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IMPROVEMENT OF WORKSTATION TOWARDS INCREMENT OF PRODUCTION RATE

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ABSTRACT

Making the most of space with suitable equipment placement while incorporating the human component into the workplace design, and properly aligning the workplace with the surrounding environment is crucial to an effective workstation design. The following study is done in a frozen food company's production line preparing boneless chicken thigh. Study showed all the workstation involved could not reach the daily production target. The objective of this study is to identify the issues causing the low production rate and implement solutions to rectify the problem. The Genchi Genbutsu technique is used to identify the issues causing the low production rate. To solve this problem, improvements have been made to the existing workstation in terms of worktable design. As a result, the daily production target of 840 kg has been achieved after the improvement of the chicken cutting workstation. The company was also to save overtime cost by 87% per month.

1. Introduction

In order to survive in today's competitive world, companies especially in the manufacturing sector are constantly pushed to find ways to reduce production costs and ensure efficiency in their day to day processes and operation in order to increase productivity and quality product. Companies can also face financial losses due to low productivity ((Rosa et.al., 2018; Kulkarni et al., 2018). These financial losses can occur due to overtime paid to workers, the penalties due to late delivery and customer loss. The loss of customers can have a major impact on business continuity. To avoid this scenario customer's satisfaction is crucial and can only be achieved by delivering quality product at reasonable cost and on the right time. Survival of any business whether manufacturing or service depends on its flexibility to continuously and systematically respond to the customers need and accordingly adds value to the product (Palange & Dhatrak, 2021).

Companies employ various method and technique to improve their daily production or add value to their existing product. Genchi Genbutsu is one of this technique. According to Senior & Hyatt (2015) Genchi Genbutsu is an effective technique to identify problems or issues on a production floor. It is a key principle of the Toyota Production System which refers to as "go and see." The principle proposes that in order to truly comprehend a scenario one needs to observe what is happening at the workplace where the actual work takes place called the

Gemba . It emphasizes on collecting facts and data at the actual site of the work or problem. It maintains that understanding of the problem via this method will produce a viable solution that is really relevant to the problem.

The following research is conducted in a major frozen food manufacturing company in Malaysia focusing on their chicken cutting production line named the boneless thigh section. The research is conducted during the period of November 2021 to January 2022. The purpose of this research is to identify the problems related to low production rate in the boneless thigh section and improve its production rate to achieve its daily production target of 840kg of processed boneless chicken thigh.

2. Materials and Methods

A mixture of qualitative and quantitative methods is used in this research. According to Kabir (2016) this mixed method of gathering and evaluating data will assist to increase the validity and reliability of research. In a mixed method design, each set of methods plays a critical role in achieving overall aim of research and is enhanced in value and outcome by its capability to complement each other failing and benefit (Palinkas et al., 2019).

For the quantitative method; An interview with persons in charge and production personnel in places within the chicken cutting production line is done together with on-site observation using the Genchi Genbutsu technique. Genchi Genbutsu is an investigation technique of going to and directly observing a location and its conditions to understand the root cause of the problem (Kumar et al., 2021; Chiarini et al., 2018). Research is conducted in the company's boneless thigh section that involves three processes. In process one the employees receive whole chicken thighs in quantity of 12kg per crate from the previous process. In the next process the employee picks the crate one by one manually and unload the chicken pieces onto their worktable until the table is full. Finally, the employee cut the chicken pieces into required size and send them to the packing line. During observation and interview with employees five main issue were highlighted:

1. The employees feel tired of picking and unloading the crates repeatedly thus slowing down production;
2. The worktable is open on all sides and has slippery surface that causes the chicken to fell off the table if more than 4 crates of chicken are uploaded onto the table as seen in Figure 1;
3. The employees need to spend extra time to clean or dispose the chicken if it falls to the ground at the workstation;
4. When chicken pieces are disposed due to hygienic reason the employees are short of pieces to work with and need to retrieve the new chicken pieces to complete the batch;
5. A limited number of workers in the section; if any of the employee take emergency leave there will not be a replacement worker.

Figure 1. The workstation before the implementation of solution

For the qualitative method, data collection in terms of daily production output from the production line is collected to evaluate the performance before and after the solution is implemented. The monthly overtime rate was also collected before and after the solution is implemented. Figure 2 shows the production data collected during observation. The data is collected during the period of 8 days starting from 1st December 2021 to 8th December 2021. The data shows that the daily production rate of 840 pieces per day is not achieved 6 out of 8 days. To further understand the trend of the production rate in the boneless thigh section the overtime data is collected. The overtime data is collected from the company's human resource department for the month of November 2021. Data shows in the month of November 576 hours of overtime has been given to employees resulting in an additional cost of RM 4,608.00 in the section.

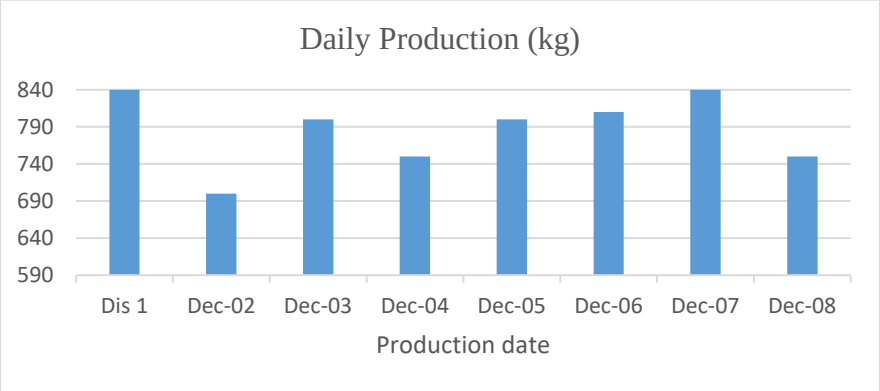

Figure 2. Graph shows the daily production rate of boneless thigh before the implementation of solution

Based on observation and data collected it became clear that the boneless thigh section is experiencing under production and is causing an additional cost for the company. The workstation design has been identified as the main cause of problem. Researcher suggested two possible solutions to the company management as shown in Table 1. The following aspects were taken into consideration; product unloading capacity, installation cost, material and cleanliness. Cleanliness and hygiene in food production is very important not just because it's a business risk, but also it is a legal obligations and there is a very real possibility of causing harm to customers.

After discussion; the company management decided to proceed with solution 2 taking into consideration the cost, maintenance and workspace factor. Solution 2 offered the company fast solution at low cost as the worktable can be fabricated in the company and there will not be any extra workspace consumption. There is also no need for the technical team to do

maintenance as it can be done by the production line worker themselves after the end of every work shift.

Table 1. The proposed solution for improving workstation at the boneless chicken thigh section

	Solution 1	Solution 2
Ideas	Add new conveyer	Worktable with extension plate
Advantages	• Smooth the chicken movement along the workstation. • Maximize product unloading at a time	• Maximize product unloading at a given time • Simple and in-house fabrication • Minimal cost
Weakness	• High starting cost • Need of electrical wiring and power supply • Need schedule / unscheduled maintenance • Need additional space usage	• A need for detail cleaning process in the workstation

After the decision is made a technical drawing utilizing Autodesk Inventor was created and presented to management for approval and fabrication. The completed worktable as seen in Figure 3 was installed on 15th of December 2021 and the feeding angle is fine-tuned to guarantee the greatest possible outcome for this project. The new table is fully stainless steel and comes with extension plates all around to ensure the chicken pieces are all contained within the worktable to avoid felling pieces.

Figure 3. The new worktable for the boneless chicken thigh section

The workers were briefed on usage and maintenance of the new worktable. Data collection on the daily production rate and overtime cost was collected for the month of December 2021 and January 2022 to study the effective of the new worktable in improving the section's production rate.

3. Results

After the implementation of the new workstation the daily production has reached its daily target of 840 kg except of one day as seen in Figure 4. Upon investigation it was noted that the low production rate on 19th December 2021 is due to the staff shortage which was rectified the following day.

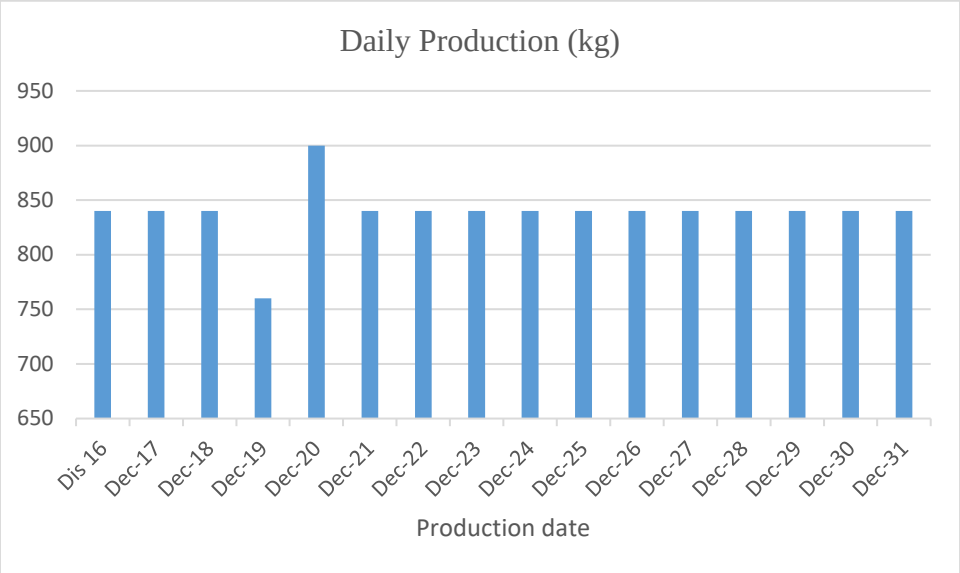

Figure 4. Graph shows the daily production rate of boneless thigh before the implementation of solution for the month of December 2021

The production plan for the month of January 2022 is the same as the previous month, which is 840kg, with a little variation in the output plan from January 10 to January 16, which is increased to 960kg. As can be seen in Figure 5 the daily output is achieved even when the output plan is increased.

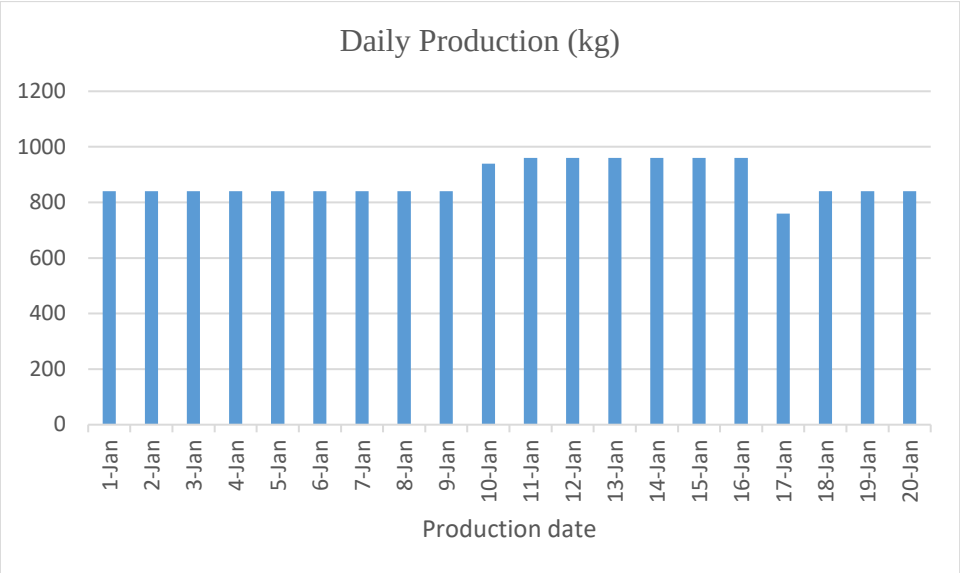

Figure 5. Graph shows the daily production rate of boneless thigh before the implementation of solution for the month of January 2022

With the daily target achieved most of the days, only a total of 4 hours of overtime was needed in the month of January 2022 which amounts to RM 576.00. This overtime cost only existed due to the staff shortage on one day and a slight increase in demand on certain days.

Observation on worksite showed the new worktable has also reduced the number of times the worker need to unload the chicken onto the worktable as the new worktable can safely hold 8 crates of chicken at one go compared to 4 crates previously. This reduces the overall unloading time by 50%. Chicken disposed due to felling on the floor has also been eliminated.

Based on results in Figure 4 and Figure 5 the researcher concludes that the improvement in this workstation has successfully helped the section to achieve its daily production target of 840 kg and save cost for the company in terms of workers' overtime by 87%. The new workstation ensures a cleaner and safer working space for employees.

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THE DEVELOPMENT OF AN AUTOMATED MODULE PERFORMANCE TRACKER OUTPUT DASHBOARD

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ABSTRACT

Planning the production process is crucial for any industry. A production plan outlines how production will be carried out. An industry's management and manufacturing team must prepare and search for solutions for any production line downtime that may occur. The production team is capable of making contributions that go beyond simply spending hours moving data around. It might take a lot of time and effort to pull out a manual report, and disengaged workers can result in low production and high employee turnover. Developing an effective module performance tracker output data for an automated dashboard can save a lot of time and energy. This paper discusses and analyses the effectiveness of automating manual spreadsheet reports through a time study conducted at XYZ company. An automated dashboard not only saves 59.11% of time but also gives the management team visibility of all the important information.

1. Introduction

In an industry, production planning is crucial. The result of the production planning process is a production plan which outlines how production will be carried out. It outlines the equipment, raw materials, and labour resources that will be required as well as the production schedule that will be adhered to.

An industry's management and manufacturing team must prepare and hunt for solutions for any production line downtime that may occur. The potential contribution of employees goes beyond merely their time spent moving data around. It might take a lot of time and effort to pull out a manual report, and disengaged workers can result in low production and a high turnover rate.

Automating data collection allows producers to save time and acquire real-time insights into each stage of the production process. Undoubtedly, the main advantage of data monitoring is automated data collection.

Before the shift is over, the management group will be able to assess their performance in relation to the plan. This will increase team engagement and has the potential to fundamentally alter how the team runs the manufacturing operation (Dellner, W. J., 1981).

1.1 Problem Statement

Supervisors, managers, and directors have traditionally relied on paper reports and spreadsheets for information, which they then complemented with what the Manufacturing Execution System (MES) and Enterprise Resource Planning (ERP) systems can supply (Clough, 2012).

The prior shift or day provides management with metrics-related production data. The status of the machine and its performance against targets are examples of the type of data. The data is between 12 to 24 hours old at this time. Managers then compile this data into status reports for the board of directors. The focus is usually on performance against plans and direct expenses. The data could be days old by the time it reaches the director's desk (Bhojaraju, 2003).

This puts the manufacturing team at risk as they lack visibility on the production target vs actual output and are unable to keep track of timely WIP at the bottleneck processes. Furthermore, the future planning target is not revised timely for the planning team as the team publishes manual reports using excel files (Ming Jian, 2018).

By automating the manual spreadsheet data not only saves time but also gives the management team visibility on production's work in progress (Bibhudutta Jena, 2019).

1.2 Objectives

The objectives that are made to achieve the aim of this project are:

i. To develop an effective shifty module performance tracker output data for an automated dashboard
ii. To compare the effectiveness of the automated dashboard of an automated vs. manual report.

1.3 Scope

i. To understand Module Manufacturing flow
ii. To analyze capacity information of weekly demand, daily output, and utilization of equipment.

1.4 Project Outcome

i. To provide the management team with shift-by-shift visibility into the following Key Performance Index in order to respond quickly and recover any losses;
ii. Planned vs. actual production output.
iii. Monitoring the work in progress (WIP) at the bottleneck processes.
iv. To track the equipment utilization in the production line,
v. Time can be saved by automating the report or dashboard.

2. Methodology

Using corporate performance management or business intelligence solutions to automate report generation used to be a hassle. Despite the fact that the technologies were not tough, automation of dashboards required a lot of consultants. As a result, many companies still construct management dashboards using a manual process. The process often involves downloading data from the ERP system, altering the data, adding the data to Microsoft Excel, and copying and pasting the data into PowerPoint. The process is inefficient, prone to errors, and offers few drill-down possibilities (Bhojaraju, 2003).

Automating dashboards has never been simpler than it is now thanks to business intelligence (BI) technology. The effectiveness of tools like Tableau has been demonstrated, and they are simple to integrate with any enterprise planning system (ERP). A dashboard can be created using these cloud-based, plug-and-play BI tools and the appropriate data (Bibhudutta Jena, 2019).

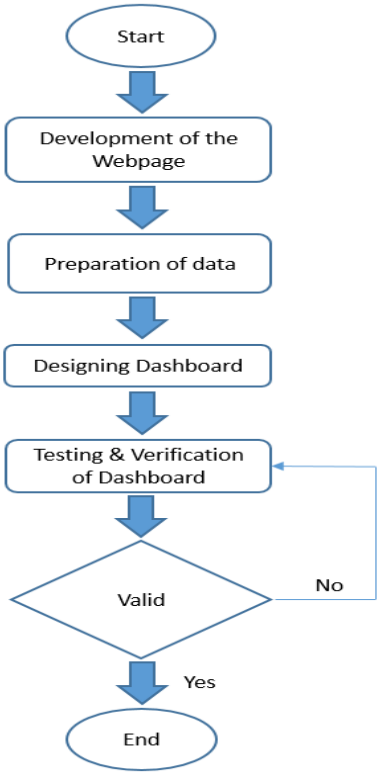

Figure 1. The process flow of developing a dashboard.

The first step, which is planning, will be done by team members who are responsible for producing the output measured, those affected by the output, and top management. Next, the web-page will be developed and designed by the system engineer. The information visualization and data requirements will be given by the planners and industrial engineers. All information gathered will have to go through the testing and verification process for future improvements. Once the information is stable, the dashboard will be completed. The steps to develop a dashboard through an online server are shown below (Bibhudutta Jena, 2019).

Step 1: Explore Projects
To get started, the user may sign into the Tableau site. Then, from the navigation pane, the user may explore to see all the content that the end user has access to across the site.

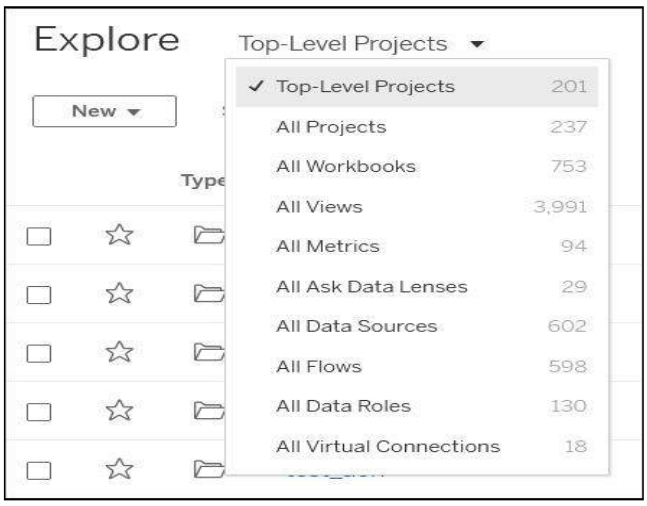

Figure 2. Explore the project webpage of Tableau

Projects are folders where workbooks, data sources, roles, and flows can be saved. Projects are a method of classifying and managing material on the site, similar to folders on a desktop.

Step 2: New workbook and Data Connection
Data needs to be connected in order to analyze it and build a workbook. Tableau allows the end user to connect data sources directly on the web.

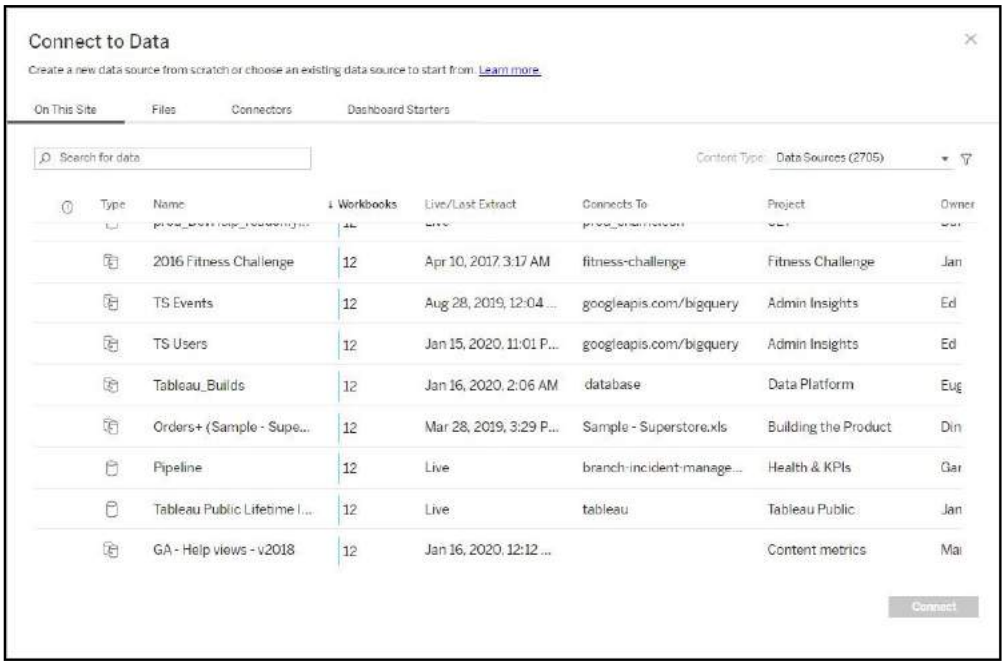

Figure 3. Connect to data web-page of tableau

Step 3: Prepare the data.
After data has been connected, the data will be used on the source page to prepare the data for analysis.

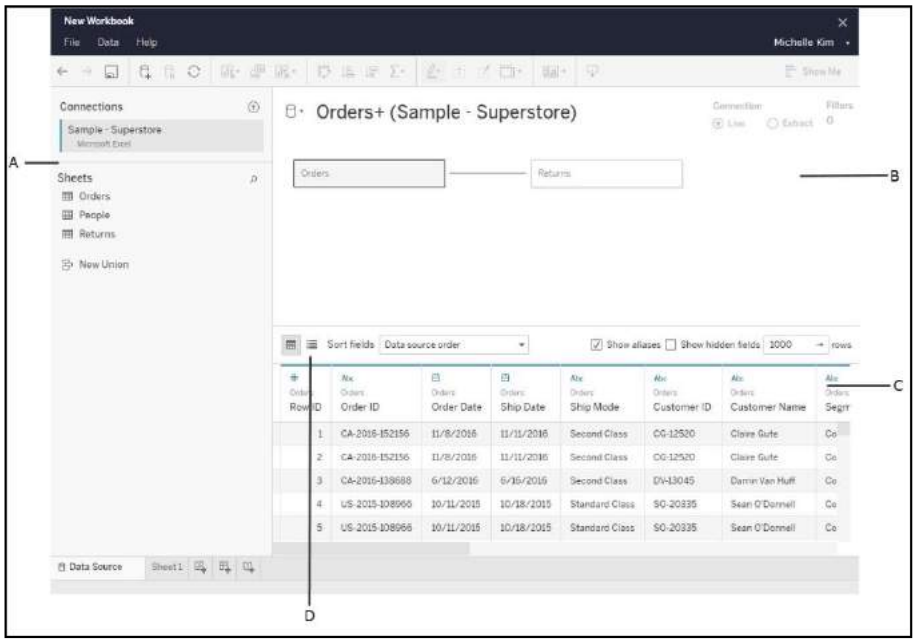

Figure 4. Parts of the data source page

Renaming the data source is one way of preparing data for analysis on the data source page, including using the Data Interpreter to clean up data and options for text files.

Step 4: Design a tableau.
The workspace layout for the dashboard is shown below.

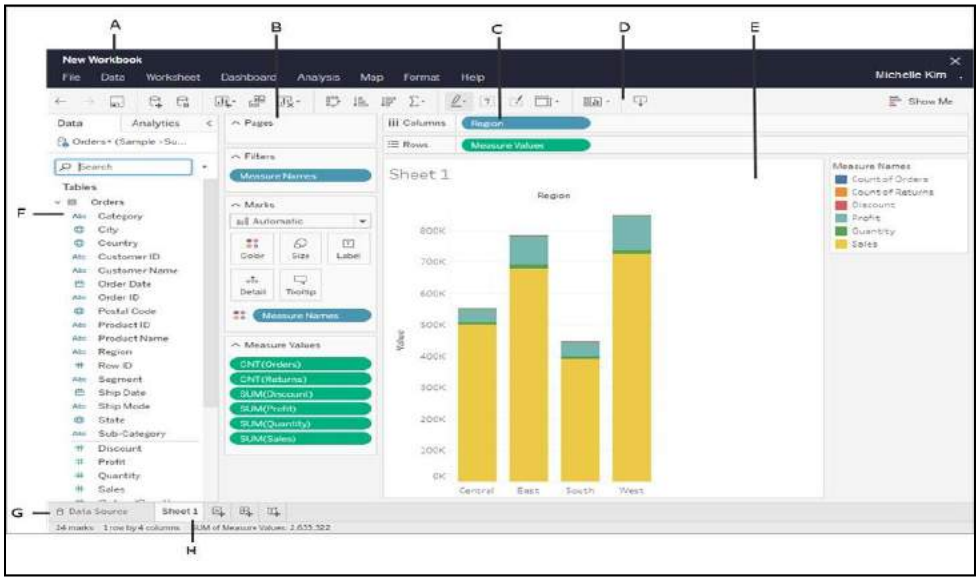

Figure 5. Layout of the dashboard workspace

Step 5: Publish Automated Dashboard.
All the parameters that are required in the module performance tracker will be fetched and automated directly from the production system into the dashboard.

WEEK 25															
		2/6/2022	3/6/2022		4/6/2022		5/6/2022		6/6/2022		7/6/2022		8/6/2022		
		Thursday	Friday		Saturday		Sunday		Monday		Tuesday		Wednesday		Thursday
Step Name		Night	Morning	Night	Morning	Night	Morning	Night	Morning	Night	Morning	Night	Morning	Night	Morning
FOL	Plan	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Actual	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Delta	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	WIP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	WIPx	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Utilization	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEST A	Plan	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Actual	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Delta	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	WIP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	WIPx	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Utilization	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TEST B	Plan	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Actual	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Delta	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	WIP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	WIPx	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Utilization	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PACK	Plan	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Actual	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Delta	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	WIP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	WIPx	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Utilization	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 6. The final product of the Automated Module performance tracker Dashboard

After developing the dashboard, a time study was carried out to investigate the effectiveness of automating reports. The data collected was done through a time study of fifteen weeks on each bottleneck process flow. The production line is divided into two shifts. The first shift will work the morning shift from 7 a.m. to 7 p.m., while the second shift will work the night shift from 7 p.m. to 7 a.m.

3. Results and analysis

The outcomes of the data collection will be presented in this section, along with a comparison of the manual and automated dashboards. A time study was done to compare the effectiveness of the automated dashboard. The data was gathered over the course of fifteen weeks for each bottleneck process flow. The planners must submit various spreadsheets on output, tool use, work in progress (WIP), and sustainability during each shift. To meet the daily production needs, each shift must meet their daily target.

There are a few formulas applied when conducting the time study for the manual dashboard:

$$\textit{Max weekly boundary} = \textit{(Current Week Total Plan x Boundary Condition Util)/ Current Week Utilization \%} \quad (1)$$

$$\textit{Module WIPx} = \textit{WIP/ (Max Weekly Boundary)/7)} \quad (2)$$

$$\textit{Delta Sum Actual - Current WeekTotal Plan} \quad (3)$$

Table 1. Analysis of Time Study Manual Spreadsheet vs. Automated Dashboard

Week	Manual Report		Automated Dashboard		Reduction
	Min	(%)	Min	(%)	(%)
1	1071.02	80.34%	262.06	19.66%	60.68%
2	1042.81	79.44%	269.83	20.56%	58.88%
3	1042.09	78.12%	291.83	21.88%	56.24%
4	1069.52	78.43%	294.12	21.57%	56.86%
5	1057.51	80.11%	262.41	19.89%	60.22%
6	1058.82	79.85%	267.13	20.15%	59.70%
7	1112.01	80.45%	270.12	19.55%	60.90%
8	1086.28	78.92%	290.13	21.08%	57.84%
9	1110.74	79.13%	292.85	20.87%	58.26%
10	1082.73	79.57%	277.9	20.43%	59.14%
11	1137.26	79.69%	289.7	20.31%	59.38%
12	1119.68	80.17%	276.93	19.83%	60.34%
13	1154.08	79.95%	289.36	20.05%	59.90%
14	1117.93	79.91%	280.95	20.09%	59.82%
15	1106.26	79.84%	279.31	20.16%	59.68%
Mean	1091.24	79.59%	279.642	20.41%	59.18%

The data in Table 1 demonstrates the difference in average time consumption for publishing the production output between the manual and automated dashboards. It can be seen from the table that the manual procedure of posting the production output reports takes longer than the automated dashboard. In a week, the total time spent manually pulling reports and publishing them is around 1091.24 minutes, and this is just an average. If production receives more customer orders, there will be more reports and information to pull manually, delaying the publishing process.

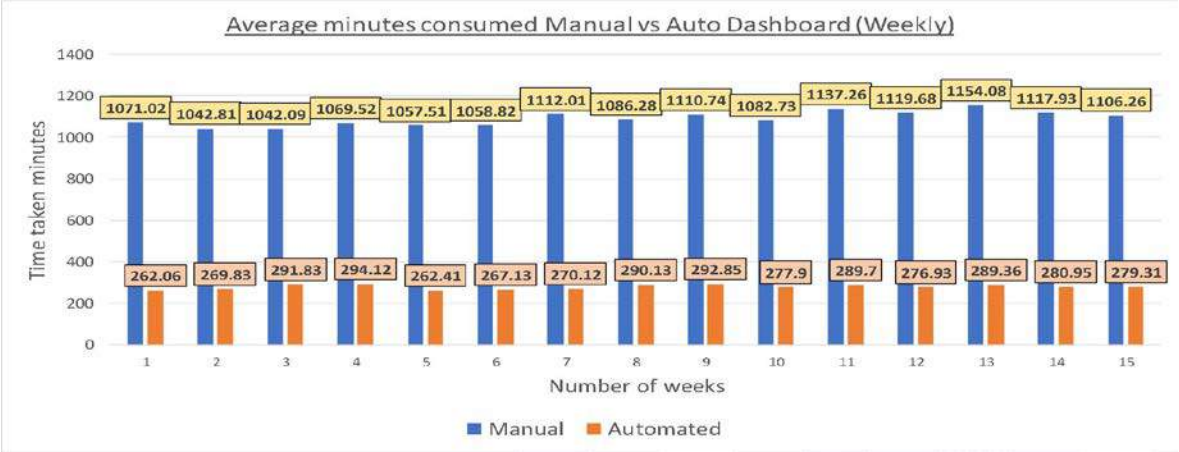

Figure 7. Average time consumption for Manual vs. Auto Dashboard (weekly)

Figure 7 above is a bar graph that depicts the weekly average time spent publishing the daily production output, both manually and automatically. The graph depicts a considerable change between the two dashboards over the course of fifteen weeks. It can be seen that human reports take an average of 1091.24 minutes per week, whereas the automated dashboard requires only 279.64 minutes per week. By automating the reports, users can save more than half the overall time. From this data analysis, it is clear that an automated dashboard takes less time than a human report.

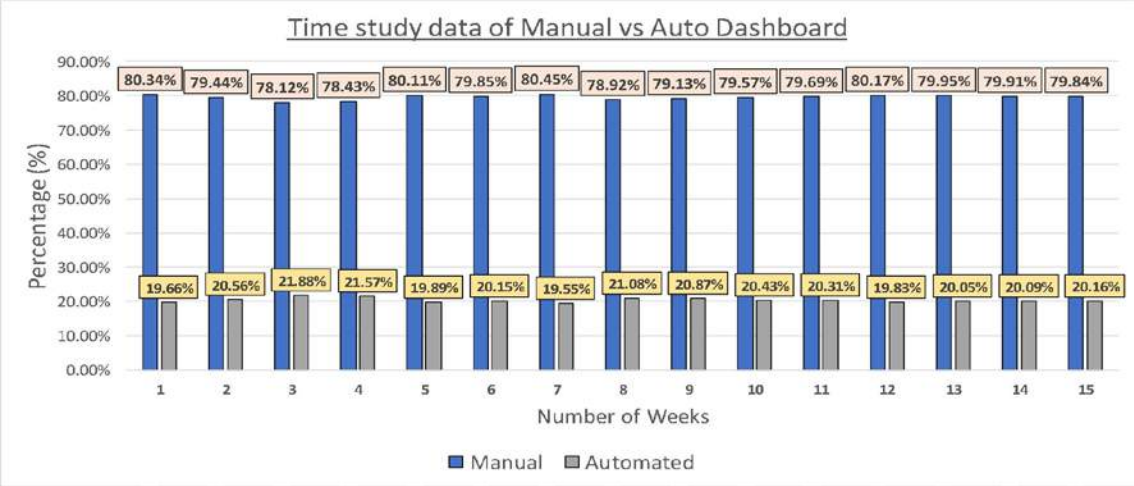

Figure 8. Average minutes of Manual vs. Auto Dashboard (weekly)

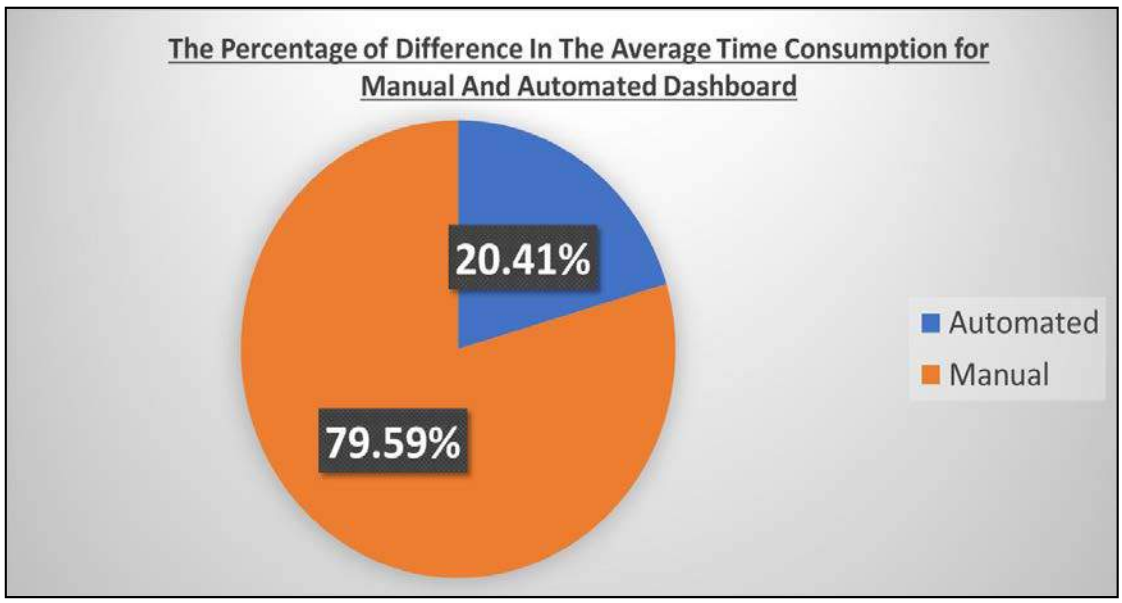

Figure 9. The Difference in time consumption for Manual and Automated Dashboard

Figure 9 above is a pie chart depicting the average weekly time spent on both the human and

automated processes of reporting daily manufacturing output. As can be seen in the chart, there are considerable variances between the two dashboards over the course of fifteen weeks. It can be noted that manual reports take an average of 79.59 percent of the time in a given project. This data analysis clearly demonstrates the first and primary goals of this study, which are to present an effective automated module performance tracker daily and to save time consumption by designing an automated daily performance for the management team's usage.

4. Conclusion

This paper discusses and analyses the effectiveness of automating manual spreadsheets through a time study. This project comprises a continuous procedure from planning how to carry out the project to presenting it to industrial supervisors and academics. The purpose of this research was to identify the effectiveness of a daily automated production output dashboard. Based on the analysis conveyed, both objectives have been achieved as it can be concluded that developing an automated daily output dashboard has saved an average time of 811.6 minutes and 59.11% in percentage in a week. In an industry, the management and the manufacturing team must plan for and find solutions for any production line downtime. Shift planners can contribute more than just hours transmitting data from one location to another. Manual report fetching can take a lot of time and effort, and disengaged personnel can result in low productivity and high attrition. By using an automated dashboard, all the data that is currently being pulled manually can be auto generated, providing the same results in a much shorter amount of time. The industry will become more effective and productive if this time-consuming and repetitive process is reduced.

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EFFICIENCY OF CONVENTIONAL AIR PURIFIER AND COCONUT SHELL ACTIVATED CARBON ON IMPROVING INDOOR AIR QUALITY

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ABSTRACT

There several types and technologies of air purifier such as by electrification, biomaterial, ceramic and synthetic material. That technology were very challenging to investigate their effectiveness on improving air quality. Therefore, this research will be investigating the conventional air purifier and coconut shell activated carbon in improving IAQ. The method will be conducted by indirect carbonization process and followed by crushing process to produce the particle size of 18 mesh. The crushed coconut shell charcoal activated by chemical activation using NaOH with ratio of 1:1 for 4 hours. The research will be conducted in office room by comparing the conventional air purifier of particle counter DAZ-400 and Coconut Shell Activated Carbon (CSAC). There are 3 various samples in this research such as by air purifier (type 1), by CSAC (type 2) and by combination of air purifier and CSAC (type 3). The result shows that combination methods has lowest $PM_{2.5}$, PM_{10} and Air Quality Index of 7, 16.56 $\mu g/m^3$ and 1 AQI respectively. The combination technique (type 3) also shows the highest efficiency of 84.46% as compare to air purifier (type 1) and CSAC (type 2) samples. Therefore, the combination filtration process by using air purifier and CSAC was very recommended to applied in office room to improve the IAQ.

1. Introduction

The World Health Organization (WHO) states the biggest environmental problem is air pollution which has a significant impact on human health. In 2020, air pollution has caused 98000 fatalities in the world (DW, 2020). Apart from outdoor air pollution, indoor air pollution also poses serious health risks due to the human spends 90% of his time in the room (USEPA, 2016).

Indoor air pollution is 2 to 5 times more dangerous than outdoor air pollution (USEPA, 2016) because the environment is contaminated by chemical, physical, and biological substances that can change the natural characteristics of the atmosphere (Leman et al., 2017). In general, indoor

air quality can be improved in many ways such as by cleaning, planting, changing air conditioning filters regularly and installing an air purifier (Harvard Women's Health Watch, 2018).

Air purifier is a device that used to improve the air quality from small particles and viruses or bacteria in the room (Cooper *et al.,* 2021). There are 3 types of filters including a pre-filter which used to filter the large particles such as animal hair, hair, and large dust (Budi et al., 2012). The second filter is a deodorising filter which used to remove odors (Lowther et al., 2020). The third filter is dust collection filter (electrostatic HEPA filter) that serves to filter dust, germs, bacteria, viruses, and other small particles. Air purifiers are different from air conditioners (AC), although current AC has an air purification feature in its system (Allen et al., 2011; Barn et al., 2008; Bräuner et al., 2008; Cooper et al., 2021; Karottki et al., 2013).

In order to reduce the pollutants, several researchers conducted studies for controlling VOCs such as adsorption, condensation, photocatalytic oxidation (PCO), negative air ions (NAIs) and non-thermal plasma (NTP) (Das *et al.,* 2004). Among those, adsorption in bulk separation or purification process has an innovative treatment process in environment application. Adsorption method is effective at low concentration level which is part per million (ppm). Large adsorption capacity is achieved by employing large surface area of the filter material and their performance in both equilibrium and kinetics. The conventional air purifier has a limitation in application and absorption capacity due to its media have small porosity that led to efficiency and performance of that filter. However, the potential filtration media come from biofilter media that made from waste material that have high porosity such as coconut shell, palm shell, rubber seed shell etc (Leman et al., 2017).

Air purification through activated carbon adsorption technique is the most common air cleaning method, especially for VOC and other polluted gases (Khan and Ghoshal, 2000). This type of adsorption method can improve indoor air quality and reduce cancer risk and non-cancer risk health problems. Activated carbon is one of the cheapest and popular materials as water purification, cleaned/ desorption which can be used hundred or thousand times (Adedayo *et al.,* 2012).

The other superiority of activated carbon criteria include large surface area, numerous pores network (see Figure 1.) as transportation media of molecules to the interior and more stable performance in dynamic condition (Abechi *et al.,* 2013).

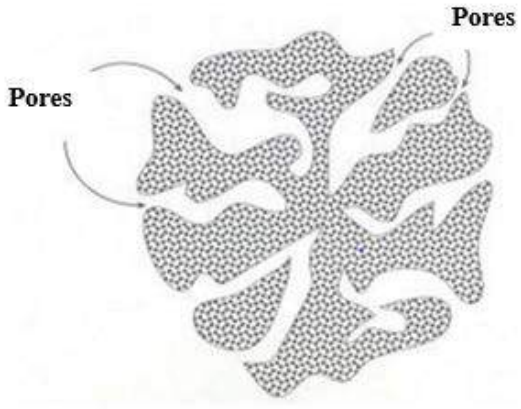

Figure 1. Numerous pores of the activated carbon (Abechi *et al.,* 2013)

The application of coconut shell AC in air filtering system is still limited; thus, it has the potential to be used as adsorbent in filtration process worth to be investigated (Leman *et al.,* 2021 and Supaat Zakaria *et al.,* 2019). Therefore, this research attempted at investigating the methods of producing palm shell AC and their application in air filtration towards IAQ improvement in particular for office buildings and industrial workplaces.

2. Materials and Methods

This study was conducted by various variation of air filtration process such as type 1 is filtration process by using conventional air purifier with the brand of Daikin MC30VVM-H, type 2 use the conventional air purifier with activated carbon filter inside and type 3 is filtration process by using coconut shell activated carbon.

The activated carbon was produced by carbonization process and followed by crushing process to achieve granular size of 18 mesh. The activation process was conducted by chemical activation using NaOH reagent with ratio charcoal and agent is 1:1 and soaked for 4 hours. Heat treatment was conducted after activation process using temperature of 110 ^{0}C for 1 hour. The activated carbon shaped with the dimension of LxWxH (23x30x0.5 cm) as shown in Figure 2.

Figure 2. Coconut shell activated carbon

This research was conducted in office room with dimension of WxLxH is 2.3 x 6 x 3 m. 3 types of air purifiers was examine in office building, type 1 which is Daikin MC30VVM-H was put in the office room for 60 minutes and data recorded for each 10 minutes. Type 2 is air purifier using CSAC by placing the CSAC into the air condition filter and the monitoring was conducted for 60 minutes and data recorded for each 10 minutes. Type 3 is combination between type 1 and type 3 also the monitoring was conducted for 60 minutes and data recorded for each 10 minutes. There are several pollutants that collected in this study such as $PM_{2.5}$, PM10, CO, CO_2, HCHO, and TVOC for every 10 minutes. That pollutant was produced by pollutant initiator to measure the effectiveness of air filter to reduce the pollutants. Air quality and pollutant was collected by using air quality detector with model of JSM-131.

3. Results

3.1 $PM_{2.5}$

$PM_{2.5}$ in various filtration media is shown in Figure 3. This data observed that the highest performance achieved by type 3 that used coconut shell activated carbon and the lowest performance showed by type 1 which use the conventional air purifier. Type 3 have performance of 98.2%, type 2 of 97.7% and type 1 have 95.5% performance on removing PM2.5. it may caused by coconut shell activated carbon has highest porosity as compared to other air purifier which led to highest absorption capacity. According to the PSI parameter index that types 2 and 3 produce air quality in good category with a range of 0- 12μg/m^3 which mean that filter was recommended to applied for improving indoor air quality. High $PM_{2.5}$ pollutant was directly associated with respiratory tract diseases, raised morbidity and mortality of cardiopulmonary diseases and undermined lung function. In addition, that the $PM_{2.5}$ surface was rich in iron, zinc, copper, manganese and other transition elements, as well as lipopolysaccharide and polycyclic aromatic hydrocarbons, etc. These components can increase consume antioxidant ingredients, free radical production in the lung and cause oxidative stress (Martinelli *et al.*, 2012)

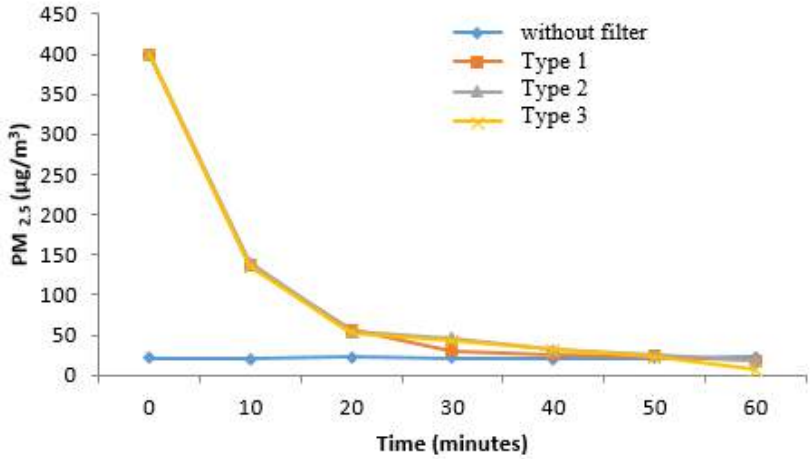

Figure 3. $PM_{2.5}$ in various filtration methods

3.2 PM_{10}

Figure 4 shows the PM10 value in various filtration media with time-based investigation. PM10 may cause by distributed by furniture stuff in the room which consist of sofa, table, cupboard and hangings which contribute to serious health risk problem (Dafit Feriyanto *et al.*, 2020). The data shows that type 3 was very effective to remove PM10 for 96.9% as compared to type 2 and type 1 of 96.2% 92.1%, respectively. After filtration process, the air quality meet the Regulation of the Minister of Health of the Republic of Indonesia Number 1077 of 2011 that the maximum level of PM10 is 70 g/m^3. Without filter means that while the investigation was not conducted pollutant initiator, therefore the pollutant is low for the 60 minutes. However, the pollutant in without filter was higher than type 2 and 3 after 60 minutes which means that the type 2 and 3 is very effective to reduce the pollutant with the initial PM_{10} of 550 ppm. It means that when the initial pollutant is lower, type 2 and 3 will reduce a significant PM_{10} and it will achieve the lowest PM_{10} after 60 minutes

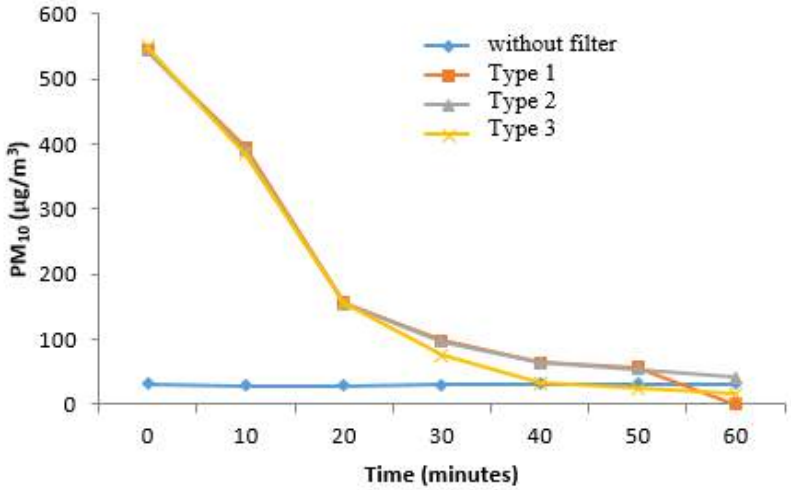

Figure 4. PM_{10} in various filtration methods

3.3 CO

CO value of various filtration media and initial condition is shown in Figure 5 that all the variation achieve the CO value below than acceptable limit of 9 ppm and after the filtration process has a lower CO pollutant as compared to without filtration process. The lowest performance showed by type 1 for 80% with the lowest CO is 4.78ppm. type 2 was higher that type 1 for 86.9% with the lowest CO is 3.33ppm and the highest performance showed by type 3 for 91% with the smallest CO is 2.33ppm in 60 minutes. It means that all filter media within 60 minutes very effective to reduce the CO pollutant and meet the acceptable limit of 9ppm based on Regulation of the Minister of Health of the Republic of Indonesia Number 1077 of 2011. Without filter is the initial condition in office room and it compared to various filter technology with pollutant initiator. The first CO pollutant value approximately of 25-27 ppm and it can be seen that after 50 minutes filtration process, the CO concentration was lower than maximum CO and after 60 minutes produce the lowest CO of 2.33 ppm. Meanwhile, CO concentration of without filter is gradually increase with time increase which means that the CO concentration is increased with the constant occupant. It not applicable when filter media performed, the CO decreased with time increased which can explained that the air purifier is very important to stabilize CO concentration below than maximum concentration.

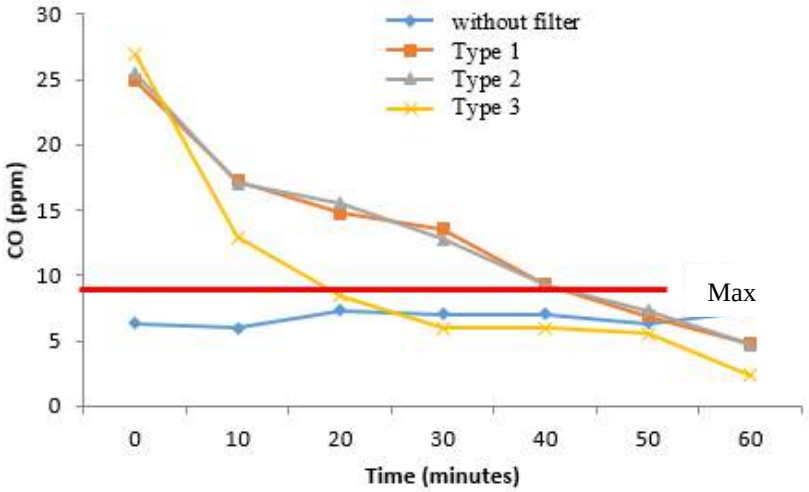

Figure 5. CO in various filtration methods

3.4 CO_2

CO_2 value of various filtration media and initial condition is shown in Figure 6. CO_2 levels indicate that they were maintained below the ceiling limit value of 1000 ppm throughout the time of measurement. Generally, number of occupants and room size affect the ability to dilute CO_2 level. The type 1 can purify the CO2 to 600ppm (40%) and type 2 produce the lowest CO_2 ppm up to 597.78ppm (41%) and the highest filtration showed by type 3 with the lowest CO_2 pollutant is 372.78ppm (59%). The source of CO_2 concentration was identified to be mainly from human respiration system. When narrowed down, two sources in the low and high CO_2 concentration from human respiratory were ascertained to the number of humans in the room and high intensity of human activity.

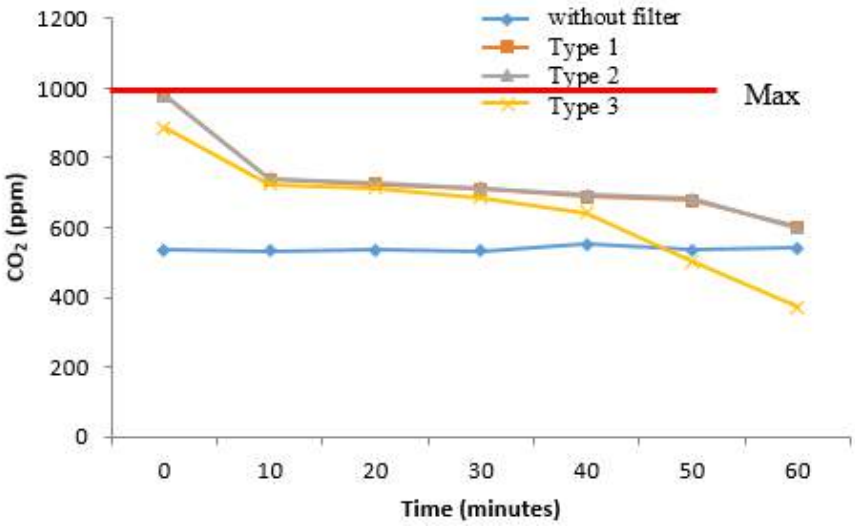

Figure 6. CO_2 in various filtration methods

3.5 TVOC

TVOC value of various filtration media and initial condition is shown in Figure 7. It can be seen that the type 1 was successfully reduce the TVOC to 0.3 ppm (88.9%), type 2 successfully reduce the TVOC from 2.71 to 0.096 ppm (96.5%) and type 3 from 2.88 to 0.07 ppm (97.6%). According to the Regulation of the Minister of Health of the Republic of Indonesia Number 1077 of 2011 that the limit of TVOC is 3 ppm. It means that the coconut shell activated carbon filter was very effective to remove the TVOC pollutant as compared to other filtration media. The suspended particles in indoor air become serious when it exceeds the acceptable limit (Silvia *et al.*, 2013). Air circulation through air-conditioning system did not seem to have significant effects in reducing indoor air contaminants especially TVOC. Therefore, it may be practical to install an effective TVOC and respirable particulate matter controlled system to diminish the harmful pollutants (i.e. activated carbon filter).

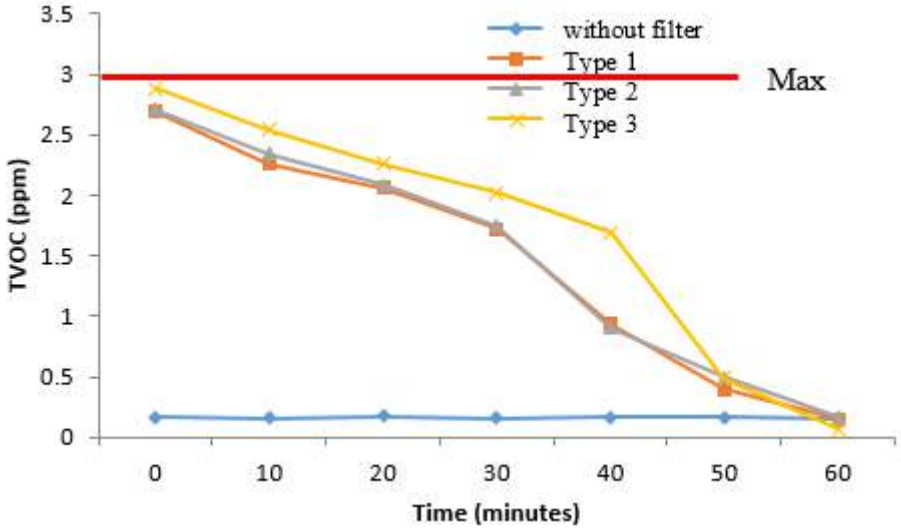

Figure 7. TVOC in various filtration methods

3.6 HCHO

HCHO value of various filtration media and initial condition is shown in Figure 8. It can be seen that the type 1 was successfully reduce the HCHO to 0.04 ppm (77.8%), type 2 successfully reduce the HCHO from 0.18 to 0.02 ppm (88.9%) and type 3 from 0.177 to 0.01 ppm (94.4%). According to the Regulation of the Minister of Health of the Republic of Indonesia Number 1077 of 2011 that the limit of HCHO is 0.1 ppm. It means that the coconut shell activated carbon filter was very effective to remove HCHO pollutant as compared to other filtration media. HCHO could cause eyes to water, causes burning feeling to the eyes and throat and can cause difficulty in breathing in humans who are exposed to its higher concentrations. The HCHO pollutant mainly source from furniture, press wood products, insulating material, textile product, painting product, wallpaper, carpet cleaner, etc. All the filtration technologies were produce the pollutant below the limit which means that the conventional air filtration or CSAC filter were effective to reduce the HCHO which may effect to occupant or employee performance to conduct their task.

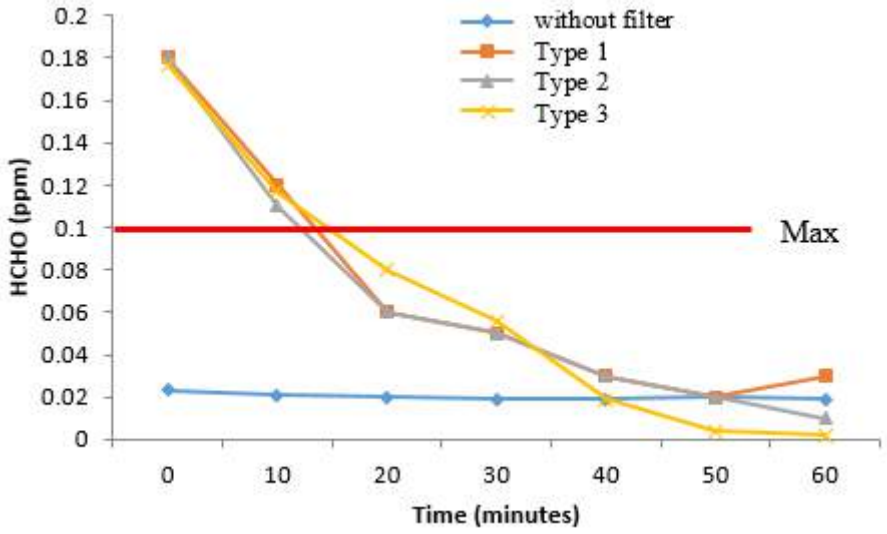

Figure 8. HCHO in various filtration methods

4. Conclusion

The comparison of the conventional air filtration, conventional combined with activated carbon and full activated carbon have been successfully achieved. The result shows that the type 3 that use the full activated carbon has highest effectiveness of pollutant reduction as compared to other filtration media which may caused by high absorption capacity and high porosity of activated carbon. Type 3 have highest performance for $PM_{2.5}$, PM_{10}, CO, CO_2, TVOC and HCHO for 98.2%, 96.9%, 372.78ppm, 97.5% and 94.4%, respectively. Higher performance of air purifier will led the human health improvement by better air quality and it cause the higher performance of employee on doing their task. The CSAC may applied for air and water purification technology in form of mask, odor absorption and as granular form as air filter.

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DESIGN AND DEVELOPMENT OF SMART ASSET HANDPHONE SCANNER APPLICATION

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ABSTRACT

Web-based Asset Management System is a centralized asset recording system practiced by many institutions. However, this system does not have smart features in line with the development of smartphone technology, such as bar code scanning, direct contact to asset owners, and fast asset tracking. Furthermore, this system is also not suitable for the use of small-sized smartphone displays. Therefore, Smart Asset Handphone Scanner (SAHS) Application was proposed and developed as an innovation project for helping asset coordinator and workshop/laboratory supervisor to perform asset tracking with ease. SAHS Application has its own database, and this application is developed using Google Appsheet and Google spreadsheet. This application is secured with google security and all the users have been validated. As a result, the smart asset handphone scanner can increase the efficiency of asset inspection process, inspection reporting process, asset monitoring process, and asset tracking. On the other hand, this scanner is also able to increase the clarity and visibility of asset status report with interactive graphs and symbol displays, and minimal cost of the application development and data maintenance. Smart asset handphone scanner also is a smart phone-based application without involve the purchase of additional equipment. This application can be used in offline or online mode. The results of the study show that the developed innovation scanner application can help asset coordinators and workshop/laboratory supervisors to manage and track all assets in the workshop or laboratory in a good and orderly manner. The contribution of this study is this application could also be used by all staff to track the details of all assets and indirectly to nurture the culture of taking good care of assets become the responsibility of all staffs.

1. Introduction

Asset management is an important topic to discuss and comprehend in order a good and efficient asset management could be implemented without failure within an organization. Since the advance of technologies, many proposed methods have been implemented in this process.

Different methods exist for the tracking of assets that range from traditional approaches such as using pen and paper to digital technologies such as barcodes, QR codes, and RFID (Jose et al., 2022a). The traditional approach involves relying on pen and paper to track company assets. Lack of proper and scalable organizational ability leads to wasted time searching for records and instant information exchange is difficult using this approach. Additionally, transparency among the project participants is difficult to keep up, due to the fragmentation of information. Lately, some of the researchers, Elaskari et al.(2021), Aliuddin et al. (2022) and Jose et al. (2022) use of barcodes to track the student attendance and assets in higher education institution in real time manner. Besides, QR code has become more favorite choice of other researchers Sulistyo et al. (2022), Fajriyah et al. (2022) and Wang et al. (2021) used for asset tracking in industries and higher learning institutions. Digital tracking methods speed up the data transfer process through technology and are often used in combination with mobile devices. Using a barcode to track assets, for example, avoids many of the issues in connection to human errors that come with spreadsheets and manual tracking methods.

Multiple types of sensors and tracking technologies exist, including barcodes, QR codes, active RFID, passive RFID, Bluetooth low energy (BLE) devices, and near-field communication (NFC) devices. The requirements for tracing systems of building components is shown in Table 1 (Iluore et al., 2020, Varshney et al., 2020).

Table 1: Requirements for tracing systems of building components

Requirements	Barcode	OR-Code	RFID-Active	RFID-Passive	BLE	NFC
Reduction of human error	/	/	/	/	/	/
Line-of-sight range	Low	Low	High	Low	Moderate	Very low
Automatic Identification	x	x	/	/	/	(/)
Simultaneous Identification	(/)	(/)	/	/	/	(/)
Wireless data Transfer	/	/	/	/	/	/
Analysis of movement patterns	x	x	/	x	/	x
Real-time location tracking	x	x	/	x	/	x
Two-way communication	x	x	x	x	/	/
Ease of Application	High	Very High	Moderate	High	Moderate	Moderate
Relative cost of implementation	Very low	Very low	Very high	Low	High	Very high

A spreadsheet-based asset tracking system offers some benefits over using pen and paper. Spreadsheet files are available to multiple users and there is no need for searching of the physical location of your asset records. However, due to manual data entry, spreadsheets are prone to error, and it is difficult for

multiple team members to access and update the files simultaneously.

In this project, a new application development platform was proposed with using the spreadsheet as the main database for recording and keeping all the data while overcoming some of inefficiencies of traditional spreadsheet-based asset tracking system. The named development platform is Google Appsheet. This Smart Asset Handphone Scanner (SAHS) Application was proposed and developed as an innovation project for helping asset coordinator and workshop/laboratory supervisor to perform asset tracking with ease. This application was developed based on several design requirement considerations and user experience is one of the priorities.

SAHS Application has its own database, and this application is developed using Google Appsheet and Google spreadsheet. This application is secured with google security and all the users have been validated. As a result, the smart asset scanner is able to increase the efficiency of asset inspection process, inspection reporting process, asset monitoring process, and asset tracking. On the other hand, this scanner is also able to increase the clarity and visibility of asset status report with interactive graphs and symbol displays, and minimal cost of the application development and data maintenance. Smart asset scanner also is a smart phone-based without involve the purchase of additional equipment for this application. The results of the study show that the developed innovation scanner application can help asset coordinators and workshop/laboratory supervisors to manage and track all assets in the workshop or laboratory in a good and orderly manner.

2. Methodology

Handphone application development basically can be divided into three methodologies, there are waterfall method, rapid application development (RAD) method, and agile approach. In this application, rapid application development (RAD) is selected as the main methodology because of its flexibility to produce a working version of the application as quickly as possible, and then to continuously finetune the application. RAD is willing to change or upgrade the application that is suited to the needs of the user. Following is the detailed explanation of the rapid application development approach provided(Diana et al., 2021).

A new Google account was created for this purpose. Google spreadsheets® were used to design the data tables and were linked to AppSheet® software to generate the graphical user interface of the mobile app of the database. Appearance and features of the App were designed through options provided by the AppSheet® .

Smart asset handphone scanner was developed based on several predetermined design requirements as shown below:

i. Increase the efficiency of asset inspection process.
ii. Increase the efficiency of asset inspection reporting process.
iii. Increase the efficiency of asset monitoring process.
iv. Increase the efficiency of asset tracking.
v. Increase the clarity and visibility of asset status report with interactive graphs and symbol displays.
vi. Minimal cost of the application development
vii. Minimal cost of the application data maintenance
viii. Smart asset scanner is smart phone-based without involve the purchase of additional equipment for this application.

Besides, SWOT analysis is a strategic planning and strategic management technique used to help a person or organization identify Strengths, Weaknesses, Opportunities, and Threats related to business competition or project planning. Table 2 shows the SWOT analysis has been done on the Smart Asset Handphone Scanner (SAHS) Application. From this analysis, it determines the level of SAHS applicable readiness in STRENGTH, grab the advantage provided by OPPORTUNITIES, identify the main WEAKNESS and foresee the THREAT. SWOT analysis on the proposed smart asset handphone scanner is shown in Table 2.

Table 2: SWOT analysis on the proposed smart asset scanner

STRENGTH	**WEAKNESS**
i. Every supervisor and asset officer has their own Smartphone. ii. Institute owns a good integrated google suite system. iii. The institution has its own institutional google domain. iv. Having a SPA system that is easy to manage asset records. v. Can use this smart scanner to access asset information even if there is no internet network. vi. Has a good security system from google platform. vii. Coordinators and officers have high skills in handling the application. viii. The smartphone is equipped with QR code and barcode scanning function.	Could not update the asset status to the database in cloud when there is no internet. But could be saved in local smartphones and will automatically update to database once internet coverage is available.
OPPORTUNITIES	**THREAT**
i. Government supports and encourage every innovation efforts that can improve the productivity of institutions. ii. This innovation has the potential to compete at the national level and get good recognition. iii. The SPA system is an integrated system used by most ministries. iv. Has a high chance of being applied to other institutions. v. Simple and effective barcode printing. vi. There are many application platforms that can facilitate the development of applications effectively.	Technology is evolving rapidly, and it is likely that smartphones will be replaced by more sophisticated devices in future.

The flow chart shows the main process in asset inspection and asset tracking as shown in Figure 1. This process starts with scanning the bar code using handphone, and the contents of the bar code will be detected and match with the asset records in database. Based on the bar code, the system could determine the owner of the assets and if the user is the owner of the asset, he/she can further update the asset status through the application. The system will work on and update all checking records as checked or unchecked asset lists. Besides, important information will be generated automatically by the system, such as monthly asset inspection list, list of assets that require maintenance, list of assets based on location, by inspector, by frequency of inspection and all this data could be displayed in an interactive graph.

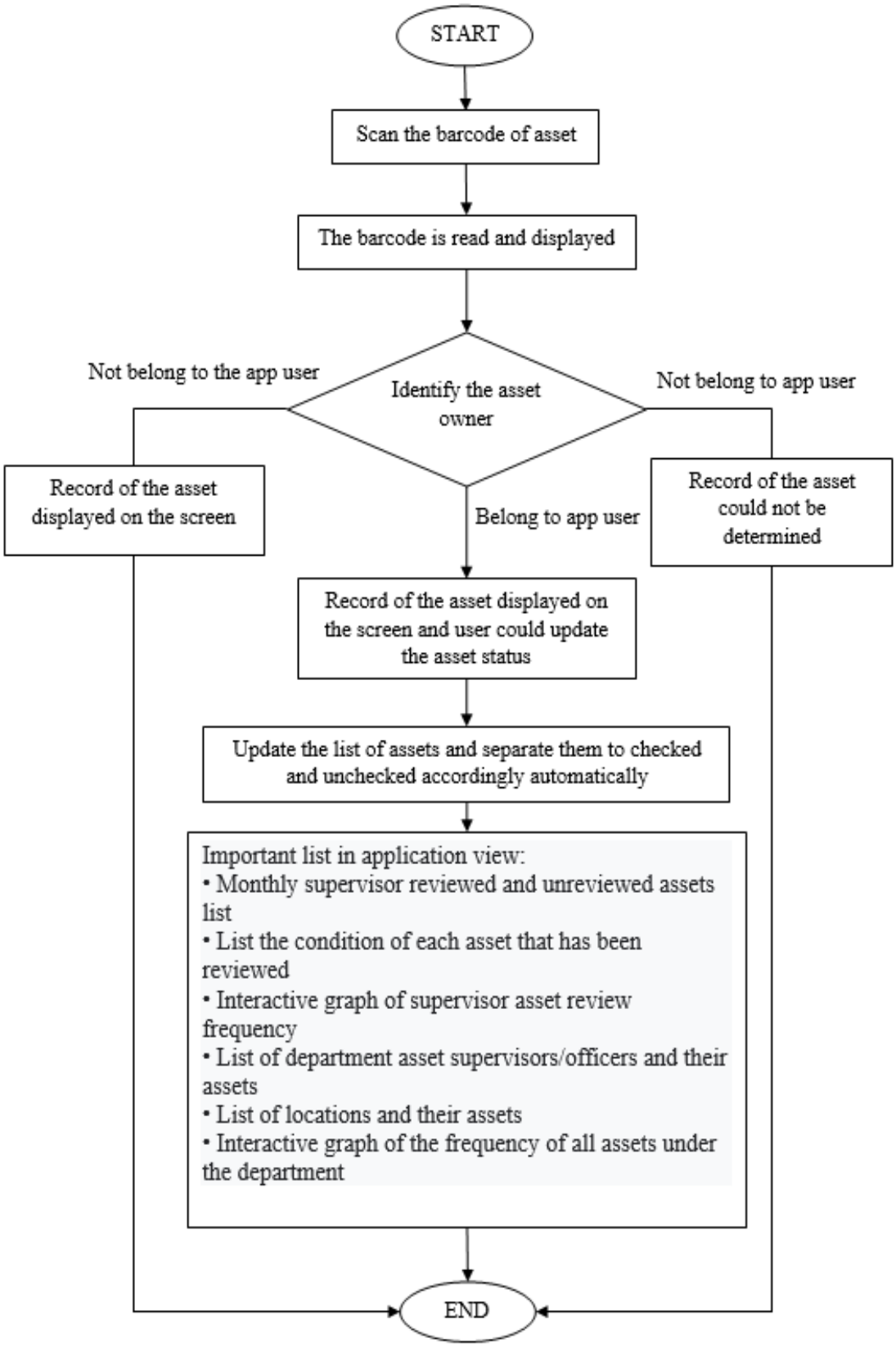

Figure 1: Flow chart for the proposed system

3. Results and Analysis

In this section, the interface of the completed SAHS will be shown and explained. Figure 2 shows the interface of SAHS with three main buttons at the bottom, which are scan asset barcode, status of asset under coordinator supervision, status of asset in the whole department.

When user press on the first button, this application will create a new form for the user to input the asset code by either key-in or scan the barcode & QR code as shown in Figure 3, Figure 4 and Figure 5. The asset details will be displayed in the application when the asset code is matched with the database. The details of the asset will be displayed, such as asset location, name of asset, asset coordinator name and asset coordinator contact number. This information is important for tracking the asset easily and could identify the authorized person for this asset. Besides, coordinator could update the status of the asset by either stating this asset is still used, asset is down, asset under maintenance and so on. Overall, the first button is important for asset tracking and status update.

Figure 2: The interface of smart asset handphone scanner with three main buttons

Figure 3: The developed application is able to scan current asset barcode sticker in the institution

Figure 4: The application tracks the asset details through handphone scanner by scanning the barcode

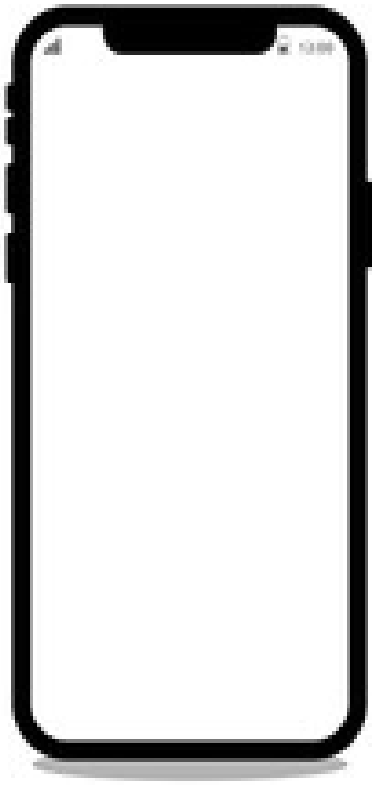

Figure 5: The application could tracks the asset details through handphone and used to update the asset status with ease

The second button shows the status of the assets in detail under the supervision of coordination. From this button, coordinator could easily identify status of asset either have been updated or not. Meanwhile, the third button shows the status of all the assets under the department which are updated or not as shown in Figure 6. Besides, asset status reports are equipped with interactive graphs and symbol displays to increase clarity and visibility. Figure 7 shows the details of record for one of the assets.

Figure 6: Increase the clarity and visibility of asset status report with interactive graphs and symbol displays

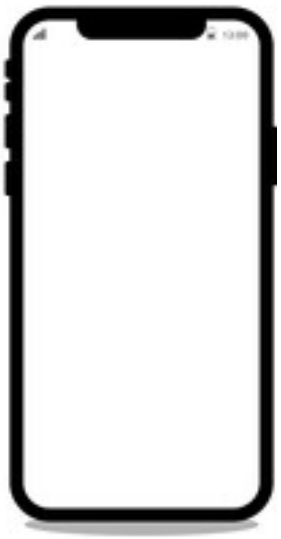

Figure 7: Details of asset status records

Table 3 shows a comparison between web-based asset management system and smart asset handphone scanner. From this, can be concluded, smart asset handphone scanner equipped with several features which have more advantages, such as barcode/ QR code reading, attractive user interface, interactive summary graph display, ease of asset tracking and save budget from purchasing scanner.

Table 3: A comparison between web-based asset management system with Smart Asset Handphone Scanner

	Web-Based Asset Management System	**Smart Asset Handphone Scanner**
Barcode/ QR Code scanning by smartphone	No	Yes
Good user interface for smartphone	No	Yes
Interactive summary graphs display	No	Yes
No extra purchase of additional equipment	No	Yes
Ease of asset tracking	No	Yes
Minimal cost of system development	No	Yes

4. Conclusion

In conclusion, this smart asset handphone application has been developed successfully for helping the asset coordinators in asset inspection, asset tracking and monitoring. This application is developed with minimal cost which uses google spreadsheet as the main database storage while Appsheet as application development platform. This application could be accessed by all the academic staff and making the asset supervision become the responsibility of each of them. For further applications, this smart handphone scanner could be used for other applications in preparing a more sustainable E-campus.

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CONSTRUCTIVE ALIGNMENT GUIDELINE IN PREPARING ASSESSMENT FOR TECHNOLOGY PROGRAM

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ABSTRACT

Accreditation serves to confirm that graduates adhere to the standards established by the Board of Engineers Malaysia (BEM) for engineering technologists. In outcome-based education, the teaching context must be created so that students may master the learning outcome, and each evaluation must be in line with the desired learning outcome (OBE). In order to assist in the process of constructing a rubric that is in line with learning outcomes, the purpose of this article was to develop constructive alignment guideline in preparing assessment for technology program. This study used document analysis to obtain data using a qualitative technique. All information was obtained from public records, such as on-going records of an organization's activities, policy manuals, Engineering Technology Accreditation Council (ETAC) guideline, strategic plans, and previous studies. From the document analysis, maps for all 12 Program Learning Outcome (PLO) and type of assessment were produced. Whilst, all 12 PLOs mapping with SP (Problem Solving) and SK (Knowledge Profiles) also been developed to eased the process of identifying the best SP and SK according to the depth of assessment and requirement by each PLO. Later, the rubrics for each assessment were developed to ensure all tasks given to student were being assessed. Finally, lecturers will have an option to choose the best mapped for their assessments according to the assessment guideline framework that has been developed. As a result, all assessment created by lecturers will aligned with CLOs, PLOs and lastly PEO were measured correctly.

1. Introduction

The body of information used in the TVET curriculum has changed as a result of many phases of change in the curriculum's growth. The adjustments are made in response to technology advancements, the Industrial Revolution 4.0, internet usage, and policies developed by institutions of higher learning (IHL). The creation of curricula must align with the standards set by the Engineering Technology Accreditation Council (ETAC), the sole accreditation body recognized in Malaysia for engineering technology bachelor's degrees, engineering diplomas, and engineering technology diplomas. ETAC, which is a division of the Board of Engineers Malaysia (BEM), aims to guarantee that the accredited programs meet the equivalent standards of engineering technology qualifications recognized by the signatories of the Sydney Accord and Dublin Accord. ETAC was established by the Board of Engineers Malaysia (BEM) to ensure the equivalent quality of the accredited engineering technology bachelor's degree, engineering diploma, and engineering technology diploma programs. Since it began offering certification in 2016, ETAC has approved 159 engineering diploma programs, delivered by 14 IHLs in Malaysia, and 50 engineering technology degree programs. Accreditation serves to guarantee that graduates meet the standards established by BEM for engineering technologists. Each assessment offered must be in line with the intended learning objective, and the teaching context must be created so that students may master the learning outcome (Biggs, 2012).

The essential tenet of constructive alignment, according to Biggs (1999), is that an effective teaching system will match its methods of instruction and evaluation with the objectives-stated learning activities so that each element of the system will support the right kind of student learning. In their study, Zhang et al. (2022) found that using a constructive alignment template can greatly increase students' learning effectiveness, offering theoretical and practical references for teaching and learning in scientific courses. Constructive alignment is a term used in the field of Outcome-Based Education (OBE) to describe the design and delivery of education programs. The concept of constructive alignment refers to the alignment of learning outcomes, assessment practices, and teaching methods, with the goal of ensuring that the students are able to achieve the desired learning outcomes.

The basic idea behind constructive alignment is that the educational process should be designed in a way that helps students to attain specific learning outcomes through a combination of instruction, practice, and feedback. To achieve this, teachers and educators must carefully design learning activities and assessments that align with the stated outcomes and provide students with the necessary opportunities to practice and demonstrate their understanding of the material. In practice, constructive alignment involves the following steps:

i. Identifying the desired learning outcomes: This is the first and most important step in the process of constructive alignment. Educators must first determine what they want students to learn, and then translate those outcomes into clear and measurable statements.

ii. Aligning instruction and assessment: Once the learning outcomes have been identified, the next step is to align the instructional methods and assessment practices with those outcomes. This means that the educational activities and assessments should be designed in such a way that they help students achieve the desired outcomes.

iii. Using formative assessment: Formative assessment is an ongoing process of evaluation that helps educators to monitor student progress and adjust instruction as needed. In the context of constructive alignment, formative assessment provides opportunities for students to receive feedback and adjust their learning strategies.

iv. Providing opportunities for practice and application: Constructive alignment also involves providing students with opportunities to practice and apply what they have learned in real-world contexts. This helps to reinforce their understanding of the material and enhances the transfer of learning from the classroom to real-life situations.
In conclusion, constructive alignment is a crucial component of Outcome-Based

Education, as it helps to ensure that students are able to attain the desired learning outcomes in an efficient and effective manner. By aligning learning outcomes, assessment practices, and teaching methods, educators can create educational experiences that are tailored to the needs of their students and help them achieve their full potential.

Program Learning Outcome (PLO) refers to the knowledge, skills, and attitudes that students are expected to attain as a result of completing a particular program of study (Biggs & Tang, 2011). PLOs are used to define the expected outcomes of an educational program and provide a clear and measurable framework for assessing student performance. According to Biggs and Tang (2011), PLOs are "statements that describe what students are expected to know and be able to do at the end of a program of study". PLOs are typically developed at the program level and provide a roadmap for the design and delivery of educational programs. PLOs are an important component of Outcome-Based Education (OBE) and are used to align educational programs with the needs and expectations of students, employers, and other stakeholders. By defining clear and measurable PLOs, educators can ensure that their programs are relevant, effective, and meet the needs of their students. Constructive alignment in teaching and learning become vital in OBE curriculum whereby the implementation of OBE must be aligned with 12 Program Learning Outcome (PLO), Course Learning Outcome (CLO) and type of assessment produced. Whilst, all 12 PLOs mapping with SP (Problem Solving) and SK (Knowledge Profiles) also been developed to eased the process of identifying the best SP and SK according to the depth of assessment and requirement by each PLO. However, there were some issue highlighted by previous researchers regarding constructive alignment in OBE curriculum and the mismatch between assessment and program learning outcome as shown in Table 1.

Table 1: Issue in developing constructive alignment

Issue	Previous Studies
The importance of learning outcomes	Biggs, (1999); Adam, (2006); Biggs and Tang, (2007); Ali, (2019); Romero, M., & Kalmpourtzis, G. (2020); Noor Al-Huda & Khoo (2013); Rathy et al, (2020); Thian et al. (2018)
Learning outcome mismatch with tasks given	Alfauzan & Tarchouna (2017); Romero & Kalmpourtzis (2020).
A misalignment of learning outcome with teaching and learning approaches	Alfauzan & Tarchouna (2017) ; Abatihun, (2020); Sun & Lee (2020)
Assessment tasks are inadequately distributed to assess the intended knowledge and ability of students expressed in the learning objective	Genon & Torres (2020); Alfauzan & Tarchouna (2017); Abatihun, (2020); Zhang et. Al. (2022);
Constructive alignment was designed to promotes students' deep learning approach	Hailikari, et. al., (2021); Zhang et. Al. (2022); Jasmin, et al. (2018); Stamov Roßnagel, et al. (2021)
Challenge in establishing an OBE system	Gunarathne et al., (2019); Reich et al., (2019); Spady & Marshall, (1991)

Aligning assessment with learning outcomes is an important aspect of ensuring that students are effectively learning what they need to know in a course or program. However, this can be a complex and challenging process, and there are a number of issues that can arise when attempting to align assessment with learning outcomes. One issue is the lack of clear and well-defined learning outcomes. If learning outcomes are not clearly defined and communicated to both instructors and students, it can be difficult to develop assessments that effectively measure these outcomes. Additionally, if learning outcomes are not well defined, it can be difficult to determine what students should be able to know and do by the end of a course or program. Another issue is the lack of alignment between the assessment methods used and the learning outcomes being assessed. For example, if a learning outcome focuses on critical thinking skills, but the assessment only measures factual recall, it may not accurately assess student mastery of the learning outcome. A third issue is the lack of integration between assessment and instruction. In order to effectively align assessment with learning outcomes, it is important that assessments are integrated into the instructional process and used to inform and improve teaching and learning. Finally, there is often a lack of ongoing assessment improvement and revision. In order to effectively align assessment with learning outcomes, it is important to continuously evaluate and improve the assessments used, in order to ensure that they are accurately and effectively measuring student learning.

A recent study by Marzano and Pickering (2017) highlights these and other challenges in aligning assessment with learning outcomes, and provides recommendations for overcoming these challenges. The authors suggest that to effectively align assessment with learning outcomes, it is important to establish a clear and well-defined set of learning outcomes, to align assessment methods with these outcomes, to integrate assessment into the instructional process, and to continuously evaluate and improve assessments. Hence, every program developed by IHL must have a Program Education Outcome to determine the graduate has mastered all knowledge and skills required. The program also needs to be formulated based on the 12 learning outcome

programs (PLO) listed by the Sydney Accord. The Sydney Accord is an international agreement between engineering accreditation bodies that was established in 2001. It provides a framework for the recognition of engineering qualifications across different countries, and is aimed at promoting the mobility of engineers and facilitating their international recognition.

The Sydney Accord is one of the five mutual recognition agreements developed by the International Engineering Alliance (IEA), and it is specifically focused on the recognition of engineering qualifications in the field of electrical and electronic engineering. The Accord sets standards for engineering education and accreditation, and provides a mechanism for the mutual recognition of engineering qualifications between countries that are signatories to the Accord. The main objectives of the Sydney Accord are to:

i. Promote the mobility of engineers between countries
ii. Facilitate the international recognition of engineering qualifications
iii. Encourage the harmonization of engineering education and accreditation standards
iv. Ensure the quality and comparability of engineering education programs

To become a signatory to the Sydney Accord, an engineering accreditation body must meet certain criteria and demonstrate that it has the necessary systems and processes in place to ensure the quality and comparability of its engineering education programs. Once a country becomes a signatory, its engineering qualifications are recognized by other signatory countries, making it easier for engineers to work and study abroad. The Sydney Accord has been widely adopted by engineering accreditation bodies around the world, and is considered an important step towards promoting the mobility and recognition of engineers in a global context. By providing a common framework for the recognition of engineering qualifications, the Accord helps to ensure that engineers have the skills and knowledge they need to meet the challenges of an increasingly interconnected world. Engineering technology graduates need to master the 12 PLOs. The intended PLO is as follows (Figure 1).

Figure 1: Program Learning Outcome

(Source: Engineering Technology Programme Accreditation Standard 2019)

Whilst, Figure 2 shows how constructive alignment in curriculum whereby all rubrics and assessment given to students reflected back to PEO.

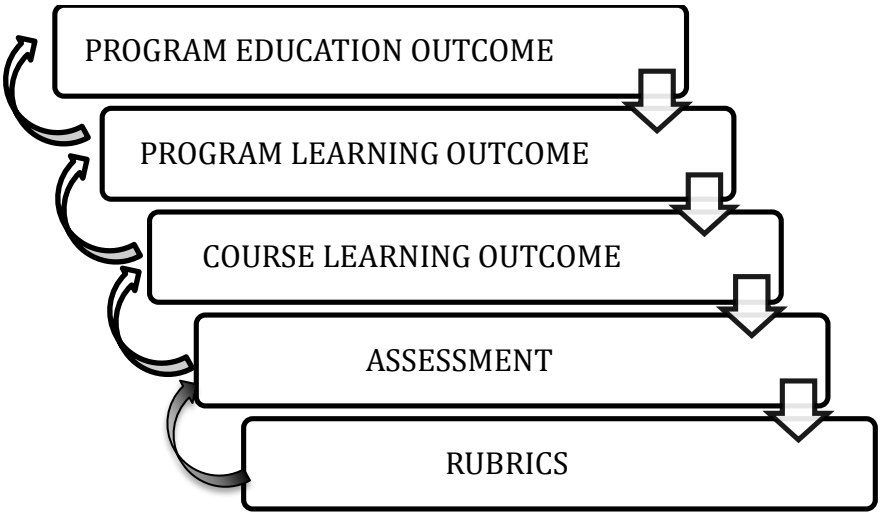

Figure 2: Constructive Alignment in Curriculum

Each program contained courses that will be offered to students. Each course offered must have a course learning outcome (CLO) for students to master. The planned CLO should be mapped with 12 PLOs designed under ETAC standard. Each CLO needs to be assessed to determine the graduate's achievement. Past studies have found that assessment needs to be done constructively aligned with CLO and PLO. PLO needs to map with knowledge profile (SK/DK) and problem solving (SP/DP). Table 2 shows 8 Knowledge Profile (SK/DK), 7 Problem Solving (SP/DP) & 5 Engineering Activities (NA/TA).

Table 2 Knowledge Profile (SK/DK), Problem Solving (SP/DP) & Engineering Activities (NA/TA)

Knowledge Profile (SK/DK)	**Problem Solving (SP/DP).**	**Engineering Activities (NA/TA)**
SK1-Natural sciences	SP1-Depth of knowledge required	TA1-Range of resources
SK2-Mathematics	SP2-Range of conflicting requirements	TA2-Level of interactions
SK3-Engineering fundamentals	SP3-Depth of analysis required	TA3-Innovation
SK4-Specialist Knowledge	SP4-Familiarity of issues	TA4-Consequences to society and the environment
SK5-Engineering Design	SP5-Extent of applicable codes	TA5-Familiarity of issues
SK6-Engineering Practice	SP6-Extent of stakeholder involvement & conflicting requirements	-
SK7-Comprehension	SP7-Interdependence	-
SK9-Research literature	-	-

Therefore, this paper aims to develop constructive alignment guideline in preparing assessment for technology program in assisting of rubric developing process that in line with learning outcome. All 12 PLOs under ETAC with knowledge profile (SK/DK) and problem solving (SP/DP) were mapped in order to create assessment rubrics for every PLOs.

2. Method

This study employs a qualitative methodology and document analysis. Comparative to quantitative research, qualitative studies use distinct types of data. Documents analysis is a widely used qualitative research method that involves the systematic examination and interpretation of written, visual, or audio material. This method can be used to gather data on a wide range of topics, including organizational processes, policies, and practices; cultural norms and beliefs; and historical events. According to Morse (1994), "document analysis is a social research method for studying written and printed texts that are relevant to the researcher's research questions. Morse goes on to explain that document analysis can involve the examination of a range of materials, including books, reports, memos, letters, journals, manuscripts, newspaper articles, government reports, organizational records, personal papers, audio-visual materials, and electronic data. In conducting document analysis, researchers often follow a systematic process, including: (1) selecting the documents to be analysed, (2) coding and categorizing the data, (3) identifying patterns and themes within the data, and (4) interpreting the findings in relation to the research questions. One of the strengths of document analysis is that it allows researchers to access a rich source of historical and contemporary data that may not be available through other methods, such as interviews or observation. Document analysis can also be less time-consuming and less expensive than other qualitative research methods, as the materials being analysed are often readily available and do not require the researcher to actively engage with participants. In conclusion, document analysis is a valuable qualitative research method that provides researchers with access to a rich source of data for understanding complex social and cultural phenomena.

A range of sources, including observations, interviews, and results from printed materials, can be used to gather data (Patton, 1990). Meanwhile, observations, interviews, and document analysis were the methods employed to collect data (Kamarul Azmi, 2012). Document analysis is a type of qualitative research in which the researcher interprets materials to give context and meaning to a topic under review (Bowen, 2009). Document analysis is a small part of the process of gathering information from written or spoken texts in order to conduct research. Information pertinent to the study's goals was gathered using this manner. Document sources inclusive of curriculum, syllabus, guidelines, circulars, minutes of meetings and many more. In this study, the documents analyzed are the curriculum documents of the Engineering Technology Program, Program Structure, ETAC standards as well as previous studies related to course assessment. Prior to conducting the analysis, O'Leary (2014) emphasized several steps in the planning process to be considered, including creating a list of texts to examine, addressing any linguistic or cultural barriers in accessing the texts, acknowledging and overcoming personal biases, acquiring relevant research skills, implementing strategies to maintain credibility, being aware of the desired data, and addressing ethical considerations. Figure 3 shows the research framework for this study.

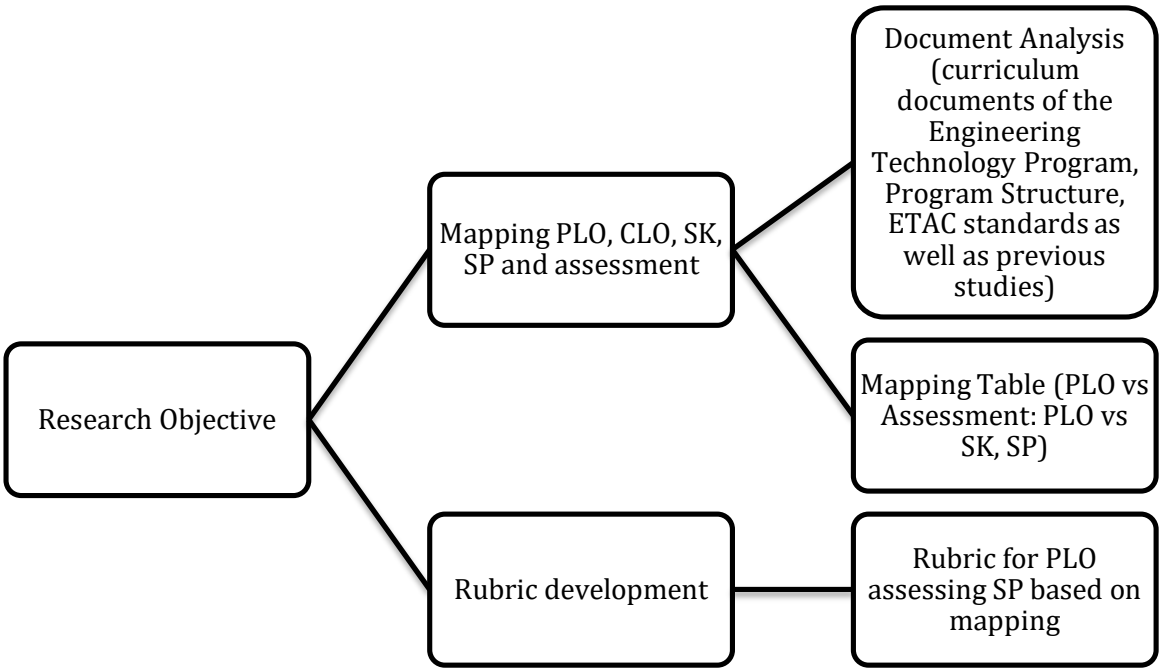

Figure 3: Research Framework

3. Result

The following section presents the results of a study that aimed to develop constructive alignment guideline in preparing assessment for technology program in assisting of rubric developing process that in line with learning outcome. After conducting a thorough review of existing literature and best practices in technology program assessment and rubric development, a draft assessment guideline was developed as it provided a clear and structured approach to aligning assessment practices with learning outcomes. Based on the analysis, the assessment constructive alignment guideline was refined and finalized. The final guideline consisted of five key components: (1) program learning outcome (PLO) identification and type of assessments, (2) PLO mapping with SP (Problem Solving) and SK (Knowledge Profiles), (3) PLO mapping with TA (Engineering Activities), (4) summary of PLOs, SPs and SKs Mapping, and (5) rubrics. Table 3 shows all 12 PLO and type of assessment suitable to assess the student competency in term of problem-solving skills and knowledge acquisition for each PLO. As for example, for PLO 1 (Knowledge), student attainment can be assessed using test, quiz and final examination whilst PLO5 (Modern Tools) can be assessed using Mini Project, Lab Report, Project Presentation and Capstone Project. Assessment is very important in determining student achievement as well as a key indicator of curriculum success. The developed curriculum should be able to be thought by the teaching staff and able to achieve the learning objectives by execution of assessment given to students.

Table 4 shows all 12 PLOs mapping with SP (Problem Solving) and SK (Knowledge Profiles). Each PLO has its owned mapping toward SP and SK according to the depth of assessment and requirement by each PLO. For example, PLO 1 (Knowledge) were mapped with 3 SP namely SP1, SP2 and SP3. PLO1 also were mapped with SP1, SP4 and SP5. Therefore, lecturers will have an

option to choose the best mapped for their assessments. Later all assessment created by lecturers will aligned with this mapping to ensure all PLOs were measured correctly.

Table 3: PLO Vs Assessment

No	*Program learning Outcome*	**SK/TA**	**SP**	**ASSESSMENT**
1	**PO1 -Engineering Knowledge**	SK1-SK4	SP1 and some or all of SP2 to SP7:	TEST, EXAM , QUIZ
2	**PO2 – Problem Analysis**	SK1-SK4	SP1 and some or all of SP2 to SP7:	TEST, EXAM, QUIZ, CASE STUDY, TUTORIAL
3	**PO3 -Design/Development of Solutions**	SK5	SP1 and some or all of SP2 to SP7:	TEST, EXAM, QUIZ, CASE STUDY, MINI PROJECT, CAPTONE PROJECT
4	**PO4 -Investigation**	SK8	SP1 and some or all of SP2 to SP7:	CASE STUDY, MINI PROJECT, LAB REPORT, SITE VISIT
5	**PO5 – Modern Tool Usage**	SK6	SP1 and some or all of SP2 to SP7:	MINI PROJECT, LAB REPORT, PROJECT PRESENTATION, CAPTONE PROJECT
6	**PO6 – The Engineer and Society**	SK7	SP1 and some or all of SP2 to SP7:	CASE STUDY, MINI PROJECT, SITE VISIT, PRESENTATION, APPRAISAL, REFLECTIVE JURNAL, CAPTONE PROJECT
7	**PO7 -Environment and Sustainability**	SK7	SP1 and some or all of SP2 to SP7	CASE STUDY, MINI PROJECT, SITE VISIT, APPRAISAL, REFLECTIVE JURNAL, PRESENTATION, CAPTONE PROJECT
8	**PO8 – Ethics**	SK7		CASE STUDY, MINI PROJECT, SITE VISIT, APPRAISAL, REFLECTIVE JURNAL, PRESENTATION, CAPTONE PROJECT
9	**PO9 - Individual and Team work**			CASE STUDY, MINI PROJECT, SITE VISIT, APPRAISAL, REFLECTIVE JURNAL, PRESENTATION, CAPTONE PROJECT
10	**PO10 - Communication**	TA1-TA5 (ANY 1 OR MORE)		CASE STUDY, MINI PROJECT, SITE VISIT, APPRAISAL, REFLECTIVE JURNAL, PRESENTATION, CAPTONE PROJECT
11	PO11 - Project Management and Finance			CASE STUDY, MINI PROJECT, SITE VISIT, APPRAISAL, REFLECTIVE JURNAL. PRESENTATION, CAPTONE PROJECT
12	PO12 - Lifelong learning			CASE STUDY, MINI PROJECT, SITE VISIT, APPRAISAL, REFLECTIVE JURNAL, PRESENTATION, CAPTONE PROJECT

Table 4: PLO vs SK and SP

PO	SP1								SP2	SP3	SP4	SP5	SP6	SP7	Assessment
	SK1	SK2	SK3	SK4	SK5	SK6	SK7	SK8							
PO1 -Engineering Knowledge	X	X	X	X					X	X					DIRECT FORMATIVE SUMMATIVE (SEM 1-3)
PO1 -Engineering Knowledge	X	X	X	X							X	X			DIRECT FORMATIVE SUMMATIVE (SEM 4-5)
PO1 -Engineering Knowledge	X	X	X	X									X	X	DIRECT FORMATIVE SUMMATIVE (SEM 6-8)
PO2 – Problem Analysis	X	X	X	X					X	X					DIRECT FORMATIVE SUMMATIVE (SEM 1-3)
PO2 – Problem Analysis	X	X	X	X							X	X			DIRECT FORMATIVE SUMMATIVE (SEM 4-5)
PO2 – Problem Analysis	X	X	X	X									X	X	DIRECT FORMATIVE SUMMATIVE (SEM 6-8)
PO3 -Design/Development of Solutions	X	X	X	X	X						X	X			DIRECT FORMATIVE SUMMATIVE
PO4 -Investigation				X				X				X	X		DIRECT FORMATIVE SUMMATIVE
PO5 – Modern Tool Usage				X		X					X	X			DIRECT FORMATIVE SUMMATIVE
PO6 – The Engineer and Society						X	X						X	X	DIRECT FORMATIVE SUMMATIVE
PO7 -Environment and Sustainability				X			X		X	X					DIRECT FORMATIVE SUMMATIVE
PO8 – Ethics							X								DIRECT FORMATIVE SUMMATIVE

Table 5 show mapping of PLO without SP/SK but has engineering activities (TA). Out of 4 PLOs, only PLO10 has TA as shown in table 4. Whilst, Figure 4 show the summary of PLOs, SPs and SKs Mapping to ease lecturer understanding on selecting the perfect match in developing assessment and rubrics.

Table 5: PLO vs TA

PO	**TA1**	**TA2**	**TA3**	**TA4**	**TA5**	
PO9 - Individual and Team work						
PO10 - Communication	X	X	X	X	X	Written Report, prototype, drawing, modelling Verbal Presentation, viva *Rubric need to be design according to TA1-TA5 depend on type of assessment taken.*
PO11 - Project Management and Finance						
PO12 - Lifelong learning						

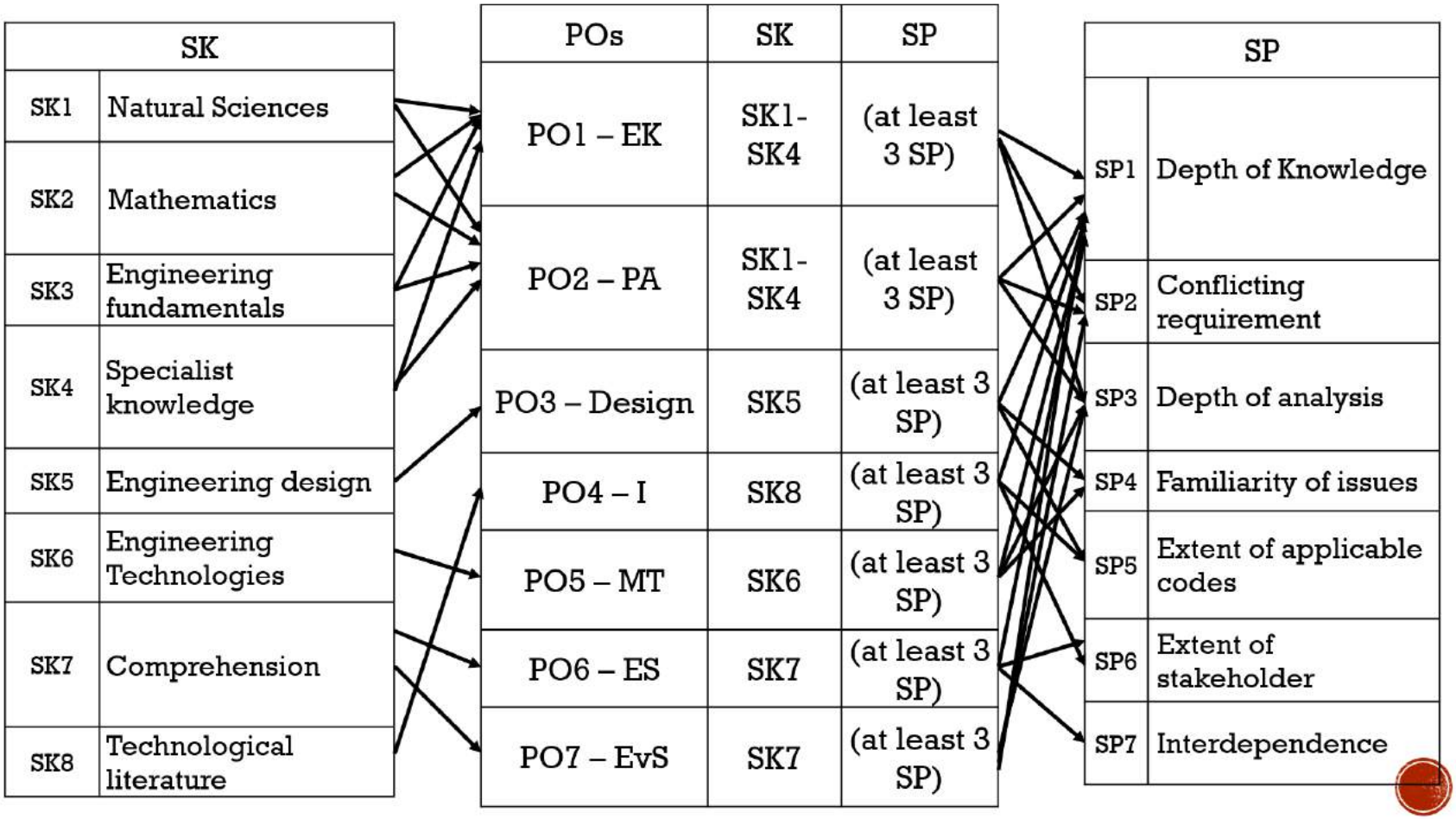

Figure 4: Summary of PLOs, SPs and SKs Mapping

Table 6 show scoring rubric for the intended PLO to assess a case study for designated course. Case study under this designated course were mapped with PLO5. Therefore, according to Table 4 and Table 6, PLO5 were mapped with SP1, SP4 and SP5. Keep also in mind that PLO5 was compulsory mapped with SK6 (engineering technologies). Using the same method, rubrics for all PLOs has been developed and implemented for all courses for technology program. Therefore, each rubric was match with assessment given to student whereby each assessment tally with the intended course learning outcome. Whilst, the CLO was mapped with designated PLO and the PLO was mapped with PEO, meaning that the constructive alignment for the intended learning outcome was achieved.

Table 6: Example of Rubric for PLO5

PO5

SP	Characteristic	Rubrics Design KNOWLEDGE	Task	1	2	3	4	5
SP1	Depth of Knowledge	Analyze the problem using specified knowledge profile	Task 2-3	Ability to Identify a building and analysis the building services system issue and problem.				
				Student able to analyze the problem using 1 specified knowledge profile	Student able to analyze the problem using 2 specified knowledge profile with some elaboration	Student able to analyze the problem using 3 specified knowledge profile with acceptable elaboration	Student able to analyze the problem using 3 specified knowledge profile with good elaboration	Student able to analyze the problem using 3 specified knowledge profile with excellent elaboration
		Evaluate the problem under such circumstance towards providing an effective solution		Ability to Evaluate the building servises system problem under such circumstance towards providing an effective solution				
				Evaluate 1 circumstance only	Evaluate 2 circumstances with acceptable justification	Evaluate 3 circumstances with acceptable justification	Evaluate 3 circumstances with with good justification	Evaluate >3 circumstances with with good justification
SP4	Familiarity of issues	Differentiate the infrequently encountered issues in problem solving	Task 4-5	Ability to Differentiate the infrequently encountered issues regarding building services system in problem solving				
				Compare the basis.	Compare and differentiate 2 issues	Differentiate 2 issues and propose	3	>3

SP	Characteristic	Rubrics Design KNOWLEDGE	Task	1	2	3	4	5
		Select formulae/procedures to resolve the infrequently encountered issues		Ability to Select formulae/procedures to resolve the infrequently encountered issues of building services using latest technology				
				Select an approach to resolve.	Select 2 approaches to resolve	Select 2 approaches to resolve and justify	3	>3
SP5	Extent of applicable codes	Develop solution using standards and codes of practice for professional engineering	Task 6-7	Ability to Develop solution using standards and codes of practice for professional engineering and **assemble 3D** (SK6) model simulation of selected housing plan to accommodate the problem arise				
				Use at least 1	Use at least 2	Use at least 2 and include practicing guide	3	>3
		Justify professional engineering experiences to resolve the problem solving		Ability to Justify professional engineering experiences to resolve the problem solving in the making of 3D model simulation				
				Justify using at least 1 experience	Justify using at least 2 experiences	Justify using 2 experiences and select at least 1	3	>3

4. Conclusions

This study has developed constructive alignment guideline in preparing assessment for technology program in assisting of rubric developing process that in line with learning outcome. This research applied qualitative approach for data collection using document analysis. All data were gathered through public records such as ongoing records of an organization's activities, policy manuals, ETAC guideline, strategic plans, and previous studies. The finding from all information gathered enable to produce 1) guideline for 12 PLOs and type of assessment suitable to assess the student competency in term of problem-solving skills and knowledge acquisition for each PLO, 2) guideline for 12 PLOs mapping with SP (Problem Solving) and SK (Knowledge Profiles) whereby each PLO has its owned mapping toward SP and SK according to the depth of assessment and requirement by each PLO, 3) a mapping of PLO without SP/SK but has engineering activities (TA), and 4) scoring rubric for all the intended PLOs to assess an assessment for designated course. All of this assessment guideline was developed to ensure the constructive alignment of each designated course are achieved by following the guided template.

Constructive alignment plays a crucial role in student assessment as it provides a framework for designing and implementing assessment practices that are aligned with the learning outcomes. In the context of constructive alignment, assessment is not just a measure of student performance, but also an integral part of the learning process. When assessments are aligned with the learning outcomes, they help students to focus on the most important concepts and skills, and provide them with feedback on their progress. This, in turn, enables students to adjust their learning strategies and improve their overall performance. In order to align assessments with the learning outcomes, the following steps are typically followed:

i. Defining clear and measurable assessment criteria: The assessment criteria should be based on the learning outcomes and should reflect the key knowledge, skills, and attitudes that students are expected to attain.
ii. Designing assessments that are relevant and authentic: Assessments should be designed in a way that is relevant to real-world situations and allows students to demonstrate their understanding of the material in an authentic context.
iii. Providing opportunities for formative assessment: Formative assessment provides students with feedback on their performance and allows them to adjust their learning strategies. In the context of constructive alignment, formative assessments should be integrated into the learning process and provide opportunities for students to demonstrate their understanding of the material.
iv. Evaluating student performance in a fair and reliable manner: The assessment process should be designed in a way that ensures fairness and reliability, and provides students with an accurate picture of their performance.

By integrating assessment into the learning process, constructive alignment helps to create a more meaningful and effective educational experience for students. It also enables educators to monitor student progress and adjust the instructional methods as needed, with the goal of ensuring that all students are able to attain the desired learning outcomes.

Effective assessments that align with constructive alignment can enhance student performance and reflect the Program Learning Outcomes (PLOs) and Course Learning Outcomes (CLOs) of the course. The mapping carried out in this study provides a clear guideline for creating improved scoring rubrics that align with the PLOs. The assessment of each PLO will be based on the mapped knowledge and skills, thereby elevating student achievement and motivating them to focus on their learning activities. This approach serves as a useful guideline for instructors to design assessments that align with the intended PLOs.

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PENGGUNAAN JAVA e_NOTES DI KALANGAN PELAJAR TVET BIDANG TEKNOLOGI MAKLUMAT : SATU TINJAUAN

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ABSTRAK

Java e_Notes merupakan satu aplikasi multimedia yang dibangunkan sebagai pemudahcara dalam proses pembelajaran kendiri pelajar bagi kursus Integrative Programming Technologies. Kajian ini adalah untuk menilai persepsi pelajar terhadap penggunaan Java e_Notes dan impak penggunaan aplikasi Java e_Notes di kalangan pelajar. Kajian berbentuk deskriptif dengan menggunakan instrumensoal selidik yang telah diedarkan kepada 73 orang pelajar yang mengambil kursus ini. Data yang diperolehi dianalisis bagi mendapatkan nilai frekuensi, peratusan dan skor min. Hasil kajian menunjukkan bahawa persepsi pelajar terhadap penggunaan Java e_Notes dan impak penggunaan Java e_Notes kepada pelajar berada pada tahap tinggi iaitu masing-masing dengan skor min 4.49 dan 4.28. Dapatan positif ini menunjukkan aplikasi ini dapat membantu dan memudahkan mereka dalam meningkatkan penguasaan kursus ini. Penghasilan Java e_Notes ini bukan sahaja memenuhi kurikulum malah ianya dapat memudahkan dan meningkatkan minat pelajar untuk pembelajaran yanglebih berkesan.

1. Pengenalan

1.1 Latar Belakang Kajian

Aplikasi pembelajaran Java e_Notes merupakan satu aplikasi yang dibangunkan berkonsepkan pembelajaran digital dimana ia merupakan satu bahan pemudahcara yang dapat membantu pelajar memahami dan menguasai topik pembelajaran. Ia direkabentuk berpandukan sukatan kurikulum kursus yang mengandungi nota serta penilaian dan aplikasi ini boleh dimuatturun melalui telefon pintar. Aplikasi ini menggunakan strategi pendidikan yang pelbagai dan dapat dipertingkatkan penggunaannya dengan pelbagai teknologi masa kini.

Justeru itu, pembangunan satu aplikasi yang dikenali sebagai *Java e_Notes* mampu dijadikan satu pendekatan pengajaran dan pembelajaran yang lebih menarik dan berkesan serta menyeronokkan para pelajar seterusnya menjadikan proses pengajaran dan pembelajaran yang dilaksanakan lebih bekesan.

1.2 Tinjauan Literatur

Sumber bahan pengajaran dan pembelajaran ialah apa-apa sahaja alat atau bahan yang berperanan dan bertugas untuk dalam menyampaikan isi pembelajaran kepadapelajar bagi memperoleh pengetahuan, kemahiran, sikap dan nilai berdasarkan objektif kurikulum. Terdapat pelbagai jenis sumber atau alat yang boleh membantu dalam proses pengajaran dan pembelajaran seperti bahan bercetak dan bahan teknologi maklumat (Mahat, A., & Yunos, N. M.,2022). Semua sumber pengajaran danpembelajaran ini dapat merangsang deria rangsangan pelajar seperti kefahaman dan interpretasi pelajar kepada maklumat yang disampaikan serta mengekalkan minat dan tumpuan serta kemahiran berfikir pelajar dalam sesi pembelajaran.

Dalam era pendidikan yang semakin berkembang menyebabkan Alat Bahan Bantu Mengajar (ABBM) telah muncul dalam berbagai-bagai bentuk. Di antaranya ialah bahan elektronik seperti penggunaan telefon pintar. Justeru, penggunaan teknologi yang baik dalam bidang pendidikan adalah sangat penting untuk memastikan sistem pendidikan di Malaysia seiring dengan negara-negara maju yang lain. Penggunaan nota secara digital dapat memberi banyak manfaat kepada pelajar dan juga tenaga pengajar (Abu Bakar, A. L., Osman, W. H., Abd. Rahim, S., & Rahman, N. D.,2021).

1.3 Tujuan Kajian

Tujuan kajian dijalankan adalah untuk :

1. Menilai persepsi pelajar terhadap penggunaan Java e_Notes.
2. Menilai impak penggunaan Java e_Notes kepada pelajar

2. Metodologi

2.1 Rekabentuk Kajian

Kajian yang dijalankan ini adalah kajian jenis deskriptif, yang merupakan satu kaedah tinjauan menggunakan instrument soal selidik bertujuan untuk menerangkan sesuatu fenomena yang sedang berlaku. Mohamad Najib (1999). Kajian jenis deskriptif sesuai digunakan dalam penyelidikan yang menerangkan suatu fenomena yang sedang berlaku. Data-data mengenai persoalan kajian diperolehi dengan kaedah soal selidik.Menurut Azizi *et al.* (2007) Kaedah yang berkesan ini adalah untuk mendapatkan data dan maklumat daripada responden selain membuat pemerhatian tingkahlaku mereka.Selain itu ia dapat mengumpulkan data dengan lebih mudah dan sesuai dengan responden.

2.2 Sampel kajian

Responden kajian merupakan pelajar semester 5 dari Jabatan Teknologi Maklumat Dan Komunikasi yang mengambil kursus Integrative Programming Technologies. Jumlah bilangan sampel bagi kajian ini mengikut seksyen adalah seperti Jadual 1.

Jadual 1: Responden Kajian

Bilangan	Seksyen	Jumlah Pelajar
1	DDT5S1	40
2	DDT5S2	33
Jumlah Responden		**73**

2.3 Instrumen kajian

Instrumen adalah alat untuk mengumpul data yang terlibat bagi menjawab soalan penyelidikan yang ditetapkan. Dalam kajian ini, instrumen yang digunakan adalah melalui borang soal selidik. Jadual 2 dibawah menunjukkan ringkasan instrumen yangdigunakan.

Jadual 2: Instrumen Kajian

Jenis	Kuantitatif
Instrumen	Borang Soal Selidik
Responden	73 orang pelajar Semester 5 yang mengambilkursus Integrative Programming Technologies

2.4 Kaedah Pengukuran

Pemberian skala untuk bahagian maklumat demografi responden adalah seperti Jadual3 :

Jadual 3:Maklumat Demografi Responden

Item	**pilihan**
Jantina	Lelaki, Perempuan
Seksyen	DDT5S1, DDT5S2

Dalam Bahagian B dan C pula, pengukuran bagi skala Likert yang digunakan sepertijadual 4 dibawah:

Jadual 4: Skala Likert

Skor	**Skala**
1	Sangat Tidak Bersetuju
2	Tidak Bersetuju
3	Tidak Pasti
4	Setuju
5	Sangat Bersetuju

Kemudian, setiap skor yang dijana akan dikira bagi menentukan keputusan negatif atau positif. Keputusan itu juga akan digunakan bagi mengenalpasti nilai min mengikut tahap bagi sisihan piawai seperti yang ditunjukkan dalam Jadual5. Pentafsiran interpretasi nilai skor min merujuk kepada Jadual Interpretasi Skor Min (Landell, 1997).

Jadual 5: Interpretasi Skor Min

Julat Skor MIn	**Tahap Kecenderungan Min**
1.00 ke < 2.33	Rendah
2.33 ke < 3.66	Sederhana
3.66 ke <= 5.00	Tinggi

(Sumber: Diadaptasi dari Landell, 1997)

2.5 Analisis Data

Analisis deskriptif digunakan untuk menerangkan skor min yang diperoleh bagi setiap item dalam instrumen kajian ini bagi mengukur persepsi pelajar terhadap penggunaan aplikasi *Java e_Notes* dan menilai impak penggunaan *Java e_Notes* di kalangan pelajar yang mengambil kursus *Integrative Programming Technologies.* Terdapat lima (3) bahagian dalam soal selidik iaitu bahagian A, B dan C dan sebanyak 20 item telah diberikan kepada responden untuk dijawab. Agihan bilangan item mengikut bahagian didalam soal selidik ini adalah seperti di dalam Jadual 6.

Jadual 6 : Taburan Bilangan item mengikut Kategori

Bahagian	Kategori Pengujian	Bilangan Item
A	Demografi Responden	2
B	Persepsi Pelajar Terhadap Penggunaan Java e_Notes	10
C	Impak penggunaan Java e_Notes di kalanganpelajar	8

Untuk bahagian A, data yang diperolehi melalui soal selidik dianalisis untuk mendapatkan nilai frekuensi dan peratusan. Manakala bagi bahagian B dan C, data dianalisis untuk mendapat nilai skor min. Pentafsiran skor min dibuat berdasarkan jadual interpretasi skor min seperti Jadual 5.

3. Dapatan Kajian

3.1 Demografi Responden

Data soal selidik ini telah dikumpul dari responden. Jadual 7 menunjukkan dapatan untuk bahagian A iaitu Demografi responden. 52.06% daripada jumlah responden adalah pelajar perempuan manakala 47.94% adalah pelajar lelaki. Manakala bagi peratusan responden mengikut seksyen pula ialah 40 orang pelajar merupakan pelajar dari seksyen DDT5S1 mewakil 54.79% manakala sebanyak 45.20% merupakan pelajar dari seksyen DDT5S2 iaitu seramai 33 orang pelajar.

Jadual 7. Demografi Responden

		Frekuensi	%
Jantina	Pelajar Lelaki	35	47.94
	Pelajar Perempuan	38	52.06
Seksyen	DDT5S1	40	54.79
	DDT5S2	33	45.20

3.2 Persepsi pelajar terhadap Penggunaan Java e_Notes

Bagi menilai persepsi pelajar terhadap penggunaan Java e_Notes, soal selidik menggunakan Skala Likert yang mempunyai dan 10 item soalan. Dapatan daripada analisis berdasarkan skor min dirumuskan seperti Jadual 8 di bawah:

Jadual 8: Persepsi penggunaan Java e_Notes di kalangan pelajar

Bil	PERNYATAAN	MIN	TAHAP
1	*Java e_Notes* sangat mudah digunakan	4.95	Tinggi
2	*Java e_Notes* mudah dibawa	4.96	Tinggi
3	***Java e_Notes* mudah untuk disimpan**	**4.97**	**Tinggi**
4	Aplikasi yang menjimatkan kos	4.55	Tinggi
5	Aplikasi yang menjimatkan masa	4.44	Tinggi
6	Capaian nota yang pantas	4.55	Tinggi
7	Kandungan nota yang lengkap	4.48	Tinggi
8	Penilaian yang sangat bersesuaian	4.04	Tinggi
9	Interaktiviti yang menarik	4.15	Tinggi
10	**Elemen multimedia yang pelbagai**	**3.82**	**Tinggi**
	PURATA	**4.49**	**Tinggi**

Berdasarkan nilai peratusan yang diperolehi, 10 item yang dinilai mencatatkan nilai skor min yang berada pada tahap tinggi. Bagi tiga item yang mendapat peratusan tertinggi adalah skor min tertinggi adalah bagi Item 3 iaitu Java e_Notes mudah untukdismpan dengan nilai skor min sebanyak 4.97, manakala bagi Item 2 mencatat nilai skor min sebanyak 4.96 merupakan item kedua tertinggi iaitu, Java e_Notes mudah untuk dibawa. Item ketiga tertinggi pula ialah Item 1 dengan nilai skor min 4.95 iaitu Java e_Notes sangat mudah untuk digunakan. Item 4 dan Item 6 mencatatkan nilai skor min yang sama sebanyak 4.55 iaitu dengan menggunakan Aplikasi Java e_Notesini, dapat menjimatkan kos serta capaian nota yang dibuat dengan pantas. Bagi Item 7 iaitu kandungan nota yang lengkap mencatatkan nilai skor min sebanyak 4.48 manakala bagi item Item ke 5 pula iaitu Aplikasi menjimatkan masa mencatatkan nilaiskor min sebanyak 4.44.

Bagi item 8 iaitu Penilaian yang terkandung dalam Java e_Notes yang lengkap dan Item 9 iaitu Interaktiviti yang menarik mencatatkan nilai skor min masing-masing iaitu 4.04 dan 4.15. Bagi item 10 pula mencatatkan nilai skor min terendah iaitu sebanyak 3.82 iaitu Elemen multimedia yang pelbagai dalam Java e_Notes ini. Purata bagi keseluruhan item untuk persepsi penggunaan Java e_Notes mencatatkan nilai skor min sebanyak 4.49 iaitu berada pada tahap tinggi. Secara keseluruhannya, bagi persepsi pelajar terhadap penggunaan Java e_Notes berada pada tahap yang tinggi.

3.3 Impak Penggunaan Java *e_Notes* di kalangan pelajar

Bagi mengenalpasti impak pembelajaran menggunakan *Java e_Notes pula*, soal selidik menggunakan Skala Likert juga digunakan dimana terdapat 8 item soalan. Dapatan daripada analisis ditunjukkan dengan nilai skor min seperti Jadual 9 di bawah.

Jadual 9 : Impak penggunaan Java e_Notes di kalangan pelajar

Bil	Pernyataan	Min	Tahap
1	***Java e_Notes* meningkatkan kefahaman**	**4.81**	**Tinggi**
2	*Java e_Notes* meningkatkan penguasaan	4.18	Tinggi
3	*Java e_Notes* meningkatkan motivasi	4.59	Tinggi
4	**Paparan yang menarik minat pelajar**	**3.97**	**Tinggi**

5	Java e_Notes menaikkan semangat dalam pembelajaran.	4.03	Tinggi
6	Kepuasan pembelajaran menggunakan *Java e_Notes*	4.25	Tinggi
7	Pembelajaran yang tenang	4.08	Tinggi
8	Pembelajaran yang selesa	4.32	Tinggi
	PURATA	**4.28**	**Tinggi**

Dapatan analisis menunjukkan Item 1 menunjukkan nilai skor min paling tinggi iaitu Java e_Notes meningkatkan kefahaman pelajar mencatatkan nilai skor min sebanyak 4.81 iaitu berada pada tahap tinggi. Diikuti dengan Item 3 iaitu Java e_Notes ini dapat meningkatkan motivasi diri kepada pelajar dengan catatan nilai skor min sebanyak 4.59 juga berada pada tahap tahap tinggi. Bagi Item 8 iaitu pembelajaran yang selesabagi pelajar dengan nilai skor min sebanyak 4.32 manakala Item 6 iaitu Kepuasan pembelajaran menggunakan Java e_Notes dengan nilai skor min sebanyak 4.25 jugaberada pada tahap tinggi.

Seterusnya bagi Item 2 iaitu Java e_Notes dapat meningkatkan penguasaan pelajar juga berada pada tahap yang tinggi dengan nilai skor min sebanyak 4.18 manakala Item 7 iaitu Pembelajaran yang tenang mencatatkan nilai skor min sebanyak 4.08 jugapada tahap tinggi. Bagi Item 5 iaitu pembelajaran mengggunakan Java e_Notes dapatmenaikkan semangat pelajar mencatatkan nilai skor min sebanyak 4.03 juga berada pada tahap tinggi dan Item 4 mencatatkan nilai skor min paling rendah iaitu 3.97 iaitu paparan yang menarik minat pelajar juga berada pada tahap tinggi. Purata keseluruhan item bagi penilaian impak penggunaan Java e_notes kepada pelajar berada pada tahap tinggi dengan mencatatkan nilai skor min sebanyak 4.28.

4. Perbincangan

4.1 Persepsi pelajar terhadap penggunaan *Java e_Notes*

Dapatan menunjukkan bahawa penggunaan Java e_Notes sangat memudahkan para pelajar kerana aplikasi yang hanya boleh diakses melalui telefon pintar dan ia memang untuk mudah dibawa, disimpan, mudah untuk digunakan serta boleh diakses setiap masa. Selain dari capaian nota yang pantas berbanding d gan penggunaan buku notabiasa, penggunaan Java e_Notes ini akan menjimatkan masa pelajar seterusnyamenjimatkan kos perbelanjaan untuk cetakan sebarang nota seperti biasa. Selain dari nota yang lengkap, penekanan kepada penilaian kepada pelajar juga dimasukkan dalam aplikasi ini bagi menguji kefahaman pelajar berkenaan dengan topik pembelajaran. Penggunaan elemen multimedia mungkin boleh ditingkatkan lagi dalamaplikasi seperti mengakses video yang berkaitan dan juga menambah penilaian yang menekankan kepada unsur permainan yang boleh menarik minat pelajar dengan lebih mendalam. Secara keseluruhannya, penggunaan aplikasi ini banyak memberikan maklumbalas positif kepada pelajar dari aspek penggunaannya yang boleh membantuserta memudahkan para pelajar dalam sesi pembelajaran.

4.2 Impak pengggunaan *Java e_Notes* di kalangan pelajar

Bagi impak setelah penggunaan aplikasi Java e_Notes ini pula, ternyata ia dapat membantu meningkatkan kefahaman pelajar itu sendiri. Aplikasi ini bukan sahaja menekankan nota semata-mata tetapi juga terdapat juga soalan-soalan penilaian yang boleh dilaksanakan oleh pelajar bagi menguji kefahaman mereka. Secara tidak langsung ia dapat membantu pelajar dari aspek penguasaan bagi topik-topik tertentu.

Pelajar juga merasa tenang dan selesa setelah menggunakan aplikasi ini kerana pelajar boleh mengulangkaji mengikut keperluan pelajar itu sendiri. Dan ini akan meningkatkan lagi semangat serta motivasi pelajar semasa berada dalam bilik kuliah. Dari segi paparan antaramuka nota dan penilaian boleh ditingkatkan lagi dengan lebih menekankan kepada kepelbagaian elemen multimedia yang lain serta penggunaan warna yang pelbagai. Kandungan bahan pengajaran yang interaktif dapat membantu meningkatkan kemahiran berfikir secara kreatif (Harjono et al, 2020). Kesimpulannya, dapatlah dinyatakan di sini bahawa penggunaan aplikasi Java e_Notes semasa sesi pembelajaran di bilik kuliah ataupun pembelajaran kendiri dapat memberikan kesan yang positif terhadap pelajar yang mengambil kursus Integrative Programming Technologies.

5. Kesimpulan

Kesimpulannya, pengaplikasian *Java e_Notes* telah memberi satu pendekatan dalam proses PdP yang lebih menarik dan menyeronokkan kepada para pelajar disamping menjadikan proses PdP lebih efektif . Selain dari aplikasi ini mampu memudahkan parapelajar dalam proses pembelajaran, ia juga dapat menjadi satu nilai tambah kepada diri pelajar dalam meningkatkan pemahaman dan penguasaan pelajar, ia juga dapat meningkatkan keyakinan dan motivasi pelajar itu sendiri. Oleh itu, pengaplikasian aplikasi ini dengan menggunakan pendekatan teknologi digital ini mampu menarik minat pelajar dalam mengulangkaji seterusnya membantu meningkatkan lagi keberkesanan dalam PdP dalam pendidikan masa kini.

Penghargaan

Kajian ini dilaksanakan di Politeknik Sultan Mizan Zainal Abidin Terengganu (PSMZA) bagi mendapatkan maklumbalas daripada pelajar Semester 5 yang mengambil kursus Integrative Programming Technologies berkaitan dengan persepsi pelajar setelah menggunakan apliasi Java e_Notes. Penglibatan pelajar-pelajar yang terlibat amat dihargai dalam memberikan maklumbalas yang berkaitan untuk digunakan dalam kajian ini.

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SUSTAINABLE PACKAGING SOLUTIONS FOR AUTOMOTIVE PRODUCT TRANSFER

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ABSTRACT

Most goods or products, especially economic or automotive items, are transported, distributed, and stored using corrugated packaging materials as the main choice. At all stages of distribution, corrugated material packaging is used to protect the loaded goods from structural loads. Containers containing these products are subject to various risks, including falling from great heights, transport shocks, compression during stacking and exposure to the weight of other packaging products, all of which can cause damage to the item. Based on that, this study aims to investigate problems related to product packaging, designing a new packaging box concept using recycled materials, and evaluating the product packaging capabilities based on packaging performance tests. The results of the evaluation show that the appearance, structural stability and content protection by using recycled corrugated paper board packaging is very satisfactory, able to reduce the cost of raw materials and meets the needs of the industry.

1. Introduction

Packaging is the process of enclosing a product or item in a container to protect it from damage during transportation, handling, and storage. Packaging for product transfer refers to the packaging used to transport goods from one place to another, such as from a manufacturing facility to a distribution centre, or from a distribution centre to a retail store(Schoormans & Robben, 1997). Effective packaging for product transfer should be designed with several factors in mind, including the size and weight of the product, the mode of transportation, the distance to be travelled, and the potential hazards the product may encounter during transit (Perez 2018). The packaging should be strong and durable enough to withstand the rigors of shipping, handling, and storage, while also being cost-effective and easy to handle.

Sustainable packaging solutions can take many forms, including using recyclable or biodegradable materials, reducing the amount of packaging required, and designing packaging that is reusable or refillable(Boz et al., 2020). One popular sustainable packaging solution is using recycled or biodegradable materials such as paper, cardboard, or plant-based materials, which can reduce the amount of waste generated and minimize the use of non-renewable resources(Chauhan et al., 2023). The choice of packaging material will

depend on the specific requirements of the product being shipped, as well as the mode of transportation and any regulatory requirements that must be met(Biegańska, 2018).

Another sustainable packaging solution is reducing the amount of packaging required, which can be achieved through better product design, optimized packaging shapes and sizes, and using materials that are lightweight but still provide adequate protection to the product(Shi, 2022). This approach not only reduces waste but can also lead to cost savings in transportation and storage. Reusable and refillable packaging is also a growing trend in sustainable packaging solutions, which allows customers to reuse the packaging for other purposes or refill the product within the packaging(Granato et al., 2022).

While sustainable packaging solutions for product transfer have many benefits, there are also some challenges and issues that businesses and manufacturers may face when implementing these solutions. Some of the problems include cost, compatibility with existing systems, performance, regulatory compliance and availability of sustainable materials(Morgan et al., 2022). Based on the issue, this study was conducted in the logistics department of an automotive parts manufacturing company to solve their packaging problems. Due to the new production of automotive spare parts, their company faced problems related to the packaging of the products for the delivery process to customers. The current packaging box is not neatly arranged and does not have enough space, which can cause damage to the product. Therefore, this study aims to design a new cost-effective packaging solution using recycled corrugated boxes to provide optimal spacing and adequate protection for product transfer.

This research paper is structured as follows. Section 1 presents the introduction of the study; Section 2 covers the methodology of the research work; Section 3 discuss the finding results, and Section 4 presents the conclusion and suggested recommendations for future work.

2. Methodology

2.1 *Concept and Ideation*

The first step in developing a new packaging solution is to generate ideas. Brainstorming sessions, and customer feedback is used to generate ideas for new packaging solutions. After generating ideas, select the most promising ones and develop them into concrete concepts. This can involve prototyping, material testing, and cost analysis to determine feasibility. The packaging should provide sufficient protection to the product during transportation and storage. The packaging must be designed to protect the product from damage, spoilage, or contamination during transit. The packaging should maintain the integrity of the product throughout the entire transfer process. The packaging should not allow any leakage, breakage, or damage to the product. The packaging should be efficient in terms of cost and space utilization. The packaging should be designed to minimize the amount of material used, reduce packaging waste, and optimize the use of transportation space.

2.2 *Materials selection: recycled corrugated box*

Corrugated packing is most used for secondary shipment boxes. This is a very tactical and utilitarian use of corrugated, where the maximum level of protection at the lowest cost takes precedence above all other considerations. These boxes are rarely, if ever, printed. Hand stamping of boxes with the firm emblem and contents is still widespread, and stencilling plays a significant role(Biegańska, 2018). Corrugated boxes are required by all sorts of businesses, whether they are huge, small, or medium-sized. Wholesalers and retailers both

require them. Movers and packers utilise corrugated boxes as well. As a result, corrugated boxes have a sizable market.

A corrugated box is a recyclable container with three layers of material on the sides: an inner layer, an exterior layer, and a middle layer. Fluted arches offer cushioning and stability for weighted materials arranged in a corrugated box in the middle layer, which is positioned between the outer and inner layers. Corrugation flutes were originally added during the first industrial revolution. Since its invention, the corrugated box has evolved into the most prevalent type of shipping container, with applications in every sector of material management and transportation(Shi, 2022).

2.3 *Design and development*

Once the concept has been refined, it can be designed and developed into a functional prototype. The packaging can be tested for its ability to protect the product and its suitability for transportation, storage, and handling. After that, we plan and discuss the process that requires packaging design and the design requirements of what must be completed. Even if the projects are simple and the specifications are basic, there is still a conceptual design process that takes place between learning the requirements and beginning to build. As the project grows and complexity, the importance of design grows. The methods and resources you'll use, the solution's scalability, and the structure of the components you'll create are all options. The Design Phase is where we can examine all the possible solutions and narrow down an option to find the most effective and efficient approach to create a solution.

During this step, we are creating the design using the characteristics listed in the literature review sections. We build models that convey process requirements and offer a framework for the system's physical design. This project resulted in the creation of a prototype method. The development stage is when planners work on projects and implement the application based on the design studies and requirements that were created previously. Whatever necessary to complete the job has been established. Potential suppliers are contacted, a timeline is created, equipment and materials are purchased, and team are given instructions, among other things. When the implementation phase is ready to begin, the development phase is over. For the people who will carried out the implementation, everything must be clear. We are beginning to construct the models after analysing the data and information required, which is accomplished via analysis on packaging box delivered by truck. The project has been completed properly.

2.4 *Performance testing and evaluation*

Performance testing is critical to ensure that the packaging solution meets its intended purpose. Testing can include drop testing, compression testing, and vibration testing, among others. Packaging solutions should be evaluated for their cost effectiveness. This can include an analysis of the materials used, manufacturing costs, transportation costs, and other associated expenses.

To evaluate the performance of packaging for product transfer, you can conduct various tests, such as drop tests, compression tests, vibration tests, and temperature tests, to determine the packaging's ability to protect the product during transportation and storage. You can also conduct customer surveys to gather feedback on the packaging's convenience and overall satisfaction. Additionally, you can evaluate the environmental impact of the packaging by conducting a life cycle assessment to determine the packaging's carbon footprint and other environmental impacts.

3. Results and discussions

3.1 *Schematic design of the packaging box*

a. Substrate air vent cover

This concept has 12 pcs per layer (Figure 1). It comes with 3 layers in 1 box. Size for this box is 69 x 40 x 54 cm.

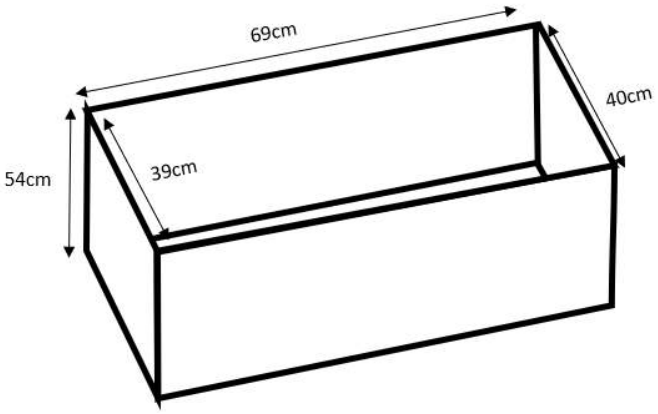

Figure 1. Schematic design Airvent Cover

b. Armrest assembly and rear storage cover

This concept uses inner nesting slot that have 30 pcs for 1 layer (Figure 2). Size for this box is 73 x 41 x 43 cm.

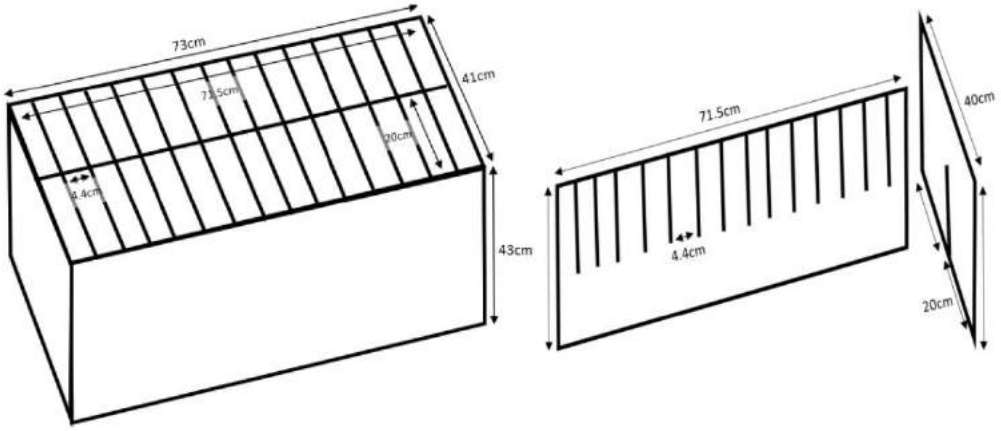

Figure 2. Schematic design Armrest & Rear Storage

c. Front bezel assembly

This concept is slot vertical per layer (Figure 3). The total for 1 box is 100pcs. Size for this box is 69 x 40 x 54 cm.

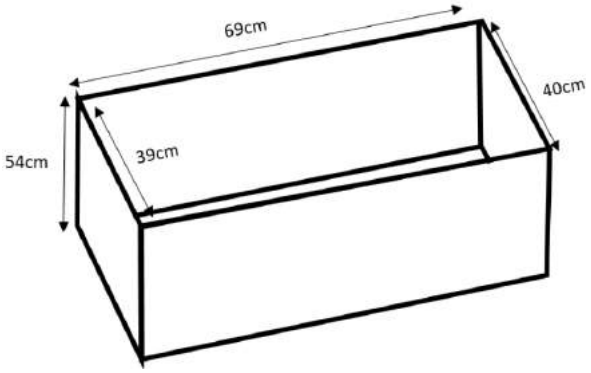

Figure 3. Schematic design Front Bezel

d. Side Panel Upper RH & LH

This concept has slot to hold partition (Figure 4). It comes with 1pcs per layer. The total for 1 box is 10pcs. Size for this box is 112 x 80 x 40 cm.

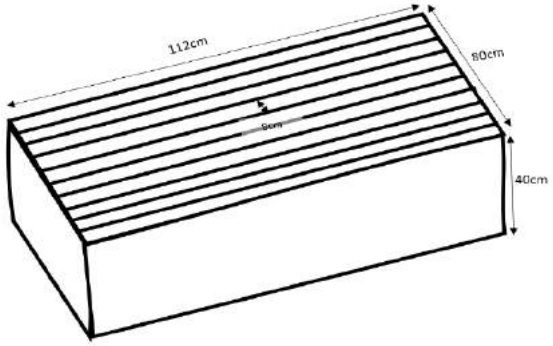

Figure 4. Schematic design Side Panel Upper RH & LH

e. Side Panel Bolster RH & LH

This concept has a slot to hold for partition (Figure 5). It comes with 8pcs per layer that 3 layers include in this box. The total for 1 box is 24 pcs. The size of this box is 65 x 38 x 57 cm.

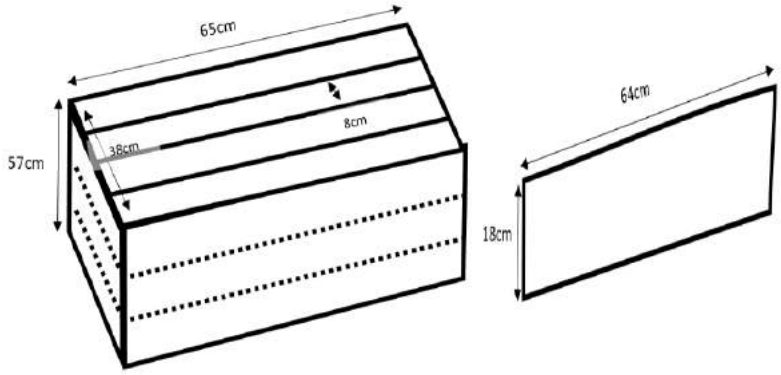

Figure 5. Schematic design Side Panel Bolster RH & LH

3.2 *Performance analysis*

a. Resistance Analysis using Mullen Test

The Mullen Test involves applying compression pressures to a cardboard sample to determine its resistance and bursting point. This test should be considered when the packaging box is projected to be stacked throughout the distribution cycle. It necessitates using a compression tester, which exerts compression forces on the box's bases until they fail. This method to analyse our Sub Assembly Lucid Armrest packaging box is shown in Figure 6.

Figure 6: Lucid Substrate Sub Assembly Armrest stacked for Mullen test

The **r**esults from Mullen test are shown in Table 1 and Table 2.

Table 1: Mullen test result for first level until third stacking level

	Stacking Level					
	1st Level		2nd Level		3rd Level	
Packaging side	**Outer**	**Inner**	**Outer**	**Inner**	**Outer**	**Inner**
On top	No damage	No damage	No damage	No damage	No damage	No damage
On bottom	No damage	No damage	No damage	No damage	No damage	No damage
On long side	No damage	No damage	No damage	No damage	No damage	No damage
On short side	No damage	No damage	No damage	No damage	No damage	No damage
On corner	No damage	No damage	No damage	No damage	No damage	No damage

Table 2: Mullen test result for fourth level until sixth stacking level

	Stacking Level					
	4th Level		5th Level		6th Level	
Packaging side	**Outer**	**Inner**	**Outer**	**Inner**	**Outer**	**Inner**
On top	No damage	No damage	No damage	No damage	Broken, Torn	Damage Goods and partition
On bottom	No damage	No damage	No damage	No damage	Torn apart a little	Good will be mess
On long side	No damage	No damage	No damage	No damage	Torn, Deflected	Broken Goods
On short side	No damage	No damage	No damage	No damage	Torn, Deflected	Damage
On corner	No damage	No damage	No damage	No damage	The nails will be pulled out	Torn, Broken

The result shows that from the first stacking level until the fifth stack, there is no damaged sign on the top, bottom, long side, short side and corner of the new packaging box, neither inner nor outer part. Only after the sixth stacking level the damaged sign appeared, such as broken, torn, deflected and extracted nails on all the packaging sides. In comparison to the previous design of the packaging box, where the damaged sign appeared as early as the fourth stacking level, these findings prove the effectiveness of the new packaging box design.

4. Conclusion

Overall, although sustainable packaging solutions for product transfer have many benefits, it is important to carefully consider the potential challenges and issues associated with implementing these solutions to ensure their effectiveness and sustainability in the long term. Based on the performance evaluation using the Mullen test, it is evidence that this type of packaging is a suitable solution for packaging automotive products. The evaluation results also prove that the appearance, structural stability and content protection by using recycled corrugated paper board packaging is very satisfactory, able to reduce the cost of raw materials and meets the needs of the industry.

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WATER QUALITY PARAMETERS IN FRESHWATER FISH CULTURE POND BY ECOFAN TECHNOLOGY

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ABSTRACT

Fish culture pond is one of the proven methods of aquaculture. Fish culture is being looked up as an opportunity to utilize existing inland water sources with great production potential to enhance production for animal protein in the country. Freshwater fish culture is an important industry as it provides a source of protein and fulfils the high market demand for freshwater fishes. Poor water quality can result in low profit, low product quality and potential human health risks. However, this system greatly depended upon the suitability of its water quality parameter in the new aquatic ecosystem. Hence this project aim to design ecofan technology for fish culture system and test the water quality parameters in pond designated for fish culture. The proposed solution involves designing and developing a new ecofan specifically for fish culture circular tanks. Circular tanks are chosen as they provide a uniform culture environment, can be adjusted for optimal fish health, and facilitate the removal of settleable solids. The rotational ecofan structures and induction removal mechanisms are engineered to improve water quality, achieve effective tank rotation, enhance mixing, and flush out solids. In conclusion, the analysis of the fish culture circular tank system using the Ecofan has revealed both positive aspects and areas for improvement. The system demonstrates favorable temperature conditions and a water color indicating a healthy plankton population, which is beneficial for fish health.

1. Introduction

Water quality in fishponds is a crucial factor that significantly impacts the productivity, health, and well-being of fish. Several chemical components, such as carbon dioxide, pH, alkalinity, and hardness, interact with each other and can have profound effects on pond conditions. For example, pH and carbon dioxide concentrations fluctuate daily, while alkalinity and hardness are relatively stable but can change over time. Maintaining good water quality is essential for fish health and overall aquaculture success. Deterioration in water quality can lead to stress in

fish and make them more susceptible to diseases. Each water quality factor interacts with others, creating complex relationships. Therefore, managing water quality is crucial to ensure the survival and growth of fish.

In fish cultivation systems like floating cages, external inputs such as nutrients, proteins, and carbon are continuously introduced. Without proper management, this can lead to a deterioration of water quality. Therefore, effective water quality management is a key component of successful fish culture practices. It determines the success or failure of an aquaculture operation. The quality of water in an ecosystem provides valuable information about the available resources to support life within that ecosystem. Assessing and monitoring various physico-chemical parameters are essential to identify and understand pollution sources and magnitudes. Fish are sensitive to changes in their environment, and any alterations induce stress. Therefore, maintaining stable and optimal conditions for factors like oxygen levels, temperature, transparency, and limited levels of metabolites is vital for successful fish pond management and maximum yield. In summary, water quality is a critical factor in fish culture systems. It affects fish health, productivity, and the overall success of aquaculture operations. Managing and maintaining optimal water quality conditions are essential to provide a suitable environment for fish and ensure their well-being and growth. The optimum range of various water quality parameters are summarised in Table 1.

Table 1. Desirable water-quality criteria for pond water fishery for getting high yield via applying minimum input

Parameter	**Desirable limits**	**Reference**
Temperature	24-30 ^{0}C	Santhosh and Singh (2007)
Turbidity	30-80 cm	Bhatnagar *et al*. (2004
Water Color	Green, bluish green/ brown greenish colour of water indicates good plankton population hence, good for fish health.	Delince (1992)
Dissolved Oxygen (DO)	DO level >5ppm is essential to support good fish production.	Bhatnagar and Singh (2010) and Bhatnagar *et al*. (2004)
Biochemical oxygen demand (BOD)	BOD levels between 1.0 and 2.0 mg L-1 -considered clean; 3.0 mg L-1 fairly clean; 5.0 mg L-1 doubtful and 10.0 mg L-1 definitely bad and polluted.	Ekubo and Abowei (2011)
Carbon-dioxide (CO2)	Tropical fishes can tolerate CO2 levels over 100 mg L-1 but the ideal level of CO2 in fishponds is less than 10 mg L-1.	Ekubo and Abowei (2011)
pH	The suitable pH range for fish culture is between 6.7 and 9.5 and ldeal pH level is between 7.5 and 8.5 and above and below this is stressful to the fishes	Santhosh and Singh (2007)
Ammonia (NH3)	the level of ammonia (<0.2 mg L-1) suitable for pond fishery.	Bhatnagar and Singh (2010)

Good quality of water resources depends on a large number of physico-chemical parameters. Assessing and monitoring of these parameters is essential to identify the magnitude and source of any pollution load. Episodes of low concentrations of dissolved oxygen and high concentrations of ammonia are major causes of fish stress, which in turn, reduces growth and increases mortality rates in aquaculture ponds. In particular, the farmer should take care to avoid over-feeding and manage water and sediments to prevent excessive accumulation of organic matter and waste at the bottom of ponds, which can influence other water quality

parameters and use aeration and mechanical mixing interventions at critical times to reduce stress on fish from low DO concentrations, and thus avoid risks of mass mortality events. Therefore, the ecofan technology combine with convertion water pumping can reduce major cause of fish stress and increase water quality parameters. Therefore, the objectives of this project were to design and development this ecofan system that will enhance the water quality parameter and increase the capacity of fish culture survivors and quantity.

2. Materials and Methods

The proposed solution involves designing and developing a new ecofan specifically for fish culture circular tanks. Circular tanks are chosen as they provide a uniform culture environment, can be adjusted for optimal fish health, and facilitate the removal of settleable solids. The rotational ecofan structures and induction removal mechanisms are engineered to improve water quality, achieve effective tank rotation, enhance mixing, and flush out solids. The goal is to lower system costs and increase productivity. The ecofan is a device based on fluid dynamic principles that generate a vertical column of water movement from the bottom to the surface of the tank. Unlike conventional devices that introduce oxygen into the water or sludge, the ecofan brings the sludge into oxygen. This process promotes highly active aerobic and anaerobic processes that effectively break down organic material in the sewage, without producing any unpleasant odorous gases. The new ecofan operated based on fluid dynamic principles, creating a vertical water column from the tank's bottom to the surface. It will be combined with a convection water blow by a pump, as depicted in Figure 1 and 2. The combination of the ecofan and pump will enhance the water movement and provide additional benefits to the fish culture circular tank system.

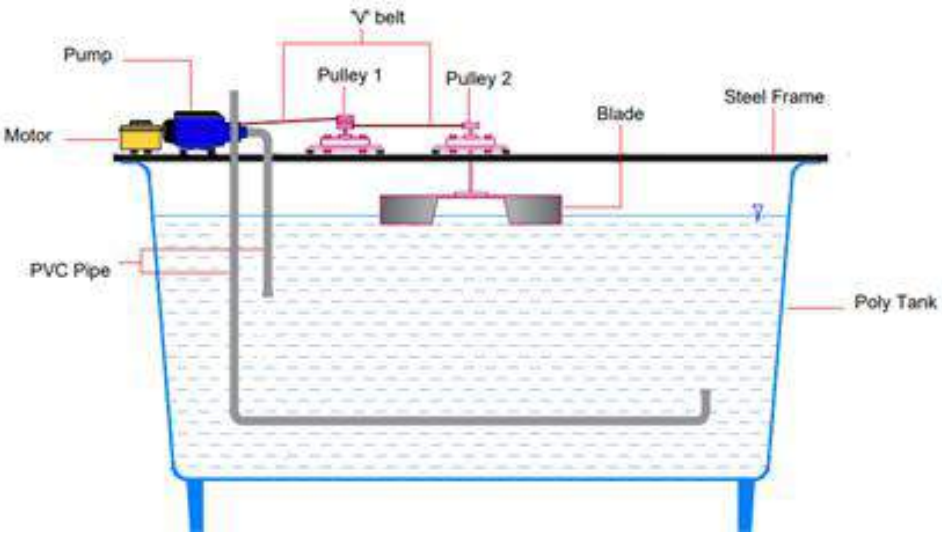

Figure 1. Schematic view of ecofan system

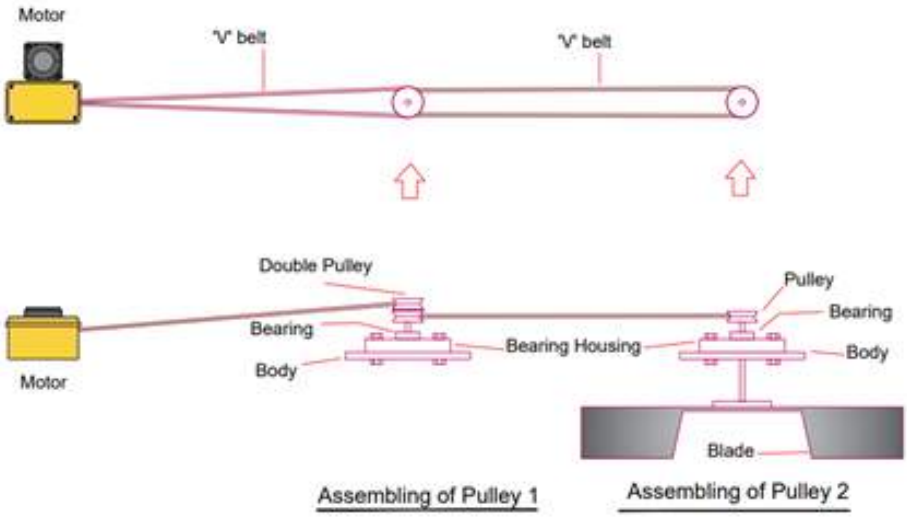

Figure 2. Pully system of ecofan

A total of 300 fish samples were released in ecofan ponds and water quality was monitored daily to detect physico-chemical parameters levels in the water.

Figure 3. Onsite Ecofan Monitoring

3. Results

Result (Table 2) from the study found that Eco-fan has achieved the performance that required by the previous research as mentioned in Table 1.

Table 2. Result of water quality for Ecofan

Parameter	**Sample from Ecofan**	**Desirable limits**
Temperature	27.87	24-30 ^{0}C
Water Color	Brown greenish	Green, bluish green/ brown greenish colour of water indicates good plankton population hence, good for fish health.
Dissolved Oxygen (DO)	4.31 (TOP) 4.10 (BOTTOM)	DO level >5ppm is essential to support good fish production.
pH	7.06	The suitable pH range for fish culture is between 6.7 and 9.5 and ldeal pH level is between 7.5 and 8.5 and above and below this is stressful to the fishes
Ammonia (NH3)	0.31 (TOP) 0.46(BOTTOM)	the level of ammonia (<0.2 mg L-1) suitable for pond fishery.

4. Discussion

Based on the provided sample from the Ecofan, here are the observed values for different parameters and their desirable limits:

i. Temperature: 27.87°C (Desirable limits: 24-30°C) The temperature falls within the desirable range for fish culture, which is good for maintaining optimal conditions.

ii. Water Color: Brown greenish (Desirable: Green, bluish green/brown greenish) The brown greenish color indicates the presence of plankton, which is beneficial for fish health. The observed color is within the desirable range.

iii. Dissolved Oxygen (DO):
   a. Top: 4.31 ppm (Desirable: >5 ppm)
   b. Bottom: 4.10 ppm (Desirable: >5 ppm) The observed DO levels are slightly below the desirable range. It is essential to have DO levels above 5 ppm to support good fish production. Further improvement is needed in this aspect.

iv. pH: 7.06 (Desirable: 6.7-9.5, Ideal: 7.5-8.5) The observed pH falls within the suitable range for fish culture. However, the ideal pH level is considered to be between 7.5 and 8.5. The current pH level is within acceptable limits.

v. Ammonia (NH3):
   a. Top: 0.31 mg/L (Desirable: <0.2 mg/L)
   b. Bottom: 0.46 mg/L (Desirable: <0.2 mg/L) The observed ammonia levels exceed the desirable range for pond fishery. Ammonia levels should be kept below 0.2 mg/L for the well-being of the fish. Steps should be taken to reduce ammonia levels.

Based on these observations, improvements are needed in the dissolved oxygen and ammonia levels to optimize the fish culture environment.

5. Conclusion

Based on the results obtained from the Ecofan analysis, several conclusions can be drawn regarding the fish culture circular tank system:

i. Temperature: The observed temperature falls within the desirable range for fish culture, indicating that the tank is maintaining optimal conditions in terms of temperature.
ii. Water Color: The brown greenish color of the water suggests a good plankton population, which is beneficial for fish health. This indicates that the tank is providing a suitable environment for fish culture.
iii. Dissolved Oxygen (DO): The observed DO levels at both the top and bottom of the tank are slightly below the desirable range (>5 ppm) for supporting good fish production. This indicates a need for improvement in oxygen levels within the tank.
iv. pH: The pH level of 7.06 falls within the suitable range for fish culture. However, the ideal pH range (7.5-8.5) is considered more favorable for fish health. Overall, the pH level is acceptable but could be optimized.
v. Ammonia (NH3): The ammonia levels at both the top and bottom of the tank exceed the desirable range (<0.2 mg/L) for pond fishery. This indicates a need for immediate action to reduce ammonia levels, as high levels can be detrimental to fish health.

In conclusion, the analysis of the fish culture circular tank system using the Ecofan has revealed both positive aspects and areas for improvement. The system demonstrates favorable temperature conditions and a water color indicating a healthy plankton population, which is beneficial for fish health. However, there are two key areas that need attention. Firstly, the dissolved oxygen (DO) levels in the tank are slightly below the desirable range for supporting good fish production. Increasing the DO levels will enhance the oxygen supply to the fish and promote their overall health and well-being. Measures should be taken to improve aeration and circulation within the tank to raise the DO levels to the recommended range. Secondly, the ammonia (NH3) levels in the tank exceed the desirable range for pond fishery. High levels of ammonia can be harmful to fish, and therefore, it is crucial to reduce the ammonia concentration in the water. Implementing appropriate strategies such as enhancing filtration, reducing organic waste accumulation, and implementing water treatment techniques will help mitigate ammonia levels and ensure a healthier environment for the fish. By addressing these areas of improvement, such as increasing dissolved oxygen levels and reducing ammonia concentrations, the fish culture circular tank system can be optimized. These measures will enhance the tank environment, promote better fish health, and ultimately improve the overall productivity of the fish culture system.

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POTENSI PENGGUNAAN APLIKASI BLIPP ME DARI SEGI KEINGINAN DAN MANFAAT PENGGUNAAN DALAM PROSES PEMBELAJARAN PELAJAR

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ABSTRAK

Kajian ini dilaksanakan bagi mengenalpasti potensi aplikasi Blipp Me dalam pembelajaran pelajar dari segi keinginan dan manfaat. Sebanyak 42 orang pelajar telah menjawab soal selidik ini. Reka bentuk kajian ini menggunakan pendekatan kuantitatif yang menggunakan kaedah deskriptif iaitu skor min bagi menilai tahap keinginan dan manfaat dari potensi aplikasi dalam proses pembelajaran pelajar. Instrumen bagi kajian ini adalah berbentuk soal selidik dan diedarkan kepada pelajar melalui Google Form. Analisis data ini menggunakan perisian SPSS 23.0. Dapatan kajian menunjukkan potensi aplikasi Blipp Me dari segi keinginan dan manfaat penggunaan dalam proses pembelajaran adalah baik dengan nilai min bagi aspek keinginan adalah 3.98 dan bagi aspek manfaat adalah 4.23. Hasil ujian T menunjukkan tidak terdapat perbezaan yang signifikan tahap keinginan berdasarkan jantina. Manakala, hasil dapatan yang sama juga diperolehi bagi aspek manfaat dimana tidak terdapat perbezaan yang signifikan tahap manfaat berdasarkan jantina. Selain itu, hasil kolerasi menunjukkan terdapat hubungan yang signifikan diantara keinginan dan manfaat menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar. Oleh itu, penggunaan aplikasi Blipp Me mampu meningkatkan tahap pemahaman pelajar melalui rasa seronok menggunakan aplikasi Blipp Me dan mendedahkan pelajar kepada pembelajaran digital.

1. Pengenalan

Pendekatan pengajaran dan pembelajaran (PdP) yang dilaksanakan pada era kini seharusnya disesuaikan mengikut perkembangan teknologi dan keperluan pendidikan abad ke-21. Sejajar dengan lonjakkan 9 iaitu pembelajaran dalam talian tahap global didalam Pelan Pembangunan Pendidikan Malaysia (Pendidikan Tinggi) (2015-2025) menunjukkan bahawa Jabatan Pendidikan Politeknik dan Kolej Komuniti (JPPKK) telah menyambut baik usaha ini dengan memberi peluang kepada warga pendidiknya untuk melaksanakan pembelajaran dalam talian

terutamanya ketika penularan wabak pandemik COVID-19 yang melanda Malaysia bermula Mac 2020 (Hin, 2020). Justeru itu, pengajar harus memilih bahan pembelajaran yang sesuai dan berkesan bagi membantu meningkatkan kefahaman pelajar.

Kursus MPU21032 Penghayatan Etika dan Peradaban merupakan kursus wajib yang diambil oleh semua pelajar semester 1 Politeknik Malaysia. Pelaksanaan kursus ini mengikut silibus kurikulum yang telah ditetapkan oleh Jabatan Pendidikan Politeknik dan Kolej Komuniti (JPPKK), Kementerian Pengajian Tinggi. Silibus kurikulum ini terdiri daripada sembilan topik yang perlu dipelajari dan tugasan dinilai dalam bentuk pembentangan, e-folio dan projek. Bagi topik yang melibatkan pembentangan, pelajar perlu memahami dan mampu untuk menguasai topik tersebut.

Augmented Reality merupakan teknologi yang canggih dan mudah dicapai. Hal ini adalah kerana, teknologi ini membantu pengajar dan pelajar untuk melaksanakan pembelajaran secara jarak jauh dengan menggunakan objek maya dan bahan pembelajaran untuk berinteraksi (Ismail, Jamali, & Marimuthu, 2021).

Aplikasi teknologi Web 2.0 dalam pendidikan merupakan satu revolusi kepada dunia pendidikan. Hal ini adalah kerana, ciri teknologi Web 2.0 seperti perkongsian maklumat, mudah kendali, reka bentuk berpusatkan pengguna dan kerjasama di World Wide Web telah menjadikan teknologi Web 2.0 diminat oleh pengguna internet (Nurul Syaida Md Zuki & Fariza Khalid, 2016).

Oleh itu, rekabentuk bahan bantu mengajar telah direka bagi kursus ini dengan menggunakan aplikasi Blippar yang mempunyai elemen Augmented Reality dan kandungan yang tersedia didalam aplikasi terdiri daripada teknologi web 2.0. Justeru kajian ini dilaksanakan bagi mengenalpasti potensi aplikasi Blipp Me dalam proses pembelajaran pelajar dari segi keinginan dan manfaat. Hasil kajian ini boleh digunakan dalam usaha mempelbagaikan alat bantu mengajar dalam pengajaran dan pembelajaran khususnya di Politeknik Malaysia.

2. Metodologi

Reka bentuk kajian ini adalah tinjauan dengan menggunakan pendekatan kuantitatif. Sebanyak 50 orang pelajar telah dipilih untuk melaksanakan kajian ini. Walaubagaimanapun, hanya 42 orang pelajar yang menjawab soal selidik ini. Kriteria sampel adalah pelajar Politeknik Metro Betong Sarawak yang mengambil kursus MPU21032 Penghayatan Etika dan Peradaban. Borang soal selidik telah diambil dari kajian lepas iaitu kajian mengenai Persepsi Pelajar Terhadap Manfaat dan Keinginan Menggunakan Snake and Ladder Digital Game Board dalam Pembelajaran Berasakan Permainan (Mohamad, Hamzah, & Osman, 2020). Borang soal selidik mengandungi 3 bahagian. Bahagian A terdiri daripada demografi responden manakala, bahagian B terdiri daripada 5 item yang mewakili konstruk tahap keinginan menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar dan bahagian C terdiri daripada 4 item yang mewakili konstruk tahap manfaat menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar. Borang soal selidik mempunyai skala Likert 5 mata iaitu 1- Sangat Tidak Setuju (STS), 2-Tidak Setuju (TS), 3-Kurang Setuju (KS), 4- Setuju dan 5-Sangat Setuju (SS). Daripada data yang dikumpulkan, perisian SPSS 23.0 telah digunakan untuk tujuan analisis seterusnya. Statistik diskriptif yang digunakan ialah kekerapan, peratusan, min dan sisihan piawai. Skala interpretasi skor min diambil daripada Fkrudin et al. (2018) adalah seperti Jadual 1.0 berikut:

Jadual 1.0. Skala Interpretasi Min

Nilai Min	Tahap Interpretasi Min
0.00-1.66	Tahap Rendah
1.67-3.33	Tahap Sederhana
3.33-5.00	Tahap Tinggi

Bagi Interpretasi kekuatan hubungan telah diambil daripada Hussain dan Shiratuddin (2017) seperti dalam Jadual 2.0 berikut,

Jadual 2.0. Interpretasi kekuatan hubungan

Saiz Pekali Kolerasi	Kekuatan Kolerasi
8.1 hingga 1.00	Sangat kuat
5.1 hingga .80	Kuat
3.1 hingga .50	Sederhana
2.1 hingga .30	Lemah
0.1 hingga .20	Sangat lemah

3. Dapatan kajian

3.1 Bilangan jantina

Berdasarkan Jadual 3.0 menunjukkan, seramai 42 orang responden telah menjawab soal selidik ini melalui platform Google Form. Berdasarkan data yang diperolehi, seramai 11 pelajar lelaki dan 31 pelajar perempuan yang telah menjawab soal selidik ini.

Jadual 3.0. Bilangan jantina

Jantina	Kekerapan	Peratusan
Lelaki	11	26.2%
Perempuan	31	73.8%
Jumlah	42	100%

3.1.1 Perbezaan tahap keinginan menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar berdasarkan jantina

Pengkaji menjalankan ujian T bagi Dua Sampel Bebas bagi mengenalpasti tahap keinginan menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar berdasarkan jantina. Sebelum menentukan sama ada statistik t berbeza secara signifikan, pengkaji telah menjalankan ujian *Levene* untuk memastikan varians kedua-dua kumpulan adalah sama atau berbeza secara signifikan. Hasil ujian *Levene* mendapati nilai F=1.595 dan nilai P=0.214 (P>0.05). Ini menunjukkan bahawa varians tahap keinginan menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar lelaki dan perempuan adalah tidak berbeza secara signifikan. Dengan kata lain, kedua-dua varians adalah sama. Oleh itu, pengkaji melihat nilai t pada bahagian pernyataan *"Equal Variances assumed"*. Hasil analisis ujian T bagi dua sampel bebas ini dapat dijelaskan melalui Jadual 4.0 berikut,

Jadual 4.0. Perbezaan tahap keinginan menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar berdasarkan jantina

	Jantina	**N**	**Min**	**Nilai T**	**df**	**Sig**
Tahap keinginan	Lelaki	11	3.87	-0.63	40	0.52
	Perempuan	31	4.02			

Berdasarkan Jadual 4.0, tidak terdapat perbezaan yang signifikan tahap keinginan berdasarkan jantina dengan nilai t (40) = -0.63 dan nilai P= 0.52 (P>0.05). Jika dilihat dari segi min menunjukkan tahap keinginan pelajar lelaki dengan nilai min=3.87, manakala pelajar perempuan pula dengan nilai min=4.02. Ini menunjukkan bahawa secara signifikannya, tahap keinginan pelajar perempuan lebih tinggi daripada pelajar lelaki.

3.1.2 Perbezaan tahap manfaat menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar berdasarkan jantina

Pengkaji menjalankan ujian T bagi Dua Sampel Bebas bagi mengenalpasti tahap manfaat menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar berdasarkan jantina. Sebelum menentukan sama ada statistik t berbeza secara signifikan, pengkaji telah menjalankan ujian *Levene* untuk memastikan varians kedua-dua kumpulan adalah sama atau berbeza secara signifikan. Hasil ujian *Levene* mendapati nilai F=0.259 dan nilai P=0.61 (P>0.05). Ini menunjukkan bahawa varians tahap manfaat yang diperolehi pelajar lelaki dan perempuan adalah tidak berbeza secara signifikan. Dengan kata lain, kedua-dua varians adalah sama. Oleh itu, pengkaji melihat nilai t pada bahagian pernyataan *"Equal Variances assumed"*. Hasil analisis ujian T bagi dua sampel bebas ini dapat dijelaskan melalui Jadual 5.0 berikut,

Jadual 5.0. Perbezaan tahap manfaat menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar berdasarkan jantina

	Jantina	**N**	**Min**	**Nilai T**	**df**	**Sig**
Tahap manfaat	Lelaki	11	4.34	-0.60	40	0.55
	Perempuan	31	4.20			

Berdasarkan Jadual 5.0 tidak terdapat perbezaan yang signifikan tahap manfaat berdasarkan jantina dengan nilai t (40) = -0.60 dan nilai P= 0.55 (P>0.05). Jika dilihat dari segi min menunjukkan tahap manfaat pelajar lelaki dengan nilai min=3.87, manakala pelajar perempuan pula dengan nilai min=4.02. Ini menunjukkan bahawa secara signifikannya, tahap manfaat pelajar perempuan dan pelajar lelaki tidak menunjukkan perbezaan yang ketara di antara satu sama lain.

3.2 Analisis Deskriptif Kajian

Analisis deskriptif yang diukur melalui kekerapan, peratus, min dan sisihan piawai digunakan untuk menjelaskan dapatan kajian bagi mengenal pasti tahap keinginan dan manfaat menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar.

3.2.1 Tahap keinginan menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar

Jadual 6.0 menunjukkan secara keseluruhannya tahap keinginan menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar berada pada tahap yang tinggi iaitu dengan nilai skor min=3.98 dan sisihan piawai=0.67. Interpretasi skor min ini berdasarkan Saffana (2021) yang mengatakan nilai skor min berada di antara nilai 3.33 hingga 5.00 adalah tinggi. Hal ini menunjukkan bahawa tahap keinginan pelajar untuk menggunakan aplikasi Blipp Me adalah baik. Tahap keinginan yang tinggi ini dapat dilihat melalui jawapan yang diberikan oleh responden. Hasil dapatan menunjukkan item yang berada pada tahap yang tinggi adalah *"Saya seronok menggunakan Blipp Me ini"* iaitu dengan nilai min= 4.14, sisihan piawai=0.78, diikuti dengan *"Saya berminat menggunakan Blipp Me ini sewaktu sesi pembelajaran"* dengan nilai min=4.05, sisihan piawai= 0.79 dan *"Saya ingin terus menggunakan Blipp Me ini dalam pembelajaran"* dengan nilai min=4.05, sisihan piawai= 0.82. Selain itu, item keempat tertinggi adalah pada item *"Blipp Me membantu saya mengulangkaji pelajaran dengan mudah"* dengan nilai min=4.02, sisihan piawai=0.11. Item min yang paling rendah tetapi dalam interpretasi adalah tinggi iaitu pada item *"Saya merasa rugi jika tidak mencuba menggunakan Blipp Me"* dengan nilai min=3.67, sisihan piawai=1.07. Hal ini adalah kerana, nilai keseluruhannya min adalah lebih tinggi daripada nilai min item ini. Dapatan ini menunjukkan pelajar sangat berkeinginan untuk menggunakan Blipp Me dalam proses pembelajaran.

Jadual 6.0 Analisis skor Min bagi konstruk tahap keinginan menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar

Konstruk keinginan pelajar	**Min**	**Sisihan Piawai**	**Interpretasi**
Saya seronok menggunakan Blipp Me ini	4.14	0.78	Tinggi
Saya berminat menggunakan Blipp Me ini sewaktu sesi pembelajaran	4.05	0.79	Tinggi
Saya ingin terus menggunakan Blipp Me ini dalam pembelajaran	4.05	0.82	Tinggi
Blipp Me membantu saya mengulangkaji pelajaran dengan mudah	4.02	0.81	Tinggi
Saya merasa rugi jika tidak mencuba menggunakan Blipp Me	3.67	1.07	Tinggi
Jumlah	3.98	0.67	Tinggi

3.2.2 Tahap manfaat menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar

Jadual 7.0 menunjukkan secara keseluruhannya tahap manfaat menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar berada pada tahap yang tinggi iaitu dengan nilai skor min=4.23 dan sisihan piawai=0.65. Interpretasi skor min ini berdasarkan Saffana (2021) yang mengatakan nilai skor min berada di antara nilai 3.33 hingga 5.00 adalah tinggi. Hal ini menunjukkan bahawa tahap manfaat yang diperolehi pelajar apabila menggunakan aplikasi Blipp Me adalah baik. Tahap manfaat yang tinggi ini dapat dilihat melalui jawapan yang diberikan oleh responden. Hasil dapatan menunjukkan item yang berada pada tahap yang tinggi adalah *"Mendedahkan pelajar kepada pembelajaran secara digital"* dengan nilai min=4.38, sisihan piawai= 0.69, diikuti dengan item *"Menggalakkan pelajar berinteraksi dengan guru"*

dengan nilai min=4.26, sisihan piawai=0.82. Item min yang paling rendah tetapi dalam interpretasi adalah tinggi iaitu pada item *"Menggalakkan pelajar berinteraksi dengan rakan-rakan"* dengan nilai min=4.19, sisihan piawai= 0.77 dan *"Meningkatkan motivasi dan minat pelajar dalam mengulangkaji pelajaran"* dengan nilai min= 4.12, sisihan piawai= 0.73. Hal ini adalah kerana, nilai keseluruhannya min adalah lebih tinggi daripada nilai min item ini. Dapatan ini menunjukkan pelajar memperolehi manfaat daripada penggunaan aplikasi Blipp Me dalam proses pembelajaran.

Jadual 7.0 Tahap manfaat menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar

Konstruk manfaat penggunaan	**Min**	**Sisihan Piawai**	**Interpretasi**
Mendedahkan pelajar kepada pembelajaran secara digital	4.38	0.69	Tinggi
Menggalakkan pelajar berinteraksi dengan guru	4.26	0.82	Tinggi
Menggalakkan pelajar berinteraksi dengan rakan-rakan	4.19	0.77	Tinggi
Meningkatkan motivasi dan minat pelajar dalam mengulangkaji pelajaran	4.12	0.73	Tinggi
Jumlah	4.23	0.65	Tinggi

3.3 Hubungan diantara keinginan dan manfaar menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar

Analisis Kolerasi Pearson telah dijalankan bagi mengenal pasti hubungan kedua-dua pemboleh ubah iaitu keinginan dan manfaat menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar. Jadual 8.0 menunjukkan nilai pekali Kolerasi Pearson antara keinginan dan manfaat adalah r=0.695 (p= 0.00). Ini menunjukkan kedua-dua pemboleh ubah berhubungan secara positif dengan kekuatan perhubungan yang kuat.

Jadual 8.0 Hubungan diantara keinginan dan manfaat menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar

Konstruk	**Pekali Kolerasi Pearson (r)**	**Tahap signifikan**	**Interpretasi kekuatan hubungan**
Keinginan	0.695	0.00	Kuat

Secara rumusannya, keputusan kajian menunjukkan terdapat hubungan yang signifikan diantara keinginan dan manfaat menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar.

3.4 Ujian kebolehpercayaan

Berdasarkan Jadual 9.0 menunjukkan nilai Alpa Croncbach yang diperolehi ialah 0.84 bagi konstruk keinginan dan 0.88 bagi konstruk manfaat menunjukkan bahawa item dalam soal selidik mempunyai kebolehpercayaan yanag baik dan boleh diterima (Mohamad, Hamzah, & Osman, 2020).

Jadual 9.0 Ujian kebolehpercayaan

Bil	Konstruk	ID Item	Jumlah Item	Nilai kebolehpercayaan
1	Keinginan	Q1-Q5	5	0.84
2	Manfaat	Q6-Q9	4	0.88

4. Perbincangan

Kajian ini telah dijalankan keatas pelajar semester 1 sesi 1 2021/2022 yang telah mengambil kursus MPU21032 Penghayatan Etika dan Peradaban dengan melibatkan seramai 42 orang pelajar. Kajian ini ingin melihat perbezaan keinginan dan manfaat menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar berdasarkan jantina. Dapatan menunjukkan tidak terdapat perbezaan signifikan diantara keinginan dan manfaat menggunakan aplikasi Blipp me dalam proses pembelajaran pelajar berdasarkan jantina. Hal ini menunjukkan bahawa pelajar lelaki dan perempuan mempunyai keinginan untuk menggunakan aplikasi Blipp Me dan mereka juga memperolehi manfaat yang sama daripada penggunaan aplikasi Blipp Me ini. Ini bertepatan dengan kajian yang dilakukan oleh Norasyikin Osman dan Mohd Isa Hamzah (2016) menunjukkan, tiada perbezaan besar antara skor min pelajar lelaki dan pelajar perempuan mengikuti pembelajaran berasaskan blended learning.

Dapatan kajian secara keseluruhannya menunjukkan tahap keinginan menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar adalah tinggi dengan nilai min keseluruhan adalah 3.98 dan sisihan piawai adalah 0.67. Kajian mendapati min item-item yang paling tinggi dalam konstruk keinginan adalah dari aspek seronok, minat dan keterujaan. Hal ini bertepatan dengan kajian yang dijalankan oleh Safar et al. (2017) menunjukkan, keupayaan yang ditawarkan oleh AR memberikan keseronokan kerana keupayaan yang ditawarkan oleh aplikasi ini menjadikan interaksi lebih bermakna. Selain itu, hasil dapatan menunjukkan terdapat pelajar yang setuju bahawa mereka tidak merasa rugi untuk menggunakan aplikasi Blipp Me ini kerana mereka mempunyai pengetahuan yang terhad dalam AR. Menurut kajian yang dijalankan oleh Muhaini et al. (2022) menunjukkan, murid menghadapi halang untuk mengikuti PdP secara atas talian disebabkan oleh pengetahuan yang terhad dalam bidang teknologi.

Dapatan kajian seterusnya menunjukkan, keseluruhan tahap manfaat menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar adalah tinggi dengan nilai min keseluruhan adalah 4.23 dan sisihan piawai adalah 0.65. Hal ini bertepatan dengan kajian yang dijalankan oleh Fkrudin et al. (2018) menunjukkan, pengguna akan lebih bermotivasi apabila aplikasi yang digunakan dapat memberi kepuasan kepada mereka. Menurut kajian yang dijalankan oleh Ahmad et al. (2017) menunjukkan, pelajar berminat untuk mempelajar subjek TITAS melalui kaedah gabungan teknologi kreatif dan Artificial Intelligence (AI). Selain itu, kajian yang dijalankan oleh Ghazali dan Halim (2022) menunjukkan bahawa, pembelajaran dalam talian memberi impak yang signifikan dalam perhubungan guru dan pelajar, pelajar dan bahan pembelajaran dan juga dalam kalangan pelajar sendiri. Bagi nilai min yang rendah menunjukkan pelajar kurang berinteraksi dengan rakan disebabkan oleh faktor kawalan diri

sendiri. Hal ini bertentangan dengan dapatan Yusup Hashim (2012) menunjukkan, penggunaan rangkaian dalam talian mampu menghubungkan pelajar dengan pelajar. Selain itu, aplikasi ini dilihat tidak meningkatkan motivasi dan minat pelajar. Hal ini disebakan oleh faktor bosan menggunakan aplikasi ini. Menurut kajian yang dijalankan oleh Nawi et al. (2014) menunjukkan, penggunaan unsur-unsur yang kompleks dalam aplikasi perlu dijauhi kerana dapat mengakibatkan pengguna bosan yang boleh memberi kesan buruk kepada pengguna.

Berdasarkan analisis Kolerasi Pearson menunjukkan terdapat hubungan yang signifikan diantara keinginan dan manfaat menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar. Hal ini bertepatan dengan kajian yang dilakukan oleh Mohamad et al. (2020) jelas menunjukkan, aspek keinginan dan manfaat menunjukkan bacaan skor purata skor min yang tinggi.

5. Kesimpulan

Kajian ini dilaksanakan adalah untuk melihat tahap keinginan dan manfaat menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar. Hasil dapatan yang diperolehi menunjukkan tahap keinginan dan manfaat menggunakan aplikasi Blipp Me dalam proses pembelajaran pelajar adalah amat baik dalam usaha menghasilkan pembelajaran kreatif bagi meningkatkan kefahaman pelajar. Ini dapat dibuktikan daripada data yang diperolehi jelas menunjukkan aspek keinginan dan manfaat yang mencatatkan bacaan purata skor min pada tahap interpretasi yang tinggi. Dapatan Mat Lui dan Ahmad (2021) menunjukkan perubahan sifat pelajar seperti minat terhadap subjek yang dipelajari dipengaruhi oleh alat bantu mengajar yang kreatif dan seterusnya mampu untuk meningkatkan pencapaian pelajar. Kajian ini secara tidak langsung telah membantu pensyarah untuk mengenalpasti bahan bantu mengajar yang dapat menarik minat pelajar seterusnya meningkatkan kefahaman pelajar dalam proses pengajaran dan pembelajaran (PdP) terutamanya bagi kursus MPU21032 Penghayatan Etika dan Peradaban. Hal ini bertepatan dengan teras ke-4 Jabatan Politeknik dan Kolej Komuniti (JPPKK) untuk menerajui sistem pendidikan melalui TVET 4.0. Kajian ini diharapkan dapat diteruskan pada masa hadapan dengan melihat kepada keupayaan bahan bantu mengajar dalam meningkatkan kefahaman pelajar dalam proses pengajaran dan pembelajaran (PdP).

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