEARCH DESIGN

3.3.1 Sketches

After deciding on our project theme, interactive learning tool, we incorporated the subject of mathematics. Following an initial literature review, we narrowed the scope to focus on 5-year-old children and basic mathematical operations: addition and subtraction. Further research based on KSPK 2017 guided us to concentrate on teaching numbers 1-10 and basic shapes like rectangles, triangles, and circles for 5-year-olds.

With this foundation, we developed and refined the project title, eventually finalizing it as 'DigitQuest: Addition and Subtraction Skills for 5-Year-Olds with an Interactive Learning Tool.' After browsing various products for inspiration, we produced our prototype sketch (as shown in Figure 3.1). This sketch was used during interviews and presentations for our proposal project course, DCW40173. Once the prototype sketch was finalized, we transferred it to technical drawing software, AutoCAD, to finalize all dimensions and prepare for production.
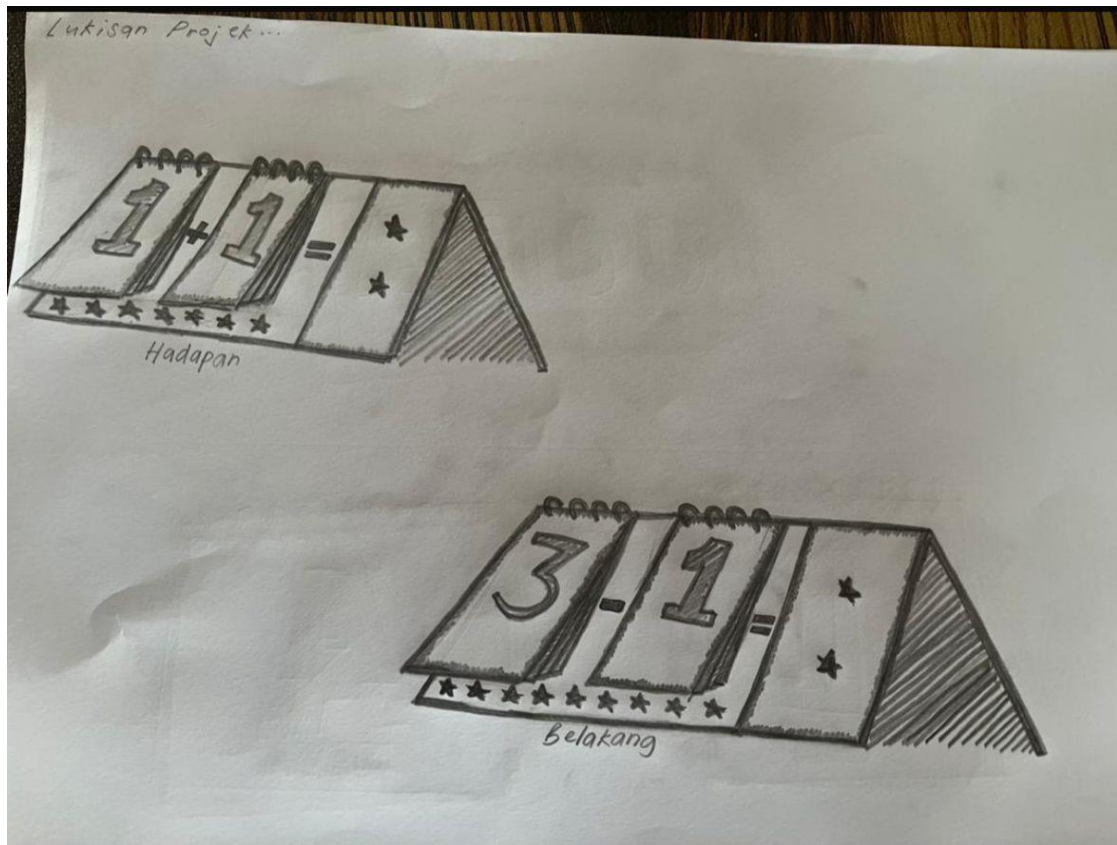
Figure 3.1 Sketch for DigitQuest before transferring into AutoCAD

3.3.2   Technical Drawings

All dimensions and colours were incorporated into the technical drawing using AutoCAD. This ensured that every aspect of the design, including precise measurements and colour details, was accurately represented and ready for production.
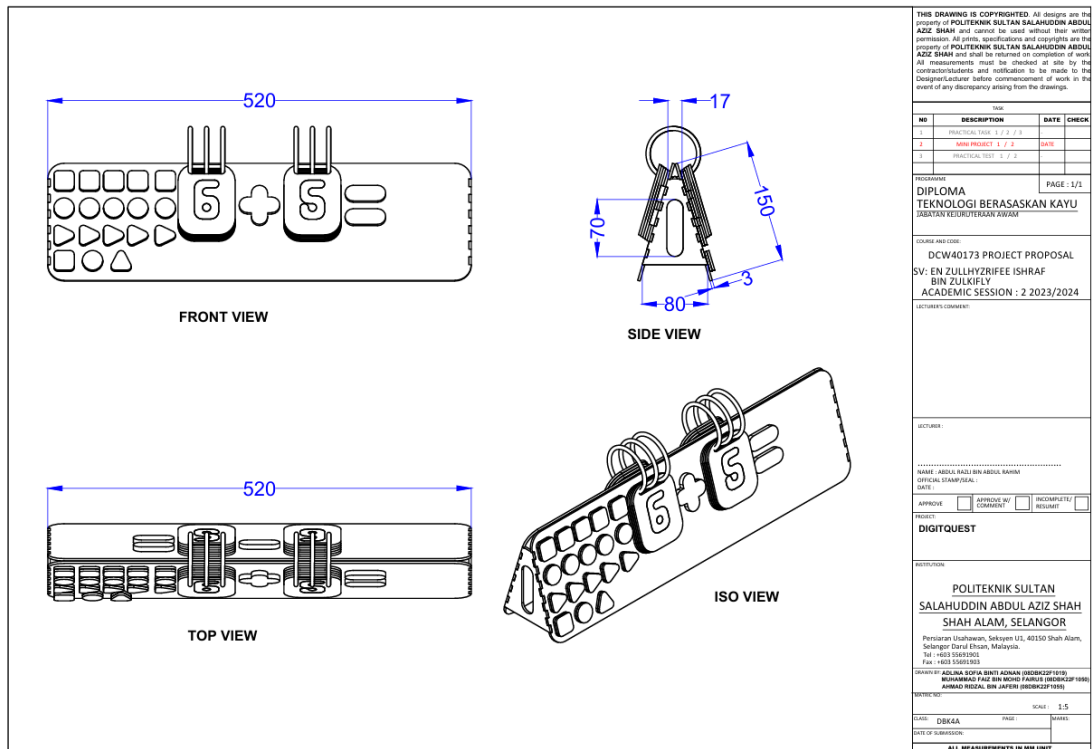
Figure 3.2 General dimension of DigitQuest prototype (A3 size; 1:5)
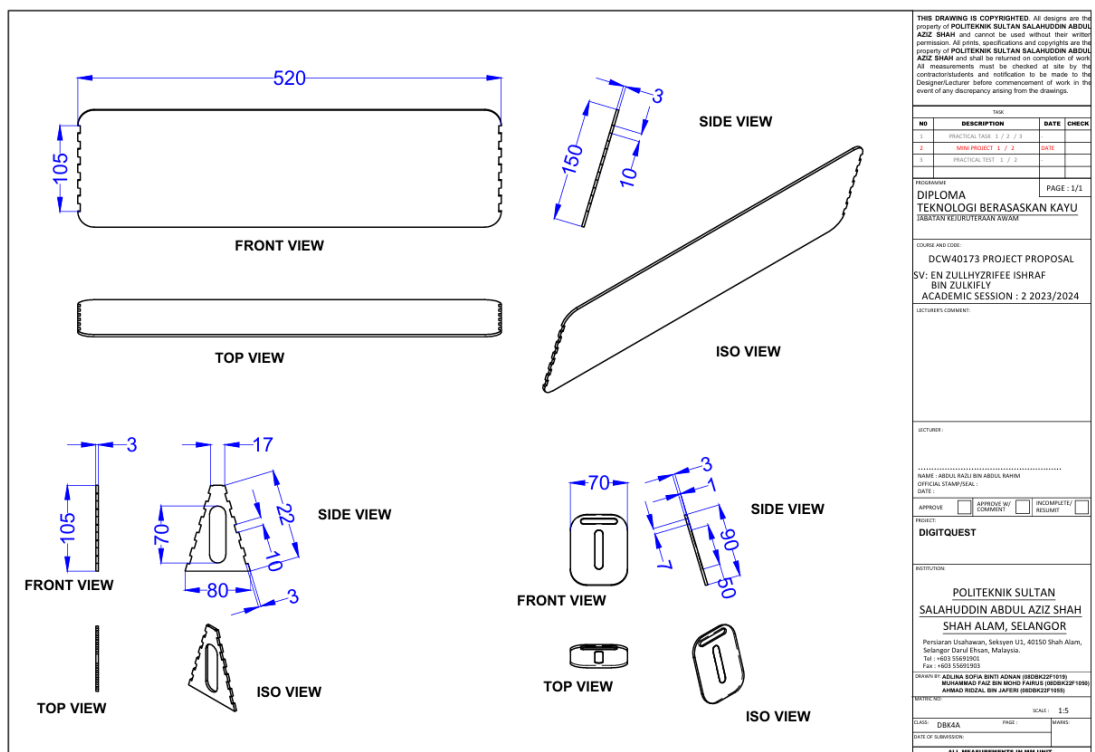
Figure 3.3 Detailed dimensions of DigitQuest for base, side bases, and numbers (A3 size; 1:5)
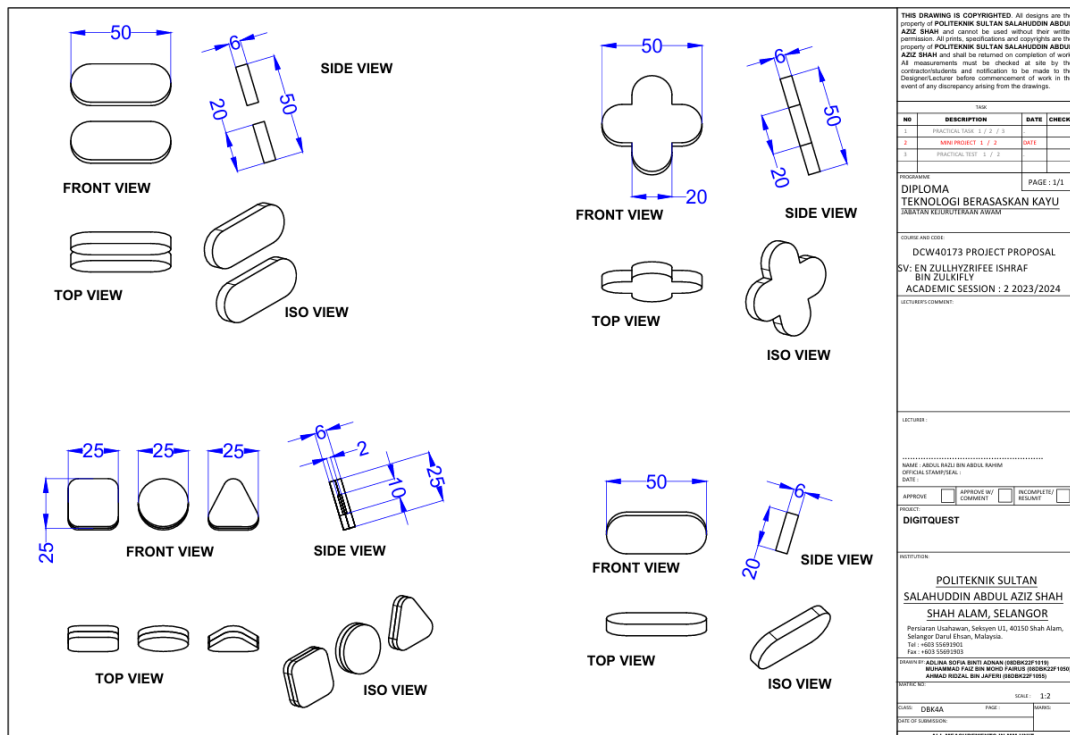
Figure 3.4 Detailed dimensions of DigitQuest for operations and shapes (A3 size; 1:2)
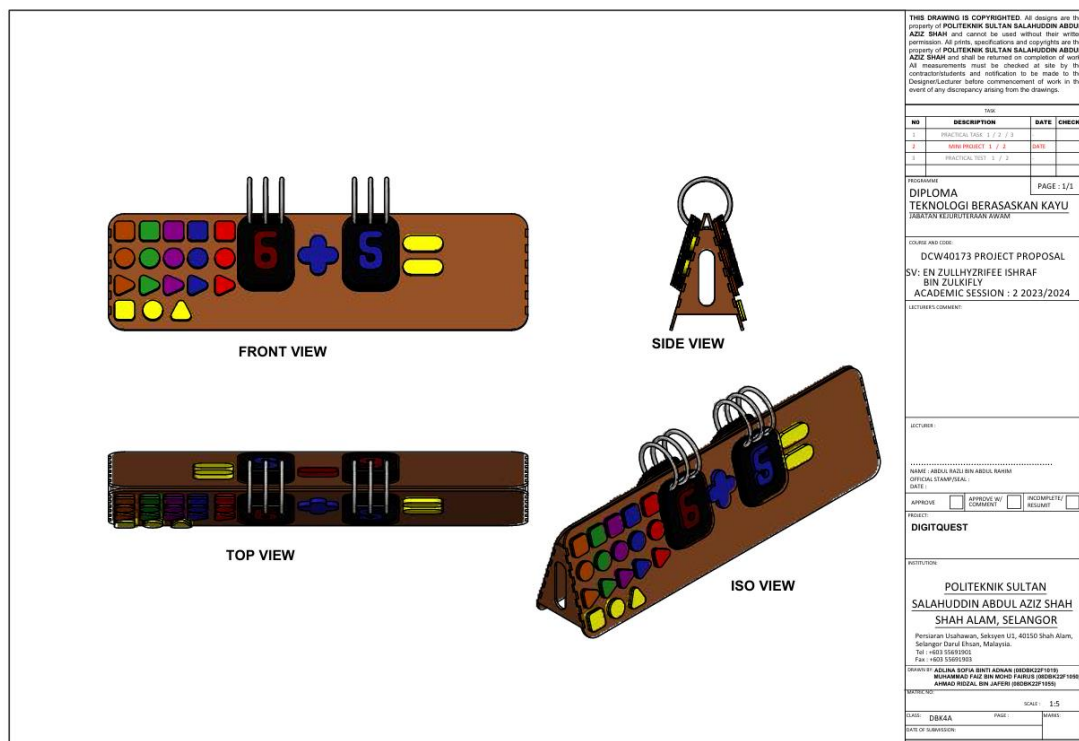
Figure 3.5 Coloured technical drawing of DigitQuest prototype (A3 size; 1:5)

3.3.3 BOM, Cutting List and Estimated Cost

BILL OF MATERIALS for DigitQuest (Prototype)

BOM LEVEL	MATERIALS	MEASUREMENT	PART NUMBER	PART NAME	PART DESCRIPTION	UNIT COST	QUANTITY	TOTAL COST
	RAW MATERIALS							
1	Plywood (A3)	297mm x 420mm x 3mm	B	Shapes, Side bases, Operation Symbols	Kayu Pine (from Shopee Ptd. Lte)	RM3.40	2	RM6.80
2	Plywood*	4ft x 8ft x 3mm	A	Base, Numbers	B. S. Huat Trading (M) Sdn. Bhd.	RM19.00	1	RM19.00
3	Steel Plate*	148mm x 210mm x 1mm	E	Steel Plate	MMC Steel (from Shopee Ptd. Lte.)	RM7.50	1	RM7.50
	HARDWARES							
4	Binder rings (Metal)	30mm diameter	C	Hinges	Dcplaylearning (from Shopee Ptd. Lte.)	RM3.45	2	RM6.90
5	Magnets*	10mm x 10mm x 6mm	D	Magnets (for Shapes part)	Kuan Yan Art & Stationery (from Shopee Pte	RM1.29	30	RM38.70
	ADHESIVES							
6	Titebond II Premium Wood Glue*	473ml / 16oz			DiyKayu (from Shopee Pte. Lte.)	RM29.99	1	RM29.99
	*FINISHING SUPPLIES**							
7	Wood Filler (Teak)	500g			Mr. DIY (M) Berhad	RM7.50	1	RM7.50
8	Wood Varnish	250g			SGB HARDWARE (from Shopee Pte. Ltd)	RM8.90	1	RM8.90
9	Spray Paint (black)	400g			Mr. DIY (M) Berhad	RM6.50	1	RM6.50
10	Spray Paint (green)	400g			Mr. DIY (M) Berhad	RM6.50	1	RM6.50
11	Spray Paint (blue)	400g			Mr. DIY (M) Berhad	RM6.50	1	RM6.50
12	Spray Paint (yellow)	400g			Mr. DIY (M) Berhad	RM6.50	1	RM6.50
13	Spray Paint (red)	400g			Mr. DIY (M) Berhad	RM6.50	1	RM6.50
14	Sandpaper (P150)	210mm x 297mm x 1mm			Trand88 DIY (from Shopee Pte. Lte.)	RM0.40	3	RM1.20
15	Sandpaper (P180)	210mm x 297mm x 1mm			Trand88 DIY (from Shopee Pte. Lte.)	RM0.40	3	RM1.20
16	Sandpaper (P220)	210mm x 297mm x 1mm			Trand88 DIY (from Shopee Pte. Lte.)	RM0.40	3	RM1.20
17	Sandpaper (P3000)	210mm x 297mm x 1mm			Trand88 DIY (from Shopee Pte. Lte.)	RM0.40	1	RM0.40
	*TOOLS**							
18	Knife				Eco-Shop Marketing Sdn. Bhd.	RM2.40	1	RM2.40
19	Scissors				Eco-Shop Marketing Sdn. Bhd.	RM2.40	1	RM2.40
20	Paint Brush				Mr. DIY (M) Berhad	RM1.80	1	RM1.80
21	Masking Tape				Mr. DIY (M) Berhad	RM1.90	3	RM5.70
	*SAFETY EQUIPMENTS**							
22	Masks				Mr. DIY (M) Berhad	RM3.50	1	RM3.50
23	Gloves				Mr. DIY (M) Berhad	RM9.50	1	RM9.50
	*use in Prototype and Model				TOTAL			RM177.59

Figure 3.6 Bill of Materials for DigitQuest prototype

CUTTING LIST for DigitQuest (Prototype)

PART NUMBER	PART NAME	QUANTITY	DESCRIPTION	DIMENSION
	Shapes	30	Use Laser + double laser to get 6mm	25mm x 25mm x 6mm
	Side Bases	2	Use Laser	80mm x 105mm x 3mm
B	Operation Symbols	6	Use Laser + double laser to get 6mm	50mm x 50mm x 6mm
	Base	2	Use Laser	520mm x 150mm x 3mm
A	Numbers	20	Use Laser	70mm x 90mm x 3mm

Figure 3.7 Cutting list for DigitQuest prototype

COST for DigitQuest (Prototype)

BOM LEVEL	MATERIAL / PART NUMBER	PART NAME	UNIT COST	QUANTITY	TOTAL COST
	RAW MATERIALS				
1	Shapes		RM0.02	60	RM1.20
2	Side bases		RM0.23	2	RM0.46
3	Operation symbols	B	RM0.07	12	RM0.84
4	Base		RM0.50	2	RM1.00
5	Numbers	A	RM0.04	20	RM0.80
6	Steel Plate	E	RM7.50	1	RM7.50
	HARDWARES				
7	Binder rings	C	RM3.45	2	RM6.90
8	Magnets	D	RM1.29	30	RM38.70
	ADHESIVES				
9	Titebond II Premium Wood Glue*		RM0.06	75	RM4.50
	FINISHING SUPPLIES*				
10	Wood Filler (Teak)		RM0.02	50	RM0.75
11	Wood Varnish		RM0.04	30	RM1.20
12	Spray Paint (black)		RM6.50	2	RM13.00
13	Spray Paint (green)		RM6.50	1	RM6.50
14	Spray Paint (blue)		RM6.50	1	RM6.50
15	Spray Paint (yellow)		RM6.50	1	RM6.50
16	Spray Paint (red)		RM6.50	1	RM6.50
17	Sandpaper (P150)		RM0.40	1	RM0.40
18	Sandpaper (P180)		RM0.40	1	RM0.40
19	Sandpaper (P220)		RM0.40	1	RM0.40
20	Sandpaper (P3000)		RM0.40	1	RM0.40
	TOOLS*				
21	Knife		RM2.40	1	RM2.40
22	Scissors		RM2.40	1	RM2.40
23	Paint Brush		RM1.80	1	RM1.80
24	Masking Tape		RM1.90	2	RM3.80
	SAFETY EQUIPMENTS*				
25	Masks		RM0.35	5	RM1.75
26	Gloves		RM0.19	20	RM3.80
	TOTAL				**RM120.40**
				100%	RM240.80

FORMULA KOS SEUNIT SEBENAR

$$\frac{saiz\ guna\ kayu}{saiz\ sebenar\ kayu} = \frac{x}{harga\ sebenar\ kayu}$$

NOTE			EQUAL TO	RM (SEUNIT)
B	297mm x 420mm x 3mm		124,740	RM3.40
A	4ft x 8ft x 3mm	1219.2mm x 2438.4mm x 3mm	2,972,897.28	RM19.00
E	148mm x 210mm x 1mm		31,080	RM7.50
C	30mm diameter			RM3.45
D	10mm x 10mm x 6mm		100	RM1.29

Figure 3.8 Estimated cost for DigitQuest prototype

3.4   RESEARCH METHODOLOGY

The data collection for this project involves both qualitative and quantitative methods. Qualitative data provides insights into underlying reasons, opinions, or motivations from interviews, while quantitative data involves numerical analysis to test hypotheses or predictions in survey. During the DCW40713 Project Proposal, we presented our sketch prototype and complete technical drawing as a visual aid to support the project's development and gather feedback for both interview and survey.

Figure 3.9 Photograph session with Mrs. Joyce after interview

An interview conducted on 26th February of 2024 at Q-Dees TTDI Jaya, Shah Alam. She's the principle and built the pre-school. With her background of Bachelors in early childhood education, her insights and feedbacks are valuable. The questions are broadly categorized into four themes: challenges, product preferences, technology, and suggestions. Under the challenges theme, educators are asked about the difficulties they face in educating children and how educational products could help. The product preferences theme explores the qualities and specific features educators look for in educational products. The technology theme delves into their views on integrating technology and using interactive elements for learning. The suggestion theme seeks their input on effective or innovative educational products and suggestions for improvement. The closing question invites any additional insights or experiences they wish to share about educational products for children.

Quantitative data is collected through a survey distributed to parents, and teachers with 5-year-old children. The survey includes questions about the potential for DigitQuest to be established as an interactive learning tool and as a teaching aid for teachers and parents. These questions are key to achieving the project's objectives. The combination of qualitative and quantitative data will provide a comprehensive understanding of the need for DigitQuest and help tailor the product to meet the specific requirements of its users.

3.5   PURCHASE OF MATERIALS, PPEs, AND TOOLS
3.5.1   B.S. Huat Trading (M) Sdn. Bhd.

Figure 3.10 Workshop visit and buying supply

At B.S. Huat Trading (M) Sdn. Bhd., we purchased one sheet of plywood, sized 8ft x 4ft with a thickness of 3mm. This single sheet was sufficient for the production of both the DigitQuest prototype and the final product, as we had also procured additional A3-sized plywood through online shopping during our semester break. The extra A3 plywood was bought in bulk to ensure we had enough material for any additional work or adjustments.

3.5.2   Mr. D.I.Y (M) Berhad

Most of the finishing supplies were purchased from Mr. D.I.Y. (M) Berhad, including spray paints, brushes, wood filler, and personal protective equipment (PPE) such as masks and gloves. This retailer was chosen for its affordability, convenience, and accessibility. Further details on the purchased items can be found in **APPENDIX D**.

3.5.3   Eco-Shop Marketing Sdn. Bhd.

Sharp tools such as knives and scissors were purchased from Eco-Shop Marketing Sdn. Bhd., where the company has set a price standard of only RM2.40 per item. This made it a convenient option, as most small items, including knives and scissors, are sold in bulk, allowing us to purchase these supplies affordably and efficiently.

3.5.4   Online Shopping
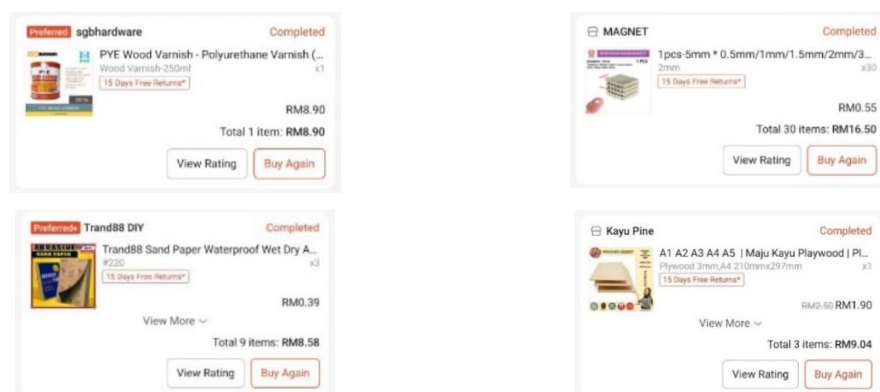
Figure 3.11 History of online purchases

Some items were purchased online during our semester break, as shown in Figure 3.16, which details the purchase history for DigitQuest. Using online platforms like the Shopee application proved to be convenient, offering free shipping and saving time compared to browsing from one physical store to another. Items such as wood varnish, sandpapers, magnets, and additional plywood were all bought through Shopee for their ease of access and delivery.

3.6   PROTOTYPE MAKING PROCESS

3.6.1   Table saw
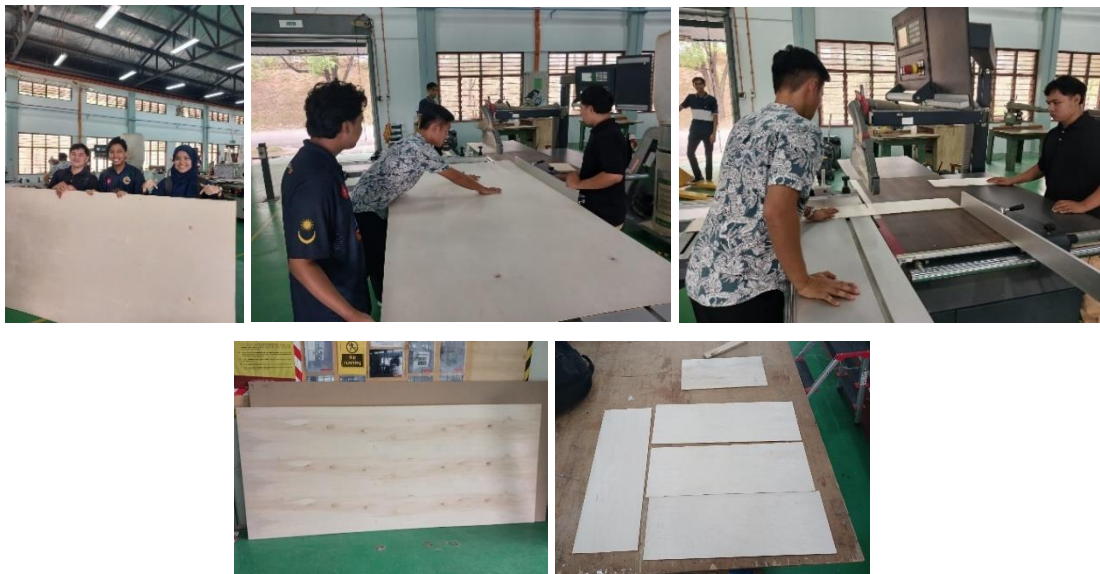
Figure 3.12 Ripping and cross-cutting an 8ft x 4ft plywood sheet under Tew's guide

Figure 3.12 illustrates the ripping and cutting process using the table saw in the workshop, carried out under Tew's guidance. The 8ft x 4ft plywood sheet was ripped and cut into smaller pieces for the base, with the base dimensions being 520mm x 150m (refer to Figure 3.3). Under Tew's guidance, we ripped the plywood into four pieces with extra allowance, measuring 550mm x 180mm. These newly cut pieces, along with other plywood sheets, were then taken to the Maker Space, where the laser cutting and engraving machine was located for further processing.

3.6.2   Laser Cutting and Engraving

Figure 3.13 Cuts and engravings performed using the laser cutting and engraving machine under Alif's guidance

All plywood sheets were taken to the Maker Space for processing with the laser cutting and engraving machine. The laser was used to cut numbers, shapes, the base, side bases, and the operation symbols. After completing the cutting, the engraving process began. Throughout this entire period, Sir Fahmi and Alif provided guidance on operating the machine. The laser cutting and engraving processes took about four weeks to complete, after which we moved on to sanding and finishing.

3.6.3   Sanding, Wood Fillers, and Fisnishing

Figure 3.14 Initial stages of covering the parts where wood filler isn't needed

Figure 3.14 shows the initial stages of covering the areas where wood filler isn't needed, specifically focusing on the numbers. This step was taken because we wanted the engraved residue and natural wood grains to remain visible, enhancing the aesthetic appeal of DigitQuest. Although this stage isn't strictly essential, it adds an extra touch, showcasing the wood grains and making DigitQuest stand out as an interactive learning tool made from wood.

Figure 3.15 Mixing wood fillers with water, then applying it to the surface of plywood

Figure 3.16 Manual sanding and using a palm sander, followed by wiping off dust with a cloth. The sanding and wood filler application steps were repeated twice on each side

After all parts went through the laser cutting and engraving process, the next steps were sanding and finishing. Each part was lightly sanded before applying wood filler. Figure 3.15 shows the process of mixing the wood filler with water, which was then spread evenly across the plywood surface. This process was repeated twice on each side to ensure the surface was smooth and even. Before repeating, the plywood was left to dry for some time, followed by further sanding. Larger areas, like the bases, were sanded using a palm sander, saving time. For smaller parts, manual sanding was done, as shown in Figure 3.16. Personal protective equipment (PPE), including masks, gloves, and safety boots, were worn throughout the process for safety.

Figure 3.17 Gluing parts with wood glue, then clamp them using quick-release clamps

For the shapes, after light sanding, they were prepared for the gluing process. As shown in Figure 3.17, the shapes were glued together, as the original thickness was 3mm, and we needed to achieve a 6mm thickness. After applying the glue, we used quick-release clamps to secure the pieces. These clamps are ideal for small parts, providing a quick and convenient solution for holding the shapes in place during the drying process.

Figure 3.18 Apply glue to the veneer and put magnets in each part. Trim the remaining veneer and clamp it all together using quick-release clamps

After the glue dried, the shapes were prepared for another gluing process, this time involving veneer and magnets. First, the shapes were glued onto a piece of veneer and allowed to dry before trimming the edges. Once that was complete, magnets were inserted into each shape. The gluing process was then repeated, attaching another veneer layer on top of the shapes. Finally, the pieces were tightened with quick-release clamps, as shown in Figure 3.18, to ensure proper adhesion and alignment.

Figure 3.19 Repeat sanding before applying spray paint. Each part is then spray painted according to the predetermined colours. Once dried, veneer is applied.

From figure 3.19, figure illustrates that fter all parts had dried and were free of dust, they were brought for the spray-painting process. Each part had a specific set of colors: blue for numbers, green for the addition symbol, red for the subtraction symbol, black for the bases and side bases, and yellow for the equal symbol. To maintain color consistency, all parts were lightly sanded and spray painted again. After drying, all parts, except for the bases and side bases, were prepared for the final step, where wood varnish was applied using a brush and/or sponge. Once dry, the parts were ready for assembly.

3.6.4 Assembly

Figure 3.20 Front and back of DigitQuest prototype

Once all the parts were assembled, binder rings were incorporated into the design. Steel plates were not used in the prototype as it was a test version. Instead, shapes were attached to the back of the base to keep the displayed shapes secure on the board (as shown in Figure 3.20).

3.7 CHALLENGES DURING PROTOTYPE MAKING

During the production of the prototype, we encountered many challenges, ranging from cutting to the finishing steps. Table 3.1 lists the challenges we faced and the solutions we implemented to overcome them.

Table 3.1 List of challenges and its solutions during prototype production

Challenges	Solution
Initially, we planned to use magnets with a thickness of 3mm (refer to Figure 3.4). However, we encountered a problem where the magnets did not securely hold.	To resolve this, we replaced the 3mm magnets with 6mm magnets to ensure proper alignment and a more secure hold.
In the original plan, we used plywood with a thickness of only 3mm, which made the board flimsy and unsuitable for long-term use.	To address this, we decided to double the 3mm plywood layers instead of purchasing new sheets. This solution-maintained precision and aesthetics while improving the board's durability.
The early design had many teeth and loose spaces, making the board flimsy and unstable, indicating the need for additional support.	We refined the design by strengthening the base parts and adding extra support layers, ensuring better durability without compromising functionality.
Unaligned adhesion caused by rushing to complete the process affected the aesthetic quality of DigitQuest.	To improve this, we ensured proper caution was taken, allowing sufficient time for the pieces to dry while keeping them aligned.

3.8 PRODUCT MAKING PROCESS

3.8.1 Review, Redesign, and Refinement

After considering the feedback and recommendations from the panels, we reviewed all possibilities and developed a new plan for redesigning and refining the product. We started by remodeling the base, which now includes holes and fewer teeth than the prototype's design. For the side bases, we reduced the number of teeth for better grip, ensuring there was no loose space. Additionally, we incorporated three supports along the length of DigitQuest, with the side bases and supports sharing a similar design, except the supports do not have holes in the middle (figure 3.21 to figure 3.24).
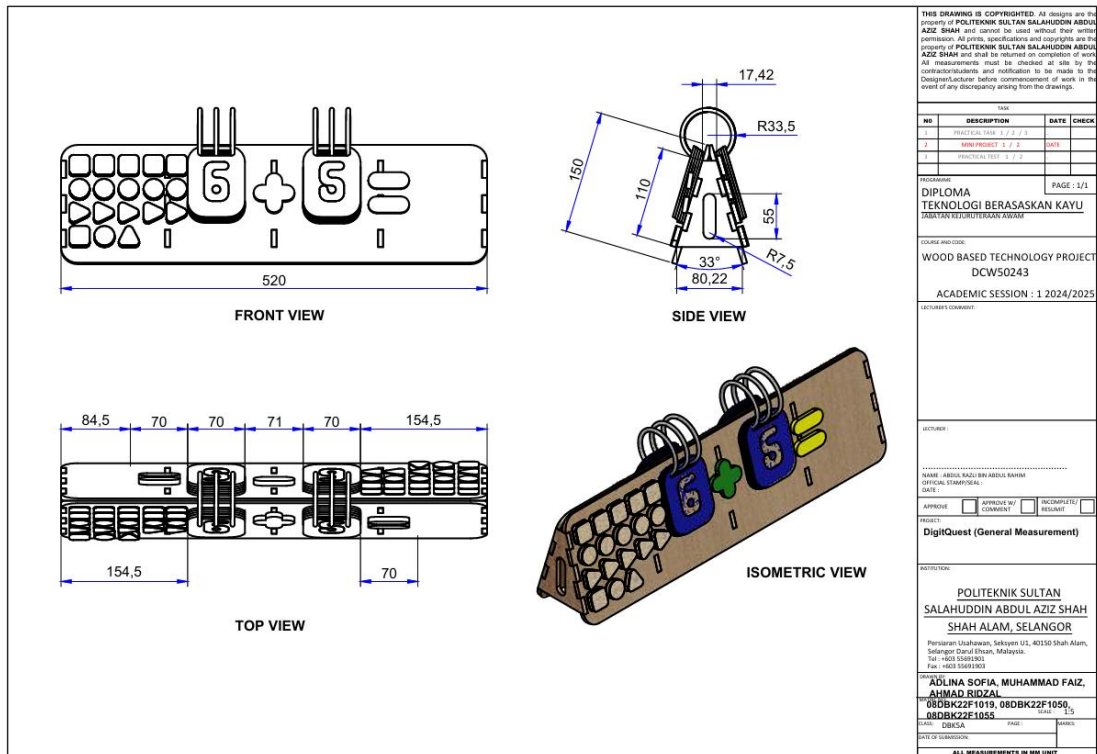
Figure 3.21 Technical drawing of redesigned DigitQuest (A3 size; 1:5)
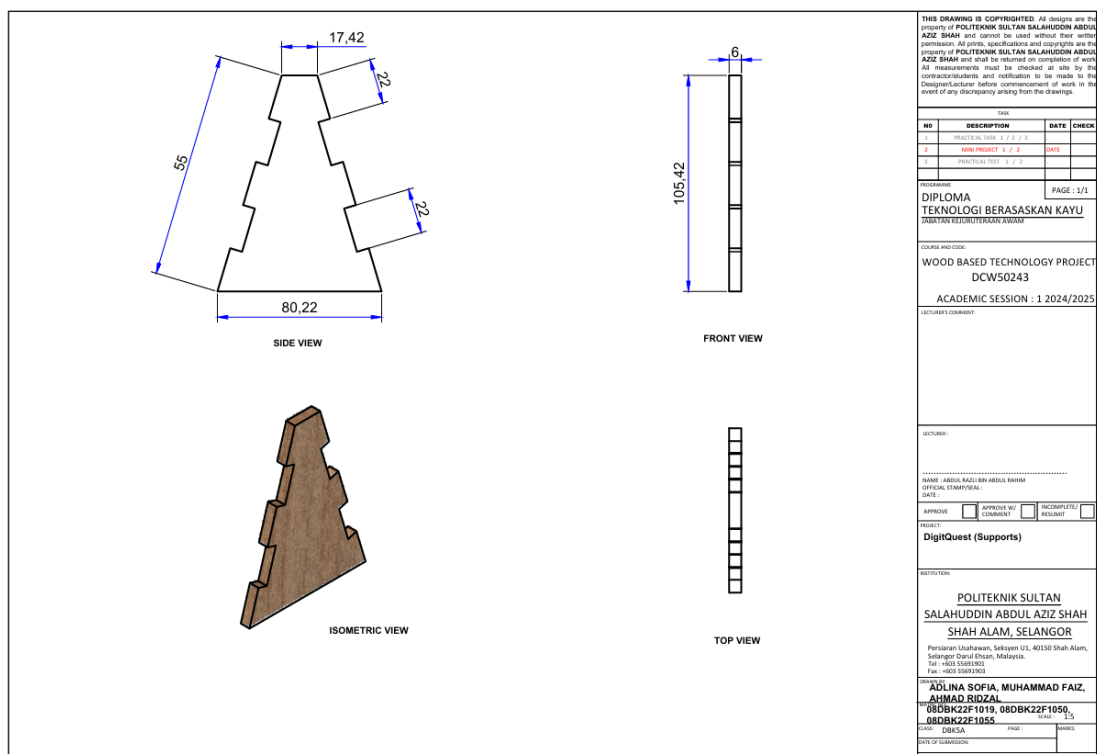
Figure 3.22 Detailed measurement of supports (A3 size; 1:2)
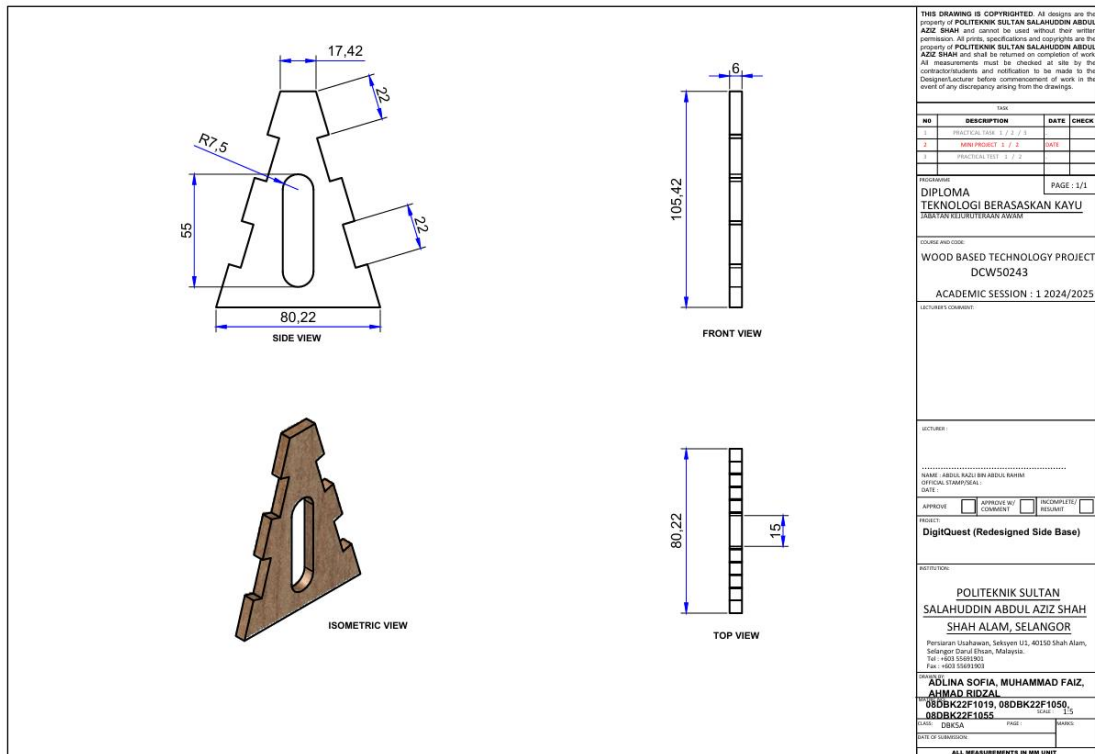
Figure 3.23 Detailed measurement of redesigned side bases (A3 size; 1:2)
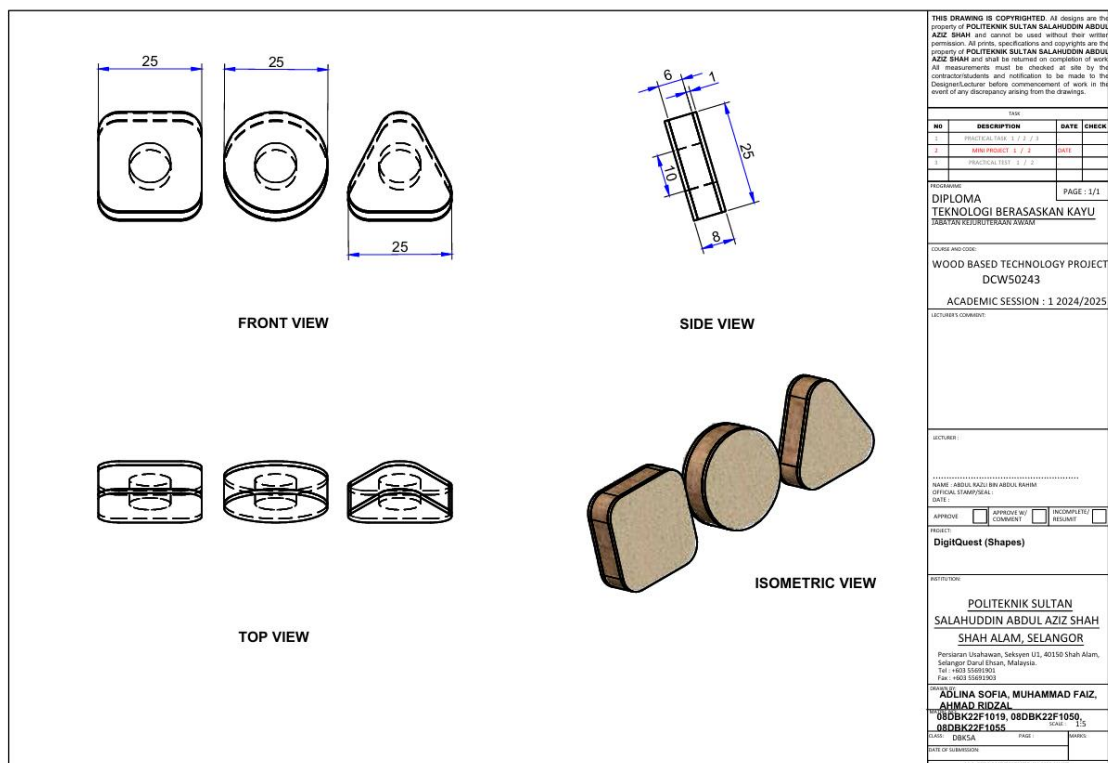
Figure 3.24 Detailed measurement of shapes (A3 size; 1:1)

3.8.2   Laser Cutting and Engraving
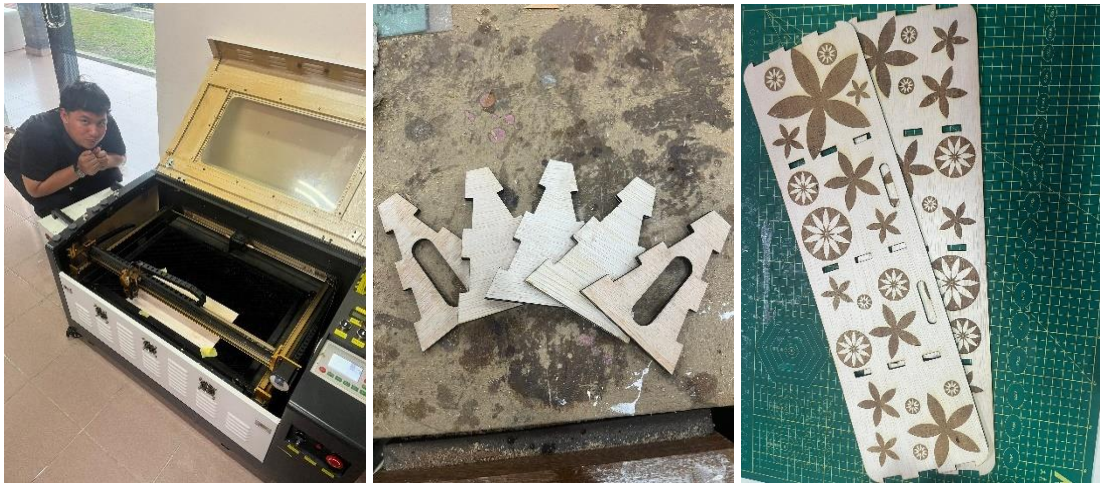
Figure 3.25 Final cut of side bases, support and bases

For the final product, we used the laser cutting and engraving machine only for the remodeled parts. Side bases, bases, and operation symbols were double-cut, as we aimed for all parts to have a thickness of 6mm. Instead of purchasing new plywood sheets, we doubled the layers of the existing parts.

3.8.3   Sanding, and Finishing

Figure 3.26 Cutting steel plates into its measurements

Figure 3.27 Epoxy and hardener were used to glued steel plates onto the back of the base
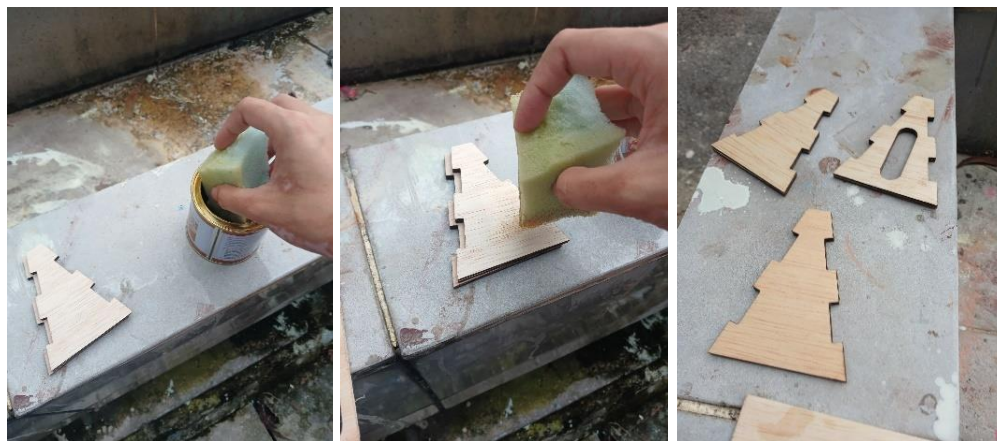
Figure 3.28 Applying wood varnish to the side bases and supports, twice on each side

Once cut, the parts were sanded and brought to the finishing steps. First, the steel plates were cut to fit the width of DigitQuest with Tew's help (figure 3.26). Then, we mixed epoxy and hardener at a 1:1 ratio and glued the steel plates to the back of the base, clamping them together with spring clamps while they dried (figure 3.27). During this time, we spray painted the operation symbols according to their respective colors. Following that, we applied wood varnish to the side bases, supports, engraved bases, and operation symbols on both sides, repeating the process twice (figure 3.28). After drying, all parts were ready for assembly.

3.8.4   Assembly
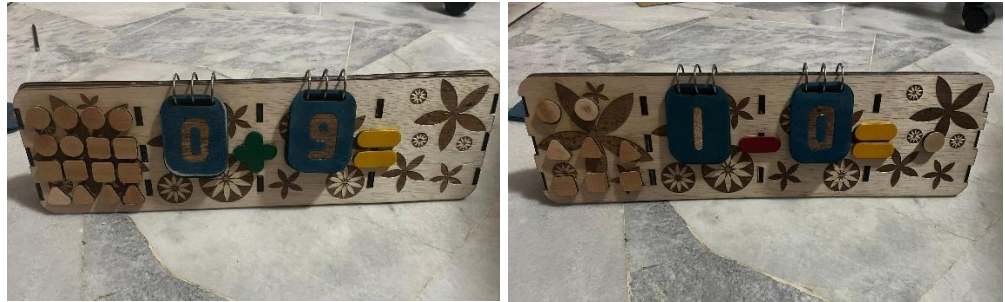
Figure 3.29 Front and back of DigitQuest product

Once all the parts were ready, the assembly process began. The fully assembled product of DigitQuest is shown in Figure 3.29.

3.8.5   Follow-up Interview

Figure 3.30 DigitQuest product were brought in the following interview with Mrs Joyce.

We then brought the final product to a follow-up interview with Mrs. Joyce at Q-Dees TTDI Jaya on October 17, 2024.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1   INTRODUCTION

In this chapter, we present and discuss the findings gathered from the qualitative and quantitative data collected through interviews, surveys, and prototype testing. The results provide valuable insights into the effectiveness of DigitQuest as an educational tool for 5-year-old children, focusing on basic mathematical operations such as addition and subtraction.

The chapter also explores the feedback from both the panels and follow-up interviews with teachers, including the recommendations from Mrs. Joyce. By analyzing these results, we can assess the strengths and areas for improvement in the design and functionality of DigitQuest. The discussions will further address how the results align with our project objectives and how they guide the final development of the product.

4.2   SKETCHES PRESENTATION

4.2.1   Results

In early stages of getting the insights for deeper understanding on interactive learning tool, we've interviewed Mrs Joyce, the principle to Q-Dees TTDI Jaya using only sketch prototype. Thus, the data analysis for this project involves two main methods tailored to the type of data collected. For the qualitative data from interviews, the data are interpreted into thematic analysis. Four categories of themes have been discussed and the feedback are transcript into readable format.

Table 4.1 Feedbacks from Mrs. Joyce at Q-Dees TTDI Jaya with sketches prototype
(26th February 2024)

Questions	Feedback
1.What are the biggest challenges you face in educating children today?	Kids are totally into games, songs and dance. The kids know the dance and how the song goes through browsing in app like TikTok. Kids are now exposed to screentime than outside world.
2. How do you think educational products could help address these challenges?	Educational products must be in the way of how kids see something. The colours must be vivid, the size is just right in their palm, and simple.
3. What qualities do you look for in educational product for children?	I (she) prioritise safety more than anything.
4. Are there any specific features or aspects that are particularly important to you?	Safety features must be lightweight, rounded edges, and no chemical involves.
5. How do you feel about the integration of technology into educational products?	At first, she dislikes the idea of using technology as learning method until COVID-19 pandemic. She realises she had to keep the kids engages during teachings through gadgets.
6. What are your thoughts on using games or interactive elements for learning?	Games are exceptionally helping kids interact in learning process. She strongly agrees that using games or interactive elements for learning is great.
7. Have you come across any educational products that you feel are particularly effective or innovative?	She come across educational products that surrounded Montessori themes. For subject related, most of the she comes across are Math addition and English basic dictionary like the weather, fruits, and colours.

8. Is there anything else you would like to add or share about your experience with educational products for children?	I (she) like to have educational tools that surrounded more into subject related than Montessori. She continues saying that kids are knows more about tech than the adults.

On the other hand, for the quantitative data from surveys are interpreted into descriptive analysis. Descriptive analysis comes after the data is transferred and calculated with SPSS. SPSS allows for statistical analysis of the survey responses, such as calculating frequencies, means, and correlations. Figures 4.1 to 4.5 present the details of the sample data gathered from the survey conducted for the sketch prototype. These figures provide insights into the responses and feedback that helped guide the development of DigitQuest.

status		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	ibu bapa	21	91.3	91.3	91.3
	guru	2	8.7	8.7	100.0
	Total	23	100.0	100.0	

Figure 4.1 Status's samples from the sketch prototype feedbacks

Saya yakin DigitQuest selamat digunakan melihat dari aspek keselamatan seperti bucu bulat itu diadakan.		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	setuju	22	95.7	95.7	95.7
	neutral	1	4.3	4.3	100.0
	Total	23	100.0	100.0	

Figure 4.2 Safety concerns feedback

Saya yakin kanak-kanak lebih berminat untuk belajar matematik dengan alat bantuan belajar DigitQuest.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	setuju	22	95.7	95.7	95.7
	neutral	1	4.3	4.3	100.0
	Total	23	100.0	100.0	

Figure 4.3 Entertain aspects of DigitQuest's sketch prototype

Saya yakin DigitQuest boleh dijadikan sebagai alat bantu belajar untuk kanak-kanak 5 tahun

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	setuju	21	91.3	91.3	91.3
	neutral	2	8.7	8.7	100.0
	Total	23	100.0	100.0	

Figure 4.4 Opinion on DigitQuest can be as an educational learning tool for 5-years-old

Saya menyokong dengan pembuatan/penghasilan DigitQuest sebagai satu alat bantu belajar untuk kanak-kanak.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	setuju	23	100.0	100.0	100.0

Figure 4.5 Opinion on DigitQuest's establishment as an interactive learning tool

4.2.2 Discussions

From the interviews and surveys conducted, the feedback indicated that DigitQuest has strong potential to achieve its objectives. Based on this, we developed a plan to conduct further research, procure the necessary materials, and determine the methods to be used for both the prototype and product development.

4.3   PROTOTYPE PRESENTATION

4.3.1   Results

Table 4.2 Feedbacks from panels after prototype presentation (4th October 2024)

Recommendations
Sir Jefri suggested adding the following limitation to the report: "Limitations: Some 5-year-olds may not have fully mastered the basic operations of addition and subtraction."
Sir Hamdi recommended enhancing the design by adding engravings to the bases, such as flora, fauna, animals, or other shapes that are appropriate for 5-year-old children. He also proposed considering the use of Formica on the plywood for added durability and aesthetic appeal.

Table 4.2 presents the recommendations from the panels following the prototype presentation on 4th October 2024. These suggestions were provided to improve and refine the final product based on their feedback.

4.3.2   Discussions

The recommendations from the panels were discussed thoroughly. We decided to incorporate the limitations into our report, as it added valuable context. Additionally, we agreed to include the engraving suggestion, as it was a great idea to enhance the beauty and appeal of DigitQuest. However, after testing the incorporation of Formica using laser cutting and engraving, we found that the material burned easily and was not suitable for long-term use.

4.4   PRODUCT PRESENTATION

4.4.1   Results

Table 4.3 presents the recommendations from Mrs. Joyce during our follow-up interview. Her insights provided valuable perspectives from the point of view of both teachers and 5-year-old children.

Table 4.3 Recommendations from Mrs Joyce after follow-up interview (17th October 2024)

Num.	Recommendations
1.	Instead of having the 'numbers part' hanging with binder rings, isolate the numbers so that children can hang the numbers themselves.
2.	Rather than extending the length, make the width of the board wider so that the shapes can be placed directly beneath the numbers. This adjustment will make it easier for children to visualize and understand addition and/or subtraction.
3.	She emphasized the importance of having a clear borderline between the numbers, operations (either addition or subtraction), equals sign, and the space for shapes. This would help children better visualize the questions and answers (from the interview, it was clear she prioritizes this suggestion).
4.	She also recommended that the operations (addition and subtraction symbols) should not be glued onto the board.

For quantitative data, we used a Google Form questionnaire, distributed to family members and kindergarten teachers. The questionnaire, as shown in Figures 4.6 to 4.18, covers questions designed for our sample group.

Figures 4.6 to 4.10 display demographic questions, with 31 participants in total. Most of the respondents were parents, followed by teachers (as shown in Figures 4.6 and 4.7). Additional demographic details include educational background (Figure 4.8), years of experience teaching children (for teachers, Figure 4.9), and number of children (Figure 4.10).

Figures 4.11 to 4.18 focus on questions about interactive learning tools and DigitQuest. The responses indicate that the participants support the objectives of DigitQuest, affirming that the objectives were effectively achieved.

Kumpulan Umur (Age Group)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-29	18	58.1	58.1	58.1
	30-39	3	9.7	9.7	67.7
	40-49	8	25.8	25.8	93.5
	50+	2	6.5	6.5	100.0
	Total	31	100.0	100.0	

Figure 4.6 Age group of samples

Pekerjaan / Peranan (Occupation / Role)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Guru (Teacher)	10	32.3	32.3	32.3
	Ibu Bapa (Parent)	19	61.3	61.3	93.5
	Kedua-duanya (Both)	2	6.5	6.5	100.0
	Total	31	100.0	100.0	

Figure 4.7 Occupations of samples

Taraf Pengajian (Education Background)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Diploma	16	51.6	51.6	51.6
	Ijazah Sarjana atau lebih / Master's degree or higher	1	3.2	3.2	54.8
	Ijazah Sarjana Muda / Bacelor	4	12.9	12.9	67.7
	SPM dan setaraf	10	32.3	32.3	100.0
	Total	31	100.0	100.0	

Figure 4.8 Education background of samples

Untuk guru, berapa tahun pengalaman Tuan/Puan mengajar kanak-kanak?
(How many years of experience do you have teaching children?)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		15	48.4	48.4	48.4
	0-2 tahun / years	5	16.1	16.1	64.5
	10+ tahun / years	4	12.9	12.9	77.4
	3-5 tahun / years	3	9.7	9.7	87.1
	6-10 tahun	4	12.9	12.9	100.0
	Total	31	100.0	100.0	

Figure 4.9 Question for teachers from the samples about how many years of experiences of teaching children

Untuk ibu bapa, berapa ramai anak Tuan/Puan?
(How many children do you have?)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		4	12.9	12.9	12.9
	1	8	25.8	25.8	38.7
	2	5	16.1	16.1	54.8
	3 atau lebih / 3 or more	14	45.2	45.2	100.0
	Total	31	100.0	100.0	

Figure 4.10 Question for parents about how many children do they have

Sejauh manakah Tuan/Puan biasa menggunakan alat pembelajaran interaktif?
(How familiar are you with using educational tools or resources?)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agak biasa / Somewhat familiar	16	51.6	51.6	51.6
	Sangat biasa / Very familiar	7	22.6	22.6	74.2
	Tidak biasa / Not familiar	8	25.8	25.8	100.0
	Total	31	100.0	100.0	

Figure 4.11 Question about familiarity in using interactive learning tool

Berapa kerap Tuan/Puan menggunakan alat atau sumber pendidikan dengan anak/pelajar anda? (How often do you use educational tools or resources with your child/student?)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bulanan / Monthly	3	9.7	9.7	9.7
	Jarang-jarang / Rarely	9	29.0	29.0	38.7
	Mingguan / Weekly	7	22.6	22.6	61.3
	Setiap hari / Daily	12	38.7	38.7	100.0
	Total	31	100.0	100.0	

Figure 4.12 Question on how often do they use an educational tool for children

Bagaimanakah Tuan/Puan menilai kepuasan keseluruhan anda dengan DigitQuest? (How would you rate your overall satisfaction with the DigitQuest?)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Memuaskan / Satisfied	22	71.0	71.0	71.0
	Sangat Memuaskan / Very Satisfied	8	25.8	25.8	96.8
	Tidak Memuaskan / Unsatisfied	1	3.2	3.2	100.0
	Total	31	100.0	100.0	

Figure 4.13 Overall rating of satisfaction with the DigitQuest

Adakah DigitQuest dapat membantu dalam pelajaran kanak kanak (Can DigitQuest help in children's studies)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Ya / Yes	31	100.0	100.0	100.0

Figure 4.14 Question on do DigitQuest help in childrens studies

Adakah rekabentuk dan susun atur DigitQuest menarik (Is the design and layout of DigitQuest attractive)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Ya / Yes	31	100.0	100.0	100.0

Figure 4.15 Aesthetics opinion of DigitQuest

Adakah DigitQuest mudah digunakan?
(How easy was to use the DigitQuest?)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Difficult / Susah	1	3.2	3.2	3.2
	Sangat Senang / Very Easy	7	22.6	22.6	25.8
	Sangat Susah / Very Difficult	1	3.2	3.2	29.0
	Senang / Easy	22	71.0	71.0	100.0
	Total	31	100.0	100.0	

Figure 4.16 Easy feature on DigitQuest

Adakah DigitQuest memenuhi kehendak pembelajaran kanak kanak
(Does DigitQuest meet the learning needs of children)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Ya / Yes	31	100.0	100.0	100.0

Figure 4.17 Question on did DigitQuest meet the learning needs of children

Sejauh manakah DigitQuest memenuhi keperluan Tuan/Puan?
(How well does DigitQuest meet your needs?)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Sangat Baik / Very Well	16	51.6	51.6	51.6
	Sederhana / Moderately	8	25.8	25.8	77.4
	Sedikit / Slightly	2	6.5	6.5	83.9
	Sempurna / Perfectly	5	16.1	16.1	100.0
	Total	31	100.0	100.0	

Figure 4.18 Question on did DigitQuest meet the samples needs (as parents and teachers)

4.3.2   Discussions

The results from the follow-up interview gave us important insights into how DigitQuest could be improved (refer to Table 4.3). We have retained her recommendations and hope to further develop and improve DigitQuest in the future, should the opportunity arise.

The results from the questionnaire (refer to Figures 4.6 to 4.18) indicate that most participants frequently use learning tools, suggesting a strong potential for DigitQuest to be welcomed as an additional educational aid. The majority of respondents expressed satisfaction with DigitQuest, with 100% agreeing that it can support children's learning and that its aesthetic design is appealing. The responses to the final two questions reinforce that DigitQuest successfully meets its objectives. Therefore, all participants demonstrated support for the objectives of DigitQuest.

CHAPTER 5

CONCLUSION

5.1   INTRODUCTION

The objective of this project was to design and develop DigitQuest, an interactive educational tool for 5-year-olds, focusing on basic mathematical operations like addition and subtraction. Another goal was to establish DigitQuest as a teaching aid for teachers and parents to 5-years-old. This chapter summarizes the key findings, limitations, and recommendations based on our research and development process.

5.2   CONCLUSION

In conclusion, DigitQuest successfully fulfilled its intended purpose as an educational tool. The qualitative and quantitative data collected throughout the process showed that both teachers and parents viewed it as an engaging, functional tool for young learners. The design refinements, particularly around the base, supports, and the use of magnets, enhanced both the product's durability and usability. All in all, DigitQuest has achieved its objectives.

We look forward to future improvements with new perspectives gained from data collection through interviews and surveys. We also plan to manage our time better to gather regular feedback from the sample group, allowing us to gain deeper insights. While working to achieve our objectives on time, we aim to balance efficiency and effectiveness. Additionally, we will consider the recommendations provided by our sample group to enhance DigitQuest further. By acknowledging the limitations, we have learned to approach the project from all perspectives, and we hope to make continuous improvements in the future.

5.3   CLOSING

We would like to express our highest gratitude and thanks to our supervisor, Mr. Zulhyzrifee Ishraf bin Zulkifly, Politeknik Sultan Salahuddin Abdul Aziz Shah, and Q-Dees Kindergarten for their unwavering support and commitment in making this final year project a success. Their contributions of ideas, insights, and guidance have not only enriched the outcome of this project but have also opened doors to more creative and innovative thinking in producing quality work.

Mr. Zulhyzrifee Ishraf bin Zulkifly, as our dedicated supervisor, has provided invaluable guidance and support throughout this process. Politeknik Sultan Salahuddin Abdul Aziz Shah has served as the main platform that allowed us to explore new knowledge and skills. We would also like to extend our thanks to Q-Dees Kindergarten for generously sharing valuable ideas that were instrumental in shaping the concept and foundation of this project.

We deeply appreciate the contributions, effort, and dedication given by everyone involved in the success of this project. Without the guidance and cooperation from Mr. Zulhyzrifee, Politeknik Sultan Salahuddin Abdul Aziz Shah, and Q-Dees Kindergarten, the success of this project would not have been possible. Our heartfelt thanks go to all for the support, inspiration, and guidance that have been provided.

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APPENDIXES

APPENDIX A

CARTA GANTT : PERANCANGAN DAN PELAKSANAAN PROJEK PELAJAR

SESI : 1 : 2024/2025
JABATAN: JKA
KODKURSUS: DCW50243
TAJUK PROJEK: DIGITQUEST: ADDITION AND SUBTRACTION SKILLS FOR 5-YEARS-OLD WITH INTERACTIVE LEARNING TOOL

ID		Task Mode	Task Name	Duration	Start	Finish	Predecessors
1							
2			Potong dan Ukiran (Proto)	4 wks	Mon 12/8/24	Fri 6/9/24	
3			Pemelasan (Proto)	1 wk	Mon 9/9/24	Fri 13/9/24	2
4			Kemasiapan & Kemasan (Proto)	1 wk	Mon 16/9/24	Fri 20/9/24	3
5			Diskusi dan Analisis (dari Proto dan untuk	1 wk	Mon 23/9/24	Fri 27/9/24	4
6			Pembuatan Model	4 wks	Mon 30/9/24	Fri 25/10/24	5
7			Draf Laporan	35 days	Mon 12/8/24	Fri 27/9/24	
8			Laporan Akhir	60 days	Mon 5/8/24	Fri 25/10/24	

Project: fyp carta gannt on proj
Date: Mon 30/9/24

Task		Inactive Summary		External Tasks
Split		Manual Task		External Milestone
Milestone		Duration-only		Deadline
Summary		Manual Summary Rollup		Progress
Project Summary		Manual Summary		Manual Progress
Inactive Task		Start-only		
Inactive Milestone		Finish-only		

1

APPENDIX C

LEGENDS

START → STEP 1: CUTTING → STEP 2: FINISHING → STEP 3: ASSEMBLY → STEP 4: TESTING → END

Flowchart:

START → Prepare, SOP, tools, materials, machines → Plywood (through laser cutting & engraving) / Steel (using steel cutter)

FORWARD TO:

Sanding → Wood Filler → Sanding (cleanse after) → Satisfied? (NO loops back, YES forward) → Glued Parts (some) → Wood Stain → Sanding (cleanse after) → Satisfied? (NO loops back, YES forward) → Wood Sealer / Lacquer → Sanding (cleanse after) → Satisfied? (NO loops back, YES forward)

Assembly → Satisfied? (NO → Analyze & Refinement → Undo assembly, YES →) → Test → Collect feedbacks → Reflects → Recorded (into Report) → END

MR. D.I.Y. (M) SDN BHD
(CO Reg 860671-D)
LOT 1851-A & 1851-B, JALAN KPB 6,
KAWASAN PERINDUSTRIAN BALAKONG,
43300 SERI KEMBANGAN, SELANGOR
(LOTUS'S BANDAR BUKIT MAHKOTA,BANGI)
--INVOICE--

```
PYEFILLA WOODFILLER (TEAK) WOTE01-0 5KG
9556268000111        1 X  7.50      7.50
SPRAY PAINT YELLOW 12#
9070925              1 X  6.50      6.50
450'S A4 80GSM 1K YELLOW PAPER
8991389140062        1 X 13.90     13.90
SPRAY PAINT BLACK 30#
9070929              1 X  6.50      6.50
SPRAY PAINT GREEN 27#  TR
9070928              1 X  6.50      6.50
SPRAY PAINT RED 33#
9070924              1 X  6.50      6.50
SPRAY PAINT MEDIUM BLUE 23#
9070926              1 X  6.50      6.50
PAINT BRUSH 1 5IN 680#
9077054              1 X  1.80      1.80
SUPER GLUE SINGLE PACK 3GM
8858357561161        1 X  1.50      1.50
NITRILE GLOVE CW35 BIODEGRADABLE-M 50PCS
9750375              1 X  9.50      9.50
MASKING TAPE 2.2CM*18M#
9080459              3 X  1.90      5.70
```

Item(s) : 11   Qty(s)   13

Total   RM 72.40
CARD   RM 72.40

07-07-24 15:22 SH01 ZJ79   T1 R000726892
OPERATOR TBGC - NURUL AIN SHUHADA

EXCHANGE ARE ALLOWED WITHIN
7 DAY WITH RECEIPT
STRICTLY NO CASH REFUND

BILL OF MATERIALS for DigitQuest (Product)

BOM LEVEL	MATERIALS	MEASUREMENT	PART NUMBER	PART NAME	PART DESCRIPTION	UNIT COST	QUANTITY	TOTAL COST
	RAW MATERIALS							
1	Plywood (A3)	297mm x 420mm x 3mm	F	Shapes, Side bases, Operation Symbols	Kayu Pine (from Shopee Ptd. Lte)	RM3.40	2	RM6.80
2	Plywood*	4ft x 8ft x 3mm	A	Base, Numbers, Legs support	B. S. Huat Trading (M) Sdn. Bhd.	RM19.00	1	RM19.00
3	Steel Plate*	148mm x 210mm x 1mm	E	Steel Plate	MMC Steel (from Shopee Ptd. Lte.)	RM7.50	1	RM7.50
	HARDWARES							
4	Binder rings (Metal)	62mm diameter	G	Hinges	KOPSA Berhad	RM0.50	4	RM2.00
5	Magnets*	10mm x 10mm x 6mm	D	Magnets (for Shapes part)	Kuan Yan Art & Stationery (from Shopee Pte. Lte.)	RM1.29	30	RM38.70
	ADHESIVES							
6	Titebond II Premium Wood Glue*	473ml / 16oz			DiyKayu (from Shopee Pte. Lte.)	RM29.99	1	RM29.99
	*FINISHING SUPPLIES**							
7	Wood Filler (Teak)	500g			Mr. DIY (M) Berhad	RM7.50	1	RM7.50
8	Wood Varnish	250g			SGB HARDWARE (from Shopee Pte. Ltd)	RM8.90	1	RM8.90
9	Spray Paint (black)	400g			Mr. DIY (M) Berhad	RM6.50	1	RM6.50
10	Spray Paint (green)	400g			Mr. DIY (M) Berhad	RM6.50	1	RM6.50
11	Spray Paint (blue)	400g			Mr. DIY (M) Berhad	RM6.50	1	RM6.50
12	Spray Paint (yellow)	400g			Mr. DIY (M) Berhad	RM6.50	1	RM6.50
13	Spray Paint (red)	400g			Mr. DIY (M) Berhad	RM6.50	1	RM6.50
14	Sandpaper (P150)	210mm x 297mm x 1mm			Trand88 DIY (from Shopee Pte. Lte.)	RM0.40	3	RM1.20
15	Sandpaper (P180)	210mm x 297mm x 1mm			Trand88 DIY (from Shopee Pte. Lte.)	RM0.40	3	RM1.20
16	Sandpaper (P220)	210mm x 297mm x 1mm			Trand88 DIY (from Shopee Pte. Lte.)	RM0.40	3	RM1.20
17	Sandpaper (P3000)	210mm x 297mm x 1mm			Trand88 DIY (from Shopee Pte. Lte.)	RM0.40	1	RM0.40
	*TOOLS**							
18	Knife				Eco-Shop Marketing Sdn. Bhd.	RM2.40	1	RM2.40
19	Scissors				Eco-Shop Marketing Sdn. Bhd.	RM2.40	1	RM2.40
20	Paint Brush				Mr. DIY (M) Berhad	RM1.80	1	RM1.80
21	Masking Tape				Mr. DIY (M) Berhad	RM1.90	3	RM5.70
	*SAFETY EQUIPMENTS**							
22	Masks				Mr. DIY (M) Berhad	RM3.50	1	RM3.50
23	Gloves				Mr. DIY (M) Berhad	RM9.50	1	RM9.50
	*use in Prototype and Model				TOTAL			RM182.19

CUTTING LIST for DigitQuest (Product)

PART NUMBER	PART NAME	QUANTITY	DESCRIPTION	DIMENSION
	Shapes	30	Use Laser + double laser to get 6mm	25mm x 25mm x 6mm
	Side Bases	2	Use Laser + double laser to get 6mm	80mm x 105mm x 6mm
F	Operation Symbols	6	Use Laser + double laser to get 6mm	50mm x 50mm x 6mm
	Base	2	Use Laser + double laser to get 6mm	520mm x 150mm x 6mm
	Numbers	20	Use Laser	70mm x 90mm x 3mm
A	Legs support	3	Use Laser + double laser to get 6mm	80mm x 105mm x 6mm

COST for DigitQuest (Product)

BOM LEVEL	MATERIAL / PART NUMBER	PART NAME	UNIT COST	QUANTITY	TOTAL COST
	RAW MATERIALS				
1	Shapes		RM0.02	60	RM1.20
2	Side bases		RM0.23	4	RM0.92
3	Operation symbols	F	RM0.07	12	RM0.84
4	Base		RM0.50	4	RM2.00
5	Numbers		RM0.04	20	RM0.80
6	Leg support	A	0.05	6	RM0.30
6	Steel Plate	E	RM7.50	1	RM7.50
	HARDWARES				
7	Binder rings	G	RM0.50	4	RM2.00
8	Magnets	D	RM1.29	30	RM38.70
	ADHESIVES				
9	Titebond II Premium Wood Glue*		RM0.06	75	RM4.50
	*FINISHING SUPPLIES**				
10	Wood Filler (Teak)		RM0.02	30	RM0.45
11	Wood Varnish		RM0.04	30	RM1.20
12	Spray Paint (black)		RM6.50	2	RM13.00
13	Spray Paint (green)		RM6.50	1	RM6.50
14	Spray Paint (blue)		RM6.50	1	RM6.50
15	Spray Paint (yellow)		RM6.50	1	RM6.50
16	Spray Paint (red)		RM6.50	1	RM6.50
17	Sandpaper (P150)		RM0.40	1	RM0.40
18	Sandpaper (P180)		RM0.40	1	RM0.40
19	Sandpaper (P220)		RM0.40	1	RM0.40
20	Sandpaper (P3000)		RM0.40	1	RM0.40
	*TOOLS**				
21	Knife		RM2.40	1	RM2.40
22	Scissors		RM2.40	1	RM2.40
23	Paint Brush		RM1.80	1	RM1.80
24	Masking Tape		RM1.90	2	RM3.80
	*SAFETY EQUIPMENTS**				
25	Masks		RM0.35	5	RM1.75
26	Gloves		RM0.19	20	RM3.80
	TOTAL				**RM116.96**
	MARK-UP			100%	RM233.92

FORMULA

$$\frac{saiz\ guna\ kayu}{saiz\ sebenar\ kayu} = \frac{x}{harga\ sebenar\ kayu}$$

NOTE			EQUAL TO	RM (SEUNIT)
F	297mm x 420mm x 3mm		124,740	RM3.40
A	4ft x 8ft x 3mm	1219.2mm x 2438.4mm x 3mm	2,972,897.28	RM19.00
E	148mm x 210mm x 1mm		31,080	RM7.50
G	62mm diameter			RM2.00
D	10mm x 10mm x 6mm		100	RM1.29