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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.

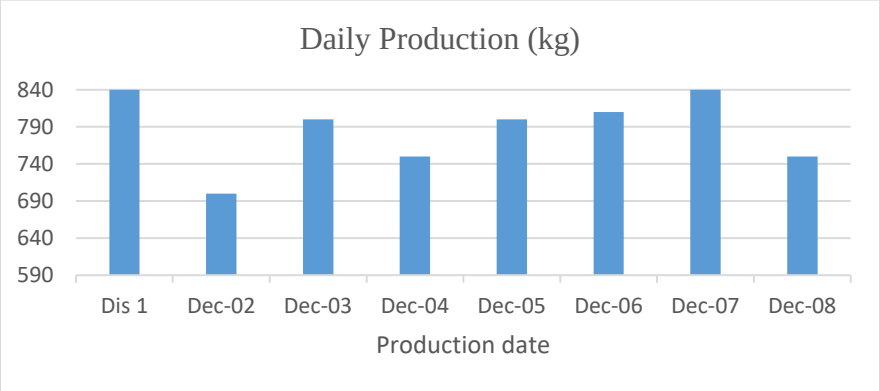

Figure 2. Graph shows the daily production rate of boneless thigh before the implementation of solution

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.

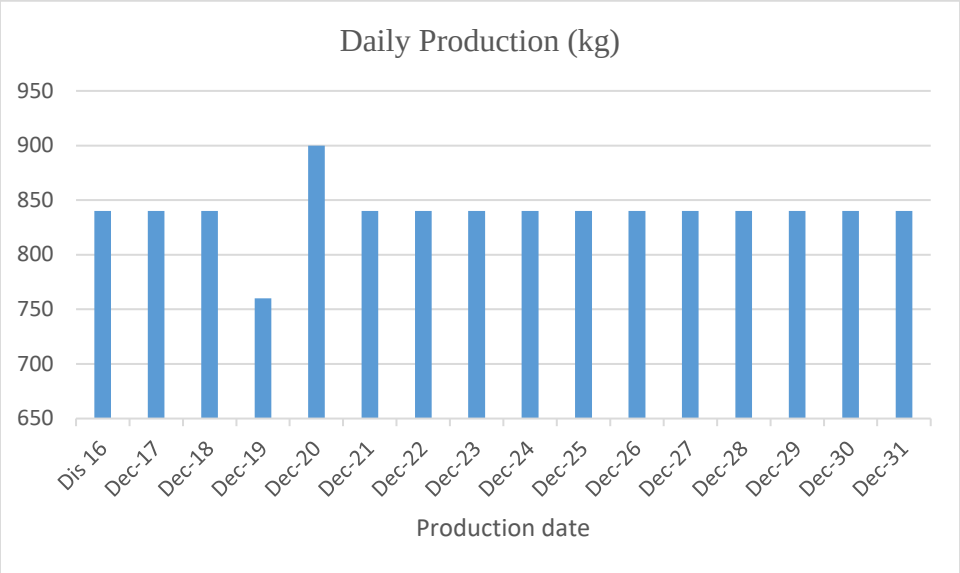

Figure 4. Graph shows the daily production rate of boneless thigh before the implementation of solution for the month of December 2021

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.

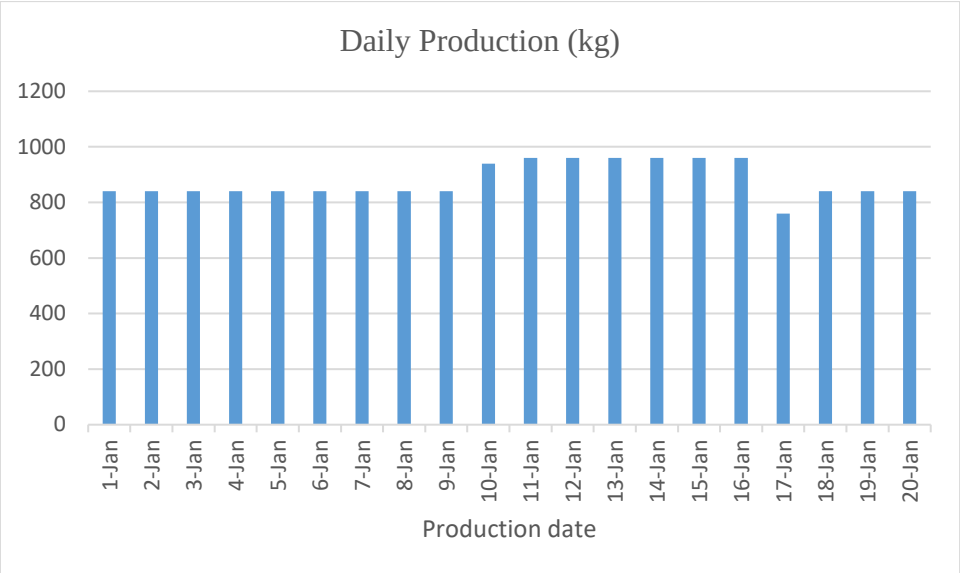

Figure 5. Graph shows the daily production rate of boneless thigh before the implementation of solution for the month of January 2022

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).

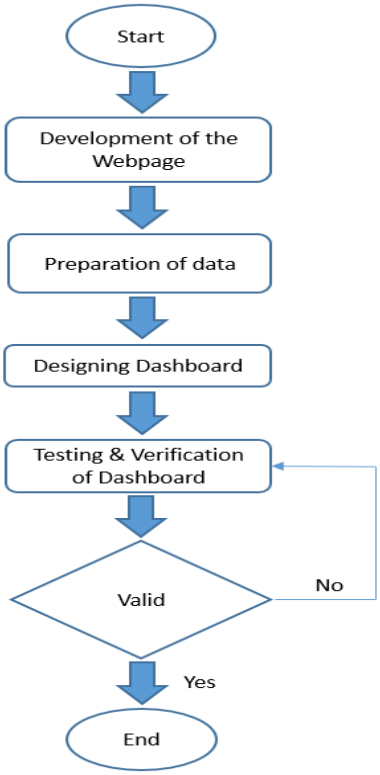

Figure 1. The process flow of developing a dashboard.

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.

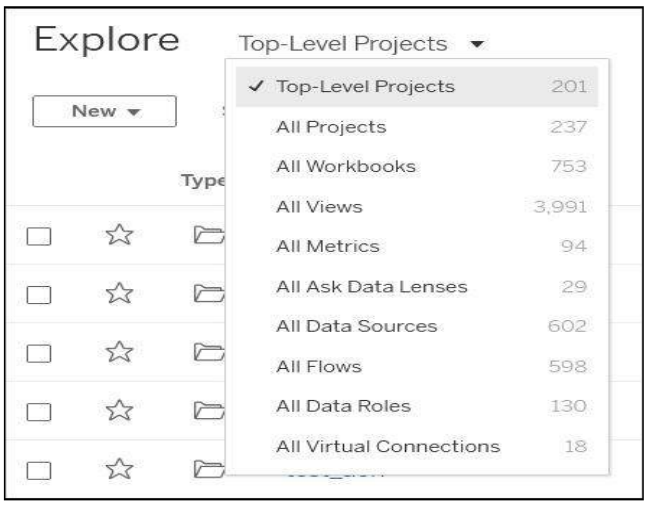

Figure 2. Explore the project webpage of Tableau

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.

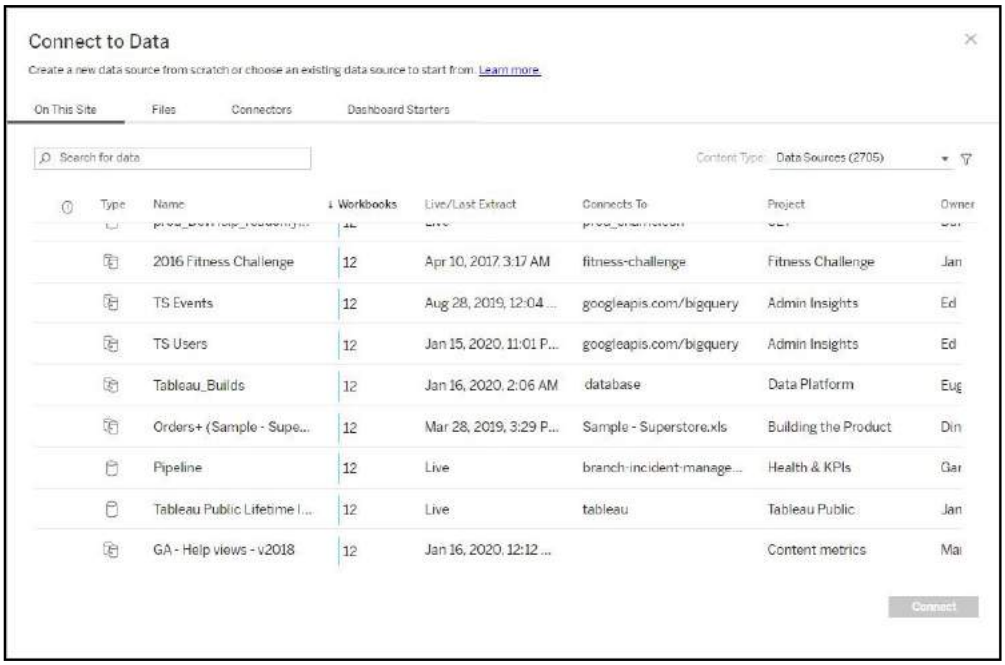

Figure 3. Connect to data web-page of tableau

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.

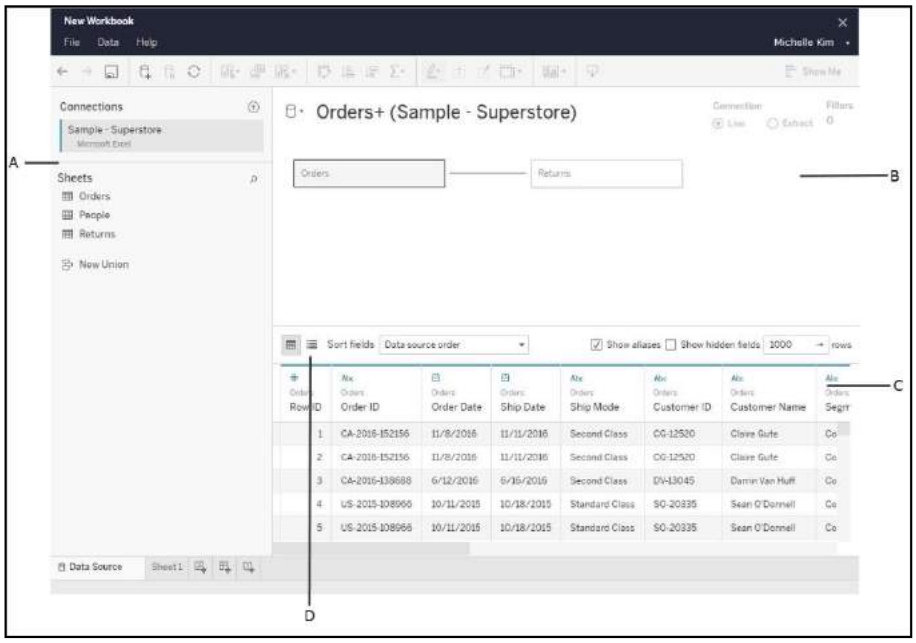

Figure 4. Parts of the data source page

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.

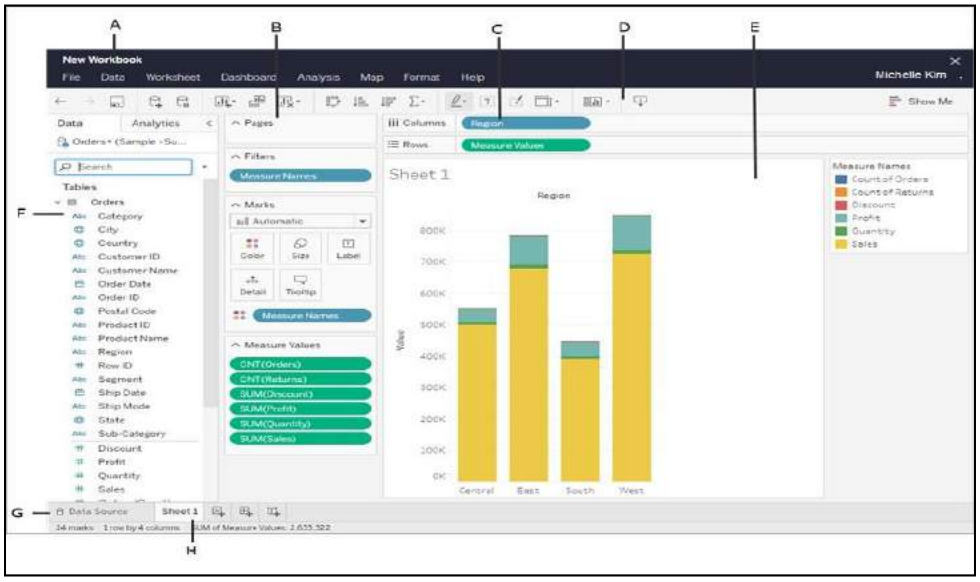

Figure 5. Layout of the dashboard workspace

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.

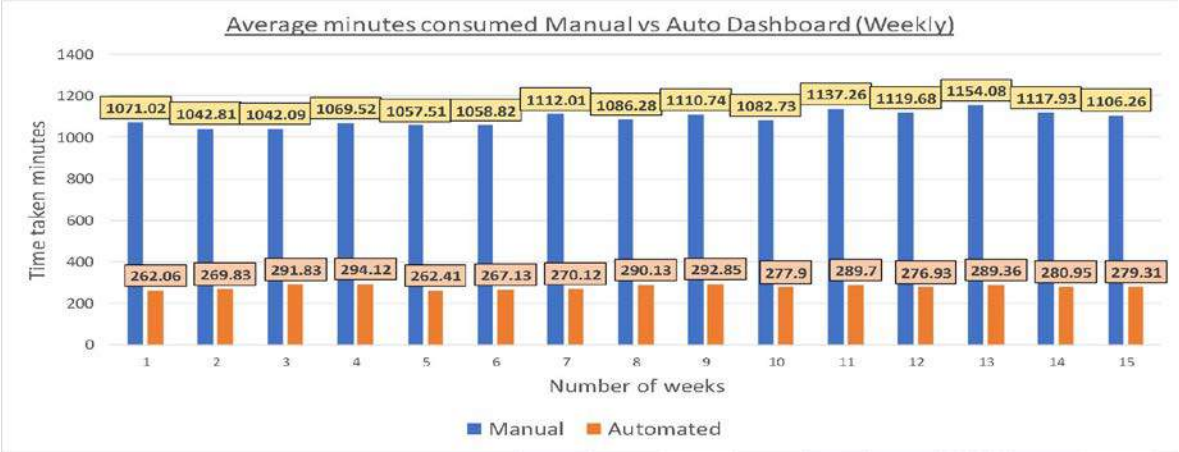

Figure 7. Average time consumption for Manual vs. Auto Dashboard (weekly)

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.

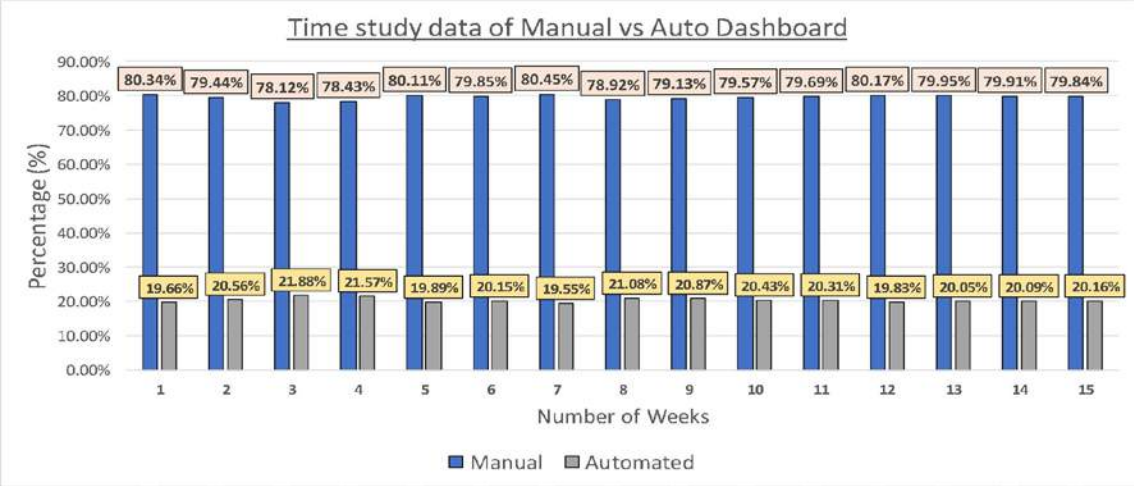

Figure 8. Average minutes of Manual vs. Auto Dashboard (weekly)

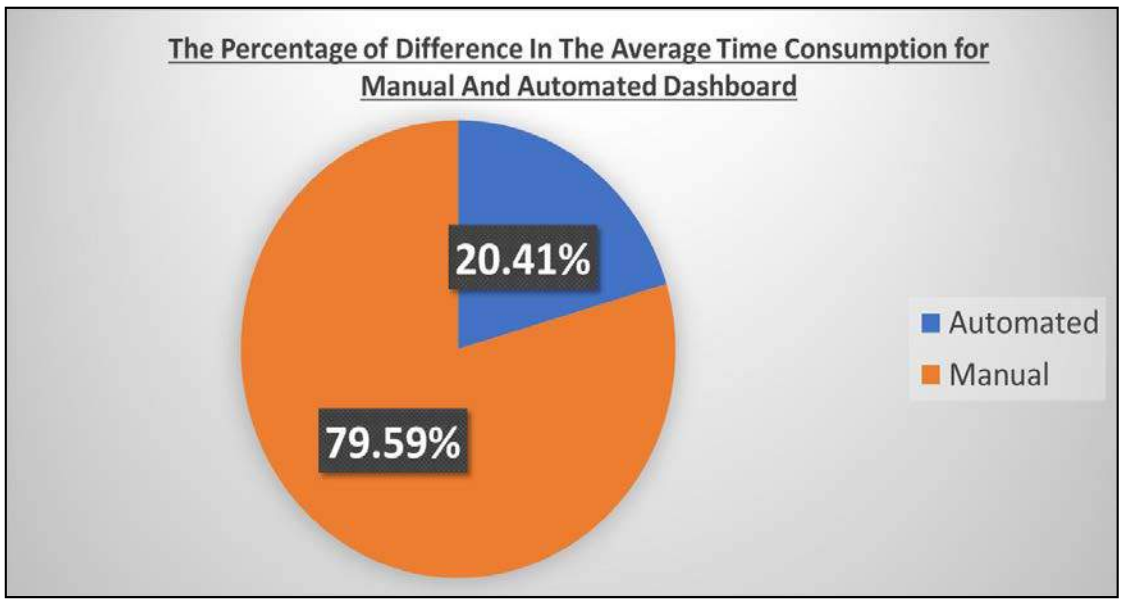

Figure 9. The Difference in time consumption for Manual and Automated Dashboard

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).

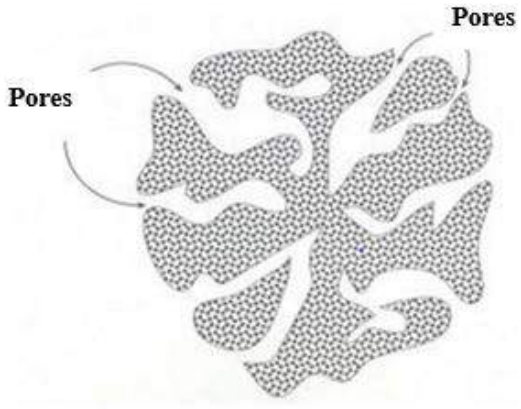

Figure 1. Numerous pores of the activated carbon (Abechi *et al.,* 2013)

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)

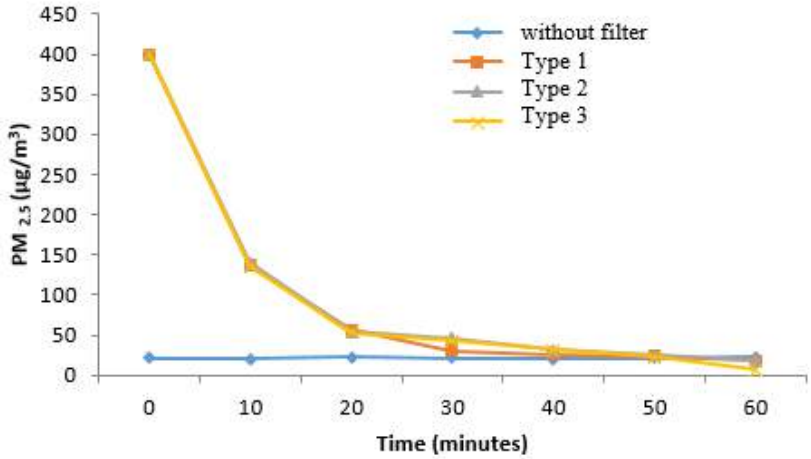

Figure 3. $PM_{2.5}$ in various filtration methods

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

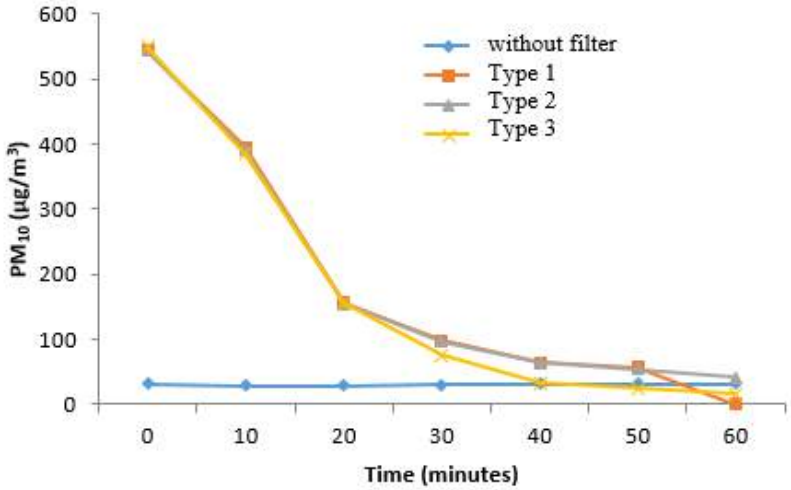

Figure 4. PM_{10} in various filtration methods

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.

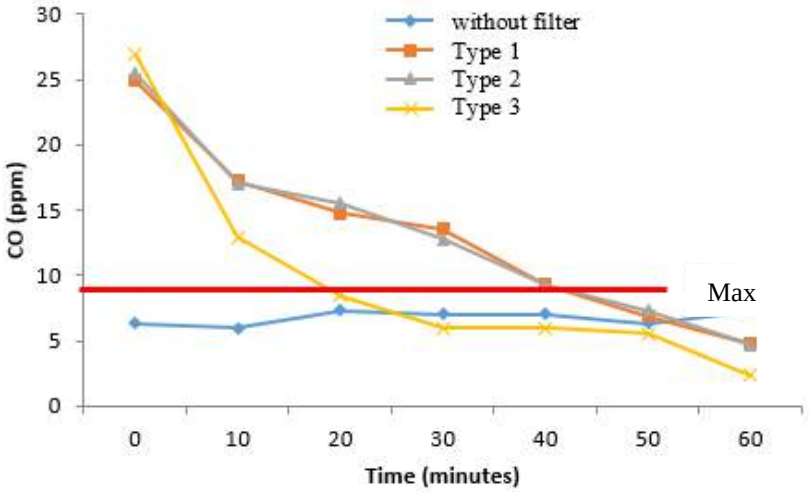

Figure 5. CO in various filtration methods

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.

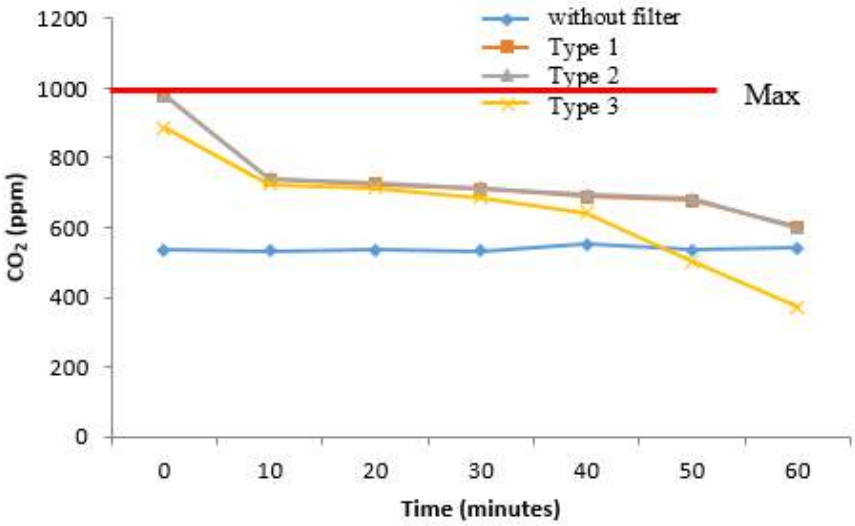

Figure 6. CO_2 in various filtration methods

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).

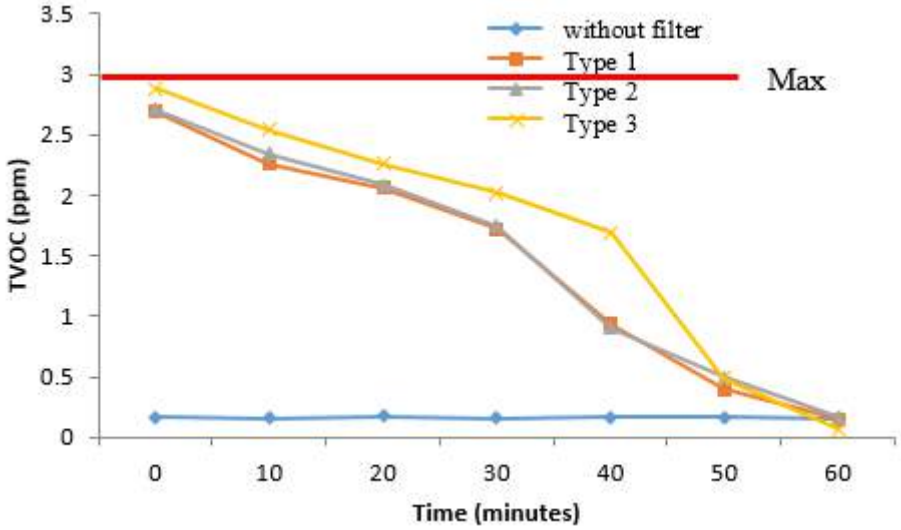

Figure 7. TVOC in various filtration methods

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.

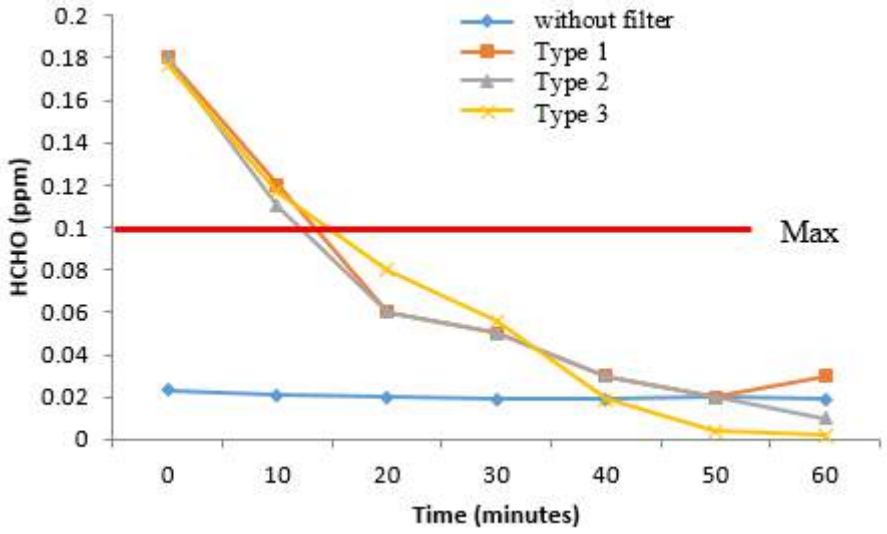

Figure 8. HCHO in various filtration methods

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.

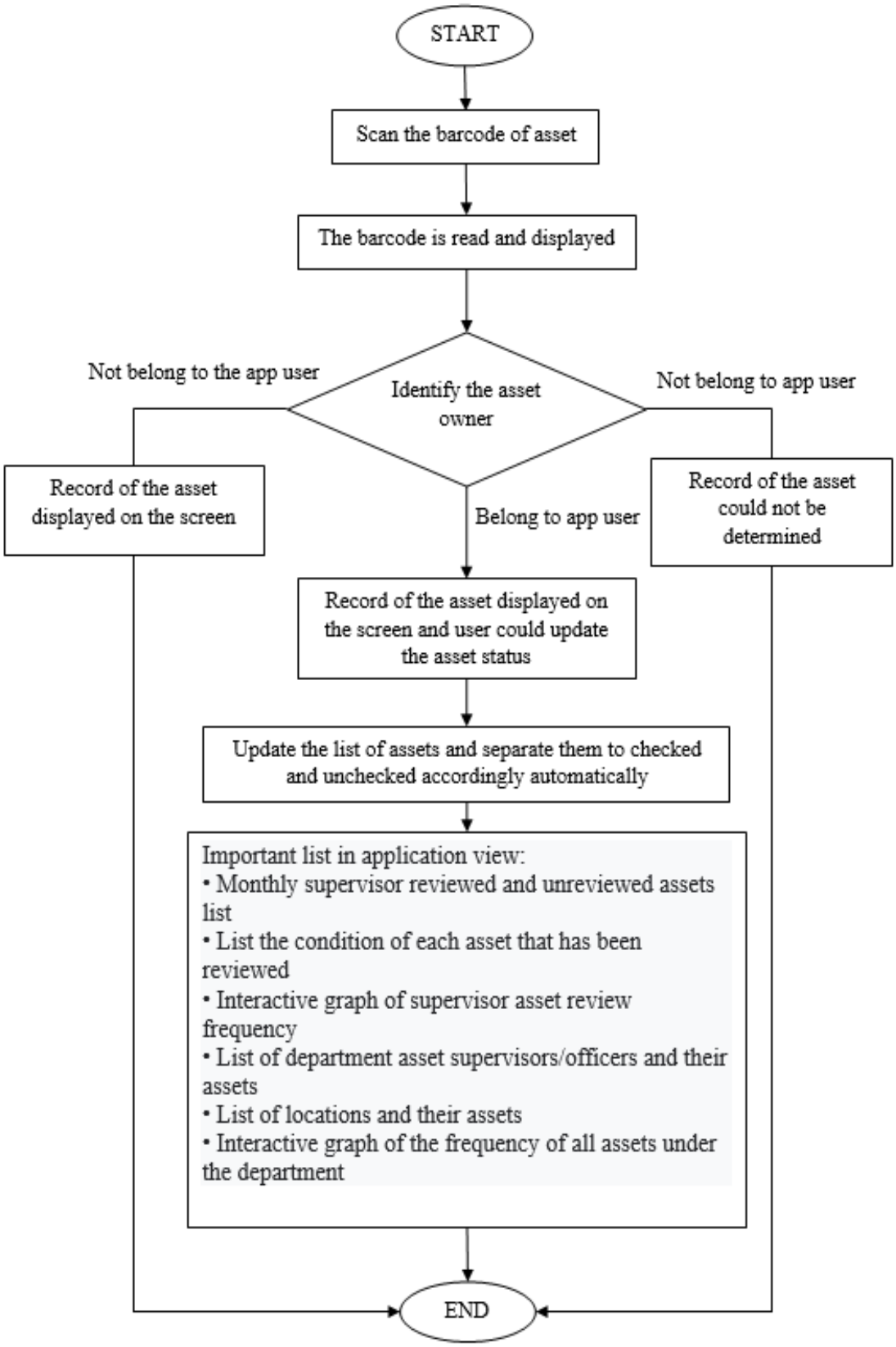

Figure 1: Flow chart for the proposed system

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

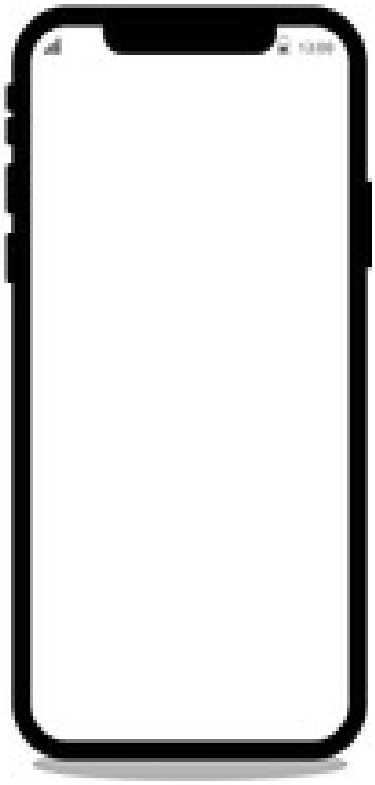

Figure 5: The application could tracks the asset details through handphone and used to update the asset status with ease

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

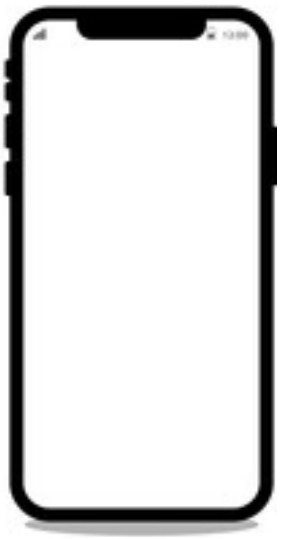

Figure 7: Details of asset status records

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 be aligned with CLOs, PLOs and lastly PEO were measured correctly.

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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). 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
ii. Aligning instruction and assessment
iii. Using formative assessment
iv. Providing opportunities for practice and application

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	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	Spady & Marshall, (1991) ;Reich et al., (2019); Gunarathne et al., (2019);

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 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. Whilst, Figure 1 shows how constructive alignment in curriculum whereby all rubrics and assessment given to students reflected back to PEO.

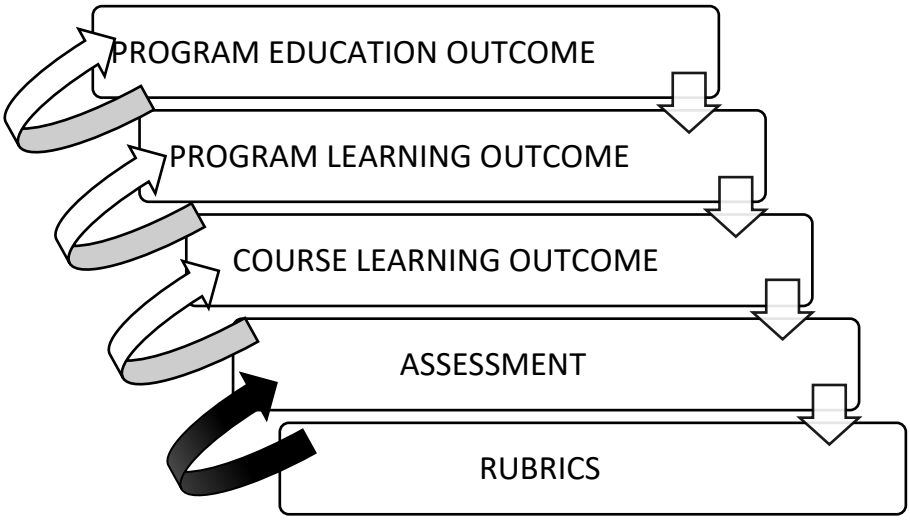

Figure 1: Constructive Alignment in Curriculum

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 2 shows the research framework for this study.

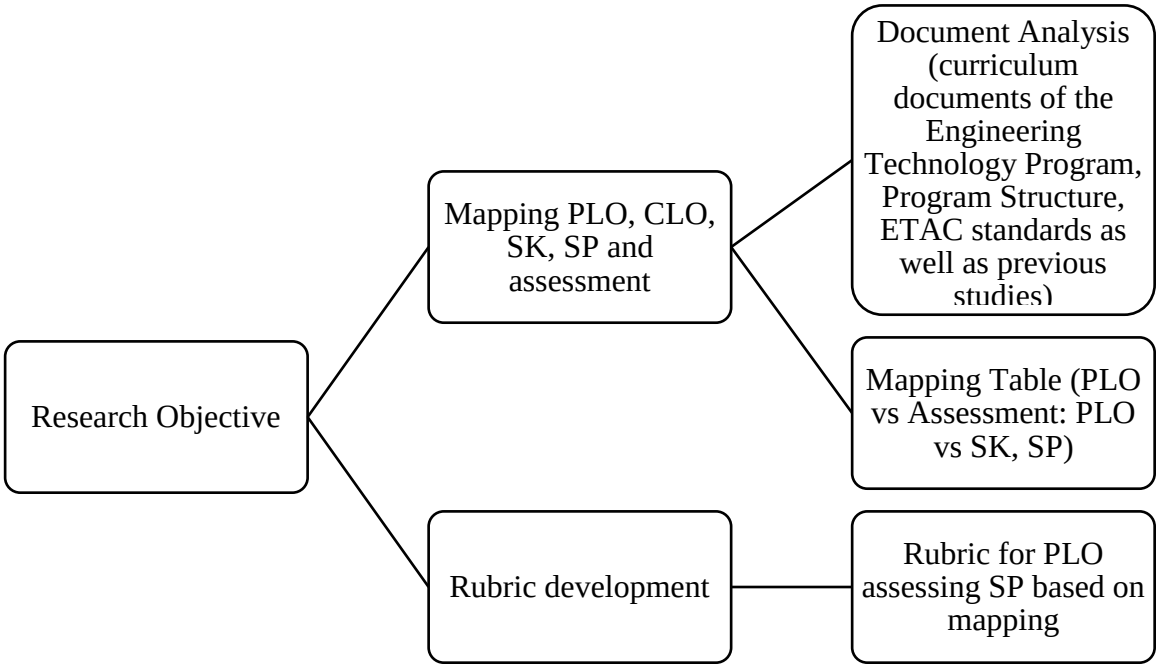

Figure 2: Research Framework

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	PLO1-Engineering Knowledge	SK1-SK4	SP1 and some or all of SP2 to SP7:	Test, Exam , Quiz
2	PLO1-Engineering Knowledge	SK1-SK4	SP1 and some or all of SP2 to SP7:	Test, Exam, Quiz, Case Study, Tutorial
3	PLO1-Engineering Knowledge	SK5	SP1 and some or all of SP2 to SP7:	Test, Exam, Quiz, Case Study, Mini Project, Captone Project
4	PLO2-Problem Analysis	SK8	SP1 and some or all of SP2 to SP7:	Case Study, Mini Project, Lab Report, Site Visit
5	PLO2-Problem Analysis	SK6	SP1 and some or all of SP2 to SP7:	Mini Project, Lab Report, Project Presentation, Captone Project
6	PLO2-Problem Analysis	SK7	SP1 and some or all of SP2 to SP7:	Case Study, Mini Project, Site Visit, Presentation, Appraisal, Reflective Journal, Captone Project
7	PLO3-Design/Development of Solutions	SK7	SP1 and some or all of SP2 to SP7	Case Study, Mini Project, Site Visit, Appraisal, Reflective Journal, Presentation, Captone Project
8	PLO4-Investigation	SK7		Case Study, Mini Project, Site Visit, Appraisal, Reflective Journal, Presentation, Captone Project
9	PLO5-Modern Tool Usage			Case Study, Mini Project, Site Visit, Appraisal, Reflective Journal, Presentation, Captone Project
10	PLO6-The Engineer and Society	TA1-TA5 (ANY 1 OR MORE)		Case Study, Mini Project, Site Visit, Appraisal, Reflective Journal, Presentation, Captone Project
11	PLO7-Environment and Sustainability			Case Study, Mini Project, Site Visit, Appraisal, Reflective Journal. Presentation, Captone Project
12	PLO8-Ethics			Case Study, Mini Project, Site Visit, Appraisal, Reflective Journal, Presentation, Captone Project

Table 4: PLO vs SK and SP

PLO	SP1								SP2	SP3	SP4	SP5	SP6	SP7
	SK1	SK2	SK3	SK4	SK5	SK6	SK7	SK8						
PLO1-Engineering Knowledge	/	/	/	/					/	/				
PLO1-Engineering Knowledge	/	/	/	/							/	/		
PLO1-Engineering Knowledge	/	/	/	/									/	/
PLO2-Problem Analysis	/	/	/	/					/	/				
PLO2-Problem Analysis	/	/	/	/							/	/		
PLO2-Problem Analysis	/	/	/	/									/	/
PLO3-Design/Development of Solutions	/	/	/	/							/	/		
PLO4-Investigation				/				/				/	/	
PLO5-Modern Tool Usage				/		/					/	/		
PLO6-The Engineer and Society						/	/						/	/
PLO7-Environment and Sustainability				/			/		/	/				
PLO8-Ethics							/							

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 3 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

PLO	TA1	TA2	TA3	TA4	TA5	
PLO9-Individual and Team work						
PLO10-Communication	/	/	/	/	/	Written Report, prototype, drawing, modelling Verbal Presentation, viva *Rubric need to be design according to TA1-TA5 depend on type of assessment taken.*
PLO11-Project Management and Finance						
PLO12-Lifelong learning						

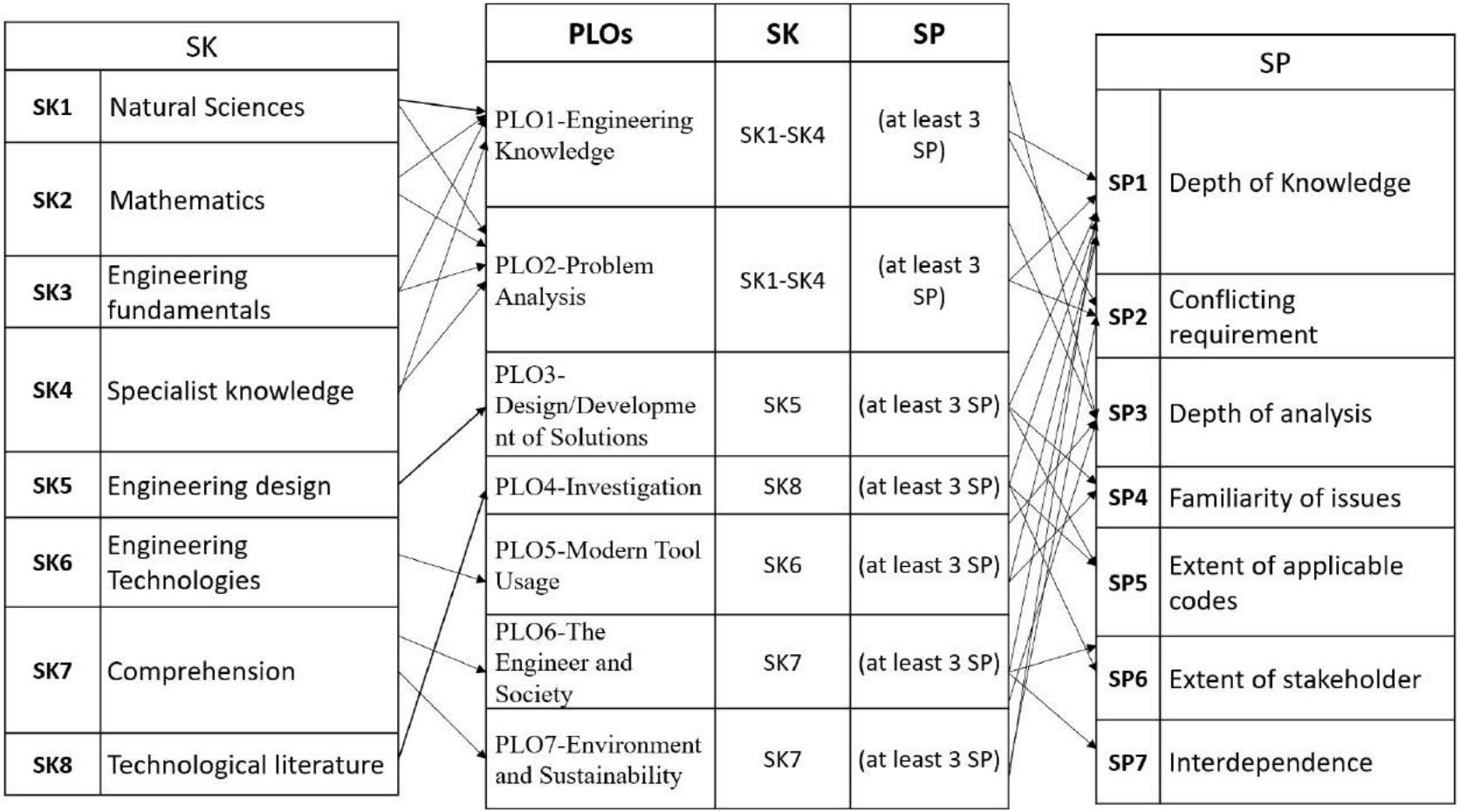

Figure 3: Summary of PLOs, SPs and SKs Mapping

Later, scoring rubric for the intended PLO was developed to assess a assignment for designated course. Example, a case study under this designated course were mapped with PLO5. Therefore, according to Figure 3, 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.

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. 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 instrumen soal 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 yang lebih 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 kepada pelajar 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 dan pembelajaran 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 yang digunakan.

Jadual 2: Instrumen Kajian

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

2.4 Kaedah Pengukuran

Pemberian skala untuk bahagian maklumat demografi responden adalah seperti Jadual 3 :

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 seperti jadual 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 Jadual 5. 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 di dalam 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 kalangan pelajar	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 untuk dismpan 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_Notes ini, 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 nilai skor 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 selesa bagi 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 juga berada 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 juga pada tahap tinggi. Bagi Item 5 iaitu pembelajaran mengggunakan Java e_Notes dapat menaikkan 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 nota biasa, penggunaan Java e_Notes ini akan menjimatkan masa pelajar seterusnya menjimatkan 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 dalam aplikasi 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 membantu serta 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 para pelajar 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.

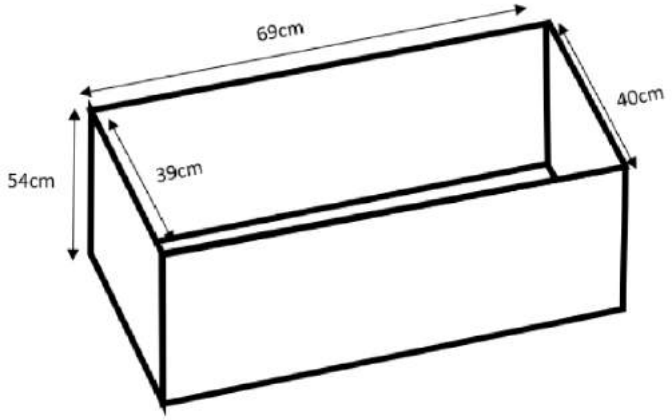

Figure 1. Schematic design Airvent Cover

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.

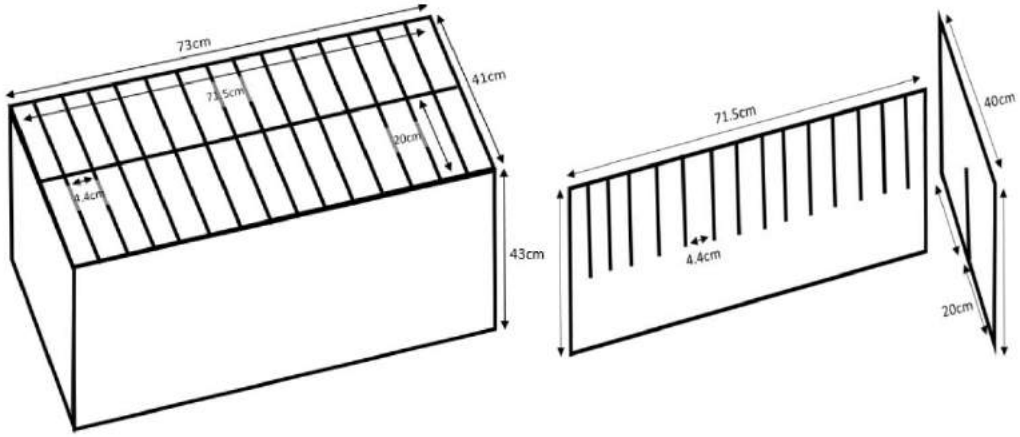

Figure 2. Schematic design Armrest & Rear Storage

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.

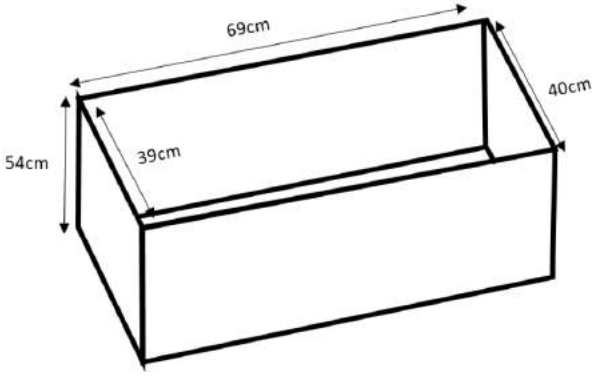

Figure 3. Schematic design Front Bezel

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.

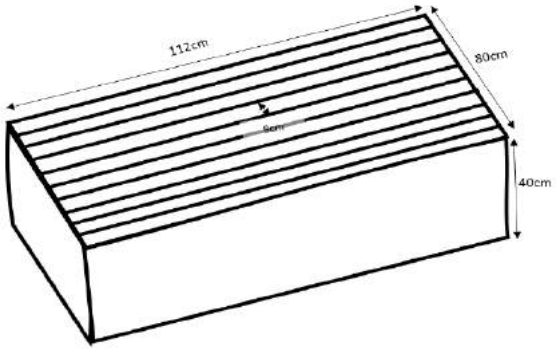

Figure 4. Schematic design Side Panel Upper RH & LH

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.

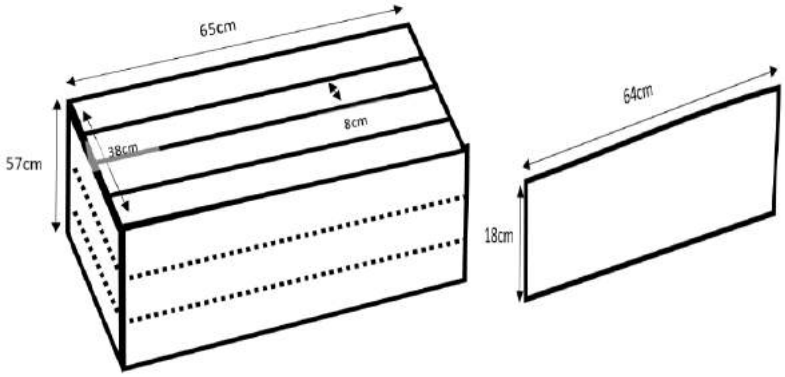

Figure 5. Schematic design Side Panel Bolster RH & LH

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.

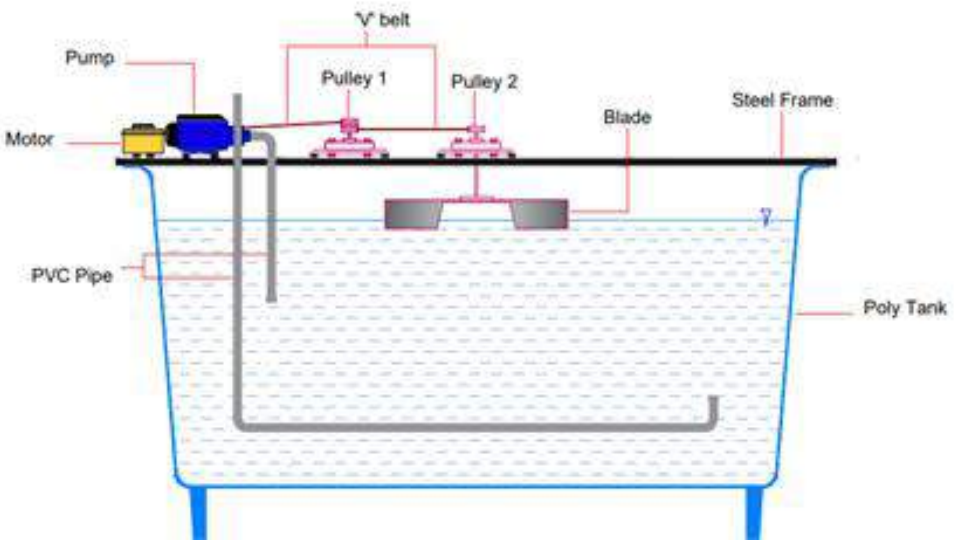

Figure 1. Schematic view of ecofan system

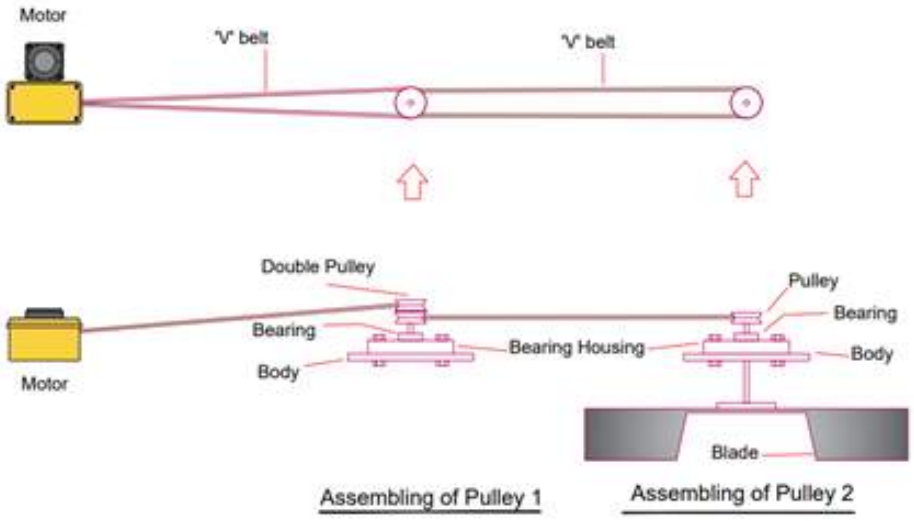

Figure 2. Pully system of ecofan

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).

1. 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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PENILAIAN TERHADAP DOMAIN PEMANTAUAN PENGAJARAN DAN PEMBELAJARAN JABATAN PENGAJIAN AM POLITEKNIK UNGKU OMAR

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ABSTRAK

Kajian ini bertujuan mengenal pasti pengukuran tahap kompetensi pemantauan pengajaran dan pembelajaran Jabatan Pengajian Am untuk pengajian Diploma dan ijazah Sarjana Muda. Kajian tinjauan ini melibatkan 40 orang responden pensyarah kursus mata pelajaran umum seperti Bahasa Inggeris, Pengajian Islam, Pendidikan Moral dan lain-lain. Pemantauan ini melibatkan 16 kursus yang ditawarkan kepada semua pelajar. Objektif kajian menilai domain-domain yang terdapat dalam garis panduan yang ditetapkan oleh Jabatan Pengajian Politeknik Kolej Komuniti 2019. Daripada dapatan kajian, maka didapati pemantauan PdP pensyarah yang dilakukan oleh pensyarah pemantau dan pelajar tiada perbezaan markah yang besar jika dibandingkan antara keduanya. Ini menjelaskan terdapatnya kesamaan dari sudut pandangan antara pensyarah pemantau dan juga pelajar terhadap proses PdP yang telah dilaksanakan oleh pensyarah di Jabatan Pengajian Am Politeknik Ungku Omar . Dengan melihat kepada purata markah skor pemantau 94.5 dan skor pelajar 92.55 yang telah diberikan, pengukuran tahap kompetensi pensyarah terhadap PdP berada dalam keadaan baik dan cemerlang. Impak kajian ini dapat meningkatkan kualiti pengajaran dan pembelajaran para pensyarah untuk mengembangkan strategi pengajaran yang lebih aktif bersesuaian dengan keperluan pelajar pada masa kini. Bagi memantapkan pengajaran dan pembelajaran, analisis keberkesanan kaedah pengajaran, penilaian kandungan pembelajaran serta penilaian penggunaan teknologi dalam pembelajaran antara cadangan untuk mendapatkan pemahaman yang lebih mendalam tentang bagaimana pengajaran dan pembelajaran berlaku, serta mengenal pasti bidang di mana penambahbaikan boleh dilakukan untuk meningkatkan kualiti pendidikan.

1. PENGENALAN

Pelan Pembangunan Pendidikan Malaysia memainkan peranan penting dalam memastikan kualiti pendidikan yang berterusan dan efektif bagi memenuhi keperluan semasa dan masa depan negara. Pemantauan pengajaran dan pembelajaran, sebagai komponen penting dalam pelan ini, merangkumi proses mengumpul data dan maklum balas yang berkaitan untuk menilai kesan serta keberkesanan proses pembelajaran dan pengajaran dalam persekitaran pendidikan.

Pemantauan ini bertujuan untuk melacak dan menilai pencapaian pelajar, memberi penekanan kepada penyempurnaan pengajaran dan pembelajaran, serta memberikan maklum balas kepada pensyarah dan pihak pengurusan. Dalam konteks pelan pembangunan pendidikan Malaysia, pemantauan ini menjadi penting kerana ia membantu menilai sejauh mana objektif pendidikan negara telah dicapai.

Melalui proses ini, pemantauan pengajaran dan pembelajaran dapat mengenal pasti titik kekuatan dan kelemahan dalam pendekatan pembelajaran yang diamalkan. Dengan menilai data dan maklum balas yang diperoleh, pensyarah dapat mengambil tindakan yang sesuai untuk memperbaiki dan meningkatkan prestasi pelajar. Ini sejajar dengan matlamat pelan pembangunan pendidikan yang bertujuan untuk memberikan pendidikan yang berkualiti tinggi kepada setiap pelajar.

Dalam mengaitkan pemantauan pengajaran dan pembelajaran dengan Pelan Pembangunan Pendidikan Malaysia, dapat dilihat bahawa pemantauan ini membantu menjamin pendekatan pengajaran dan pembelajaran yang diaplikasikan sejajar dengan aspirasi pelan tersebut. Selain itu, ia juga membantu pihak pengurusan dan pembuat dasar untuk membuat penyesuaian yang diperlukan berdasarkan maklum balas dan data yang diperoleh, memastikan perkembangan pendidikan yang berterusan dan selari dengan keperluan semasa dan masa depan.

2. PERNYATAAN MASALAH

Pendidik adalah tugas yang sangat mulia. Pemantauan pengajaran dan pembelajaran guru atau pendidik merupakan satu faktor utama dalam sistem pendidikan, Hamid Darmadi (2015). Segelintir pendidik boleh menghasilkan pengajaran yang berkesan dan berkualiti setiap masa, Jasmi et.al (2012). Pendidik yang pandai mendidik akan memudahkan pelajar memahami sesuatu konsep atau sesuatu kemahiran, manakala pendidik yang tidak pandai mendidik atau mengajar akan menyebabkan pelajar sukar untuk memahami sesuatu konsep atau sesuatu kemahiran, Hamdan et. al (2022), malah ianya akan menyebabkan pengajaran pensyarah tersebut membosankan dan seterusnya akan memberi kesan negatif kepada tumpuan pelajar dalam pelajarannya dan minatnya terhadap pelajaran tersebut dan ini juga menyebabkan pelajar-pelajar tidak mahu untuk hadir ke kelas, Marzuki (2005). Tamuri et. al (2015) mencadangkan pendidik bebas menggunakan kaedah yang bersesuaian bagi PdP kerana tiada kaedah yang dikatakan terbaik atau lebih sesuai untuk sesuatu mata pelajaran atau modul sahaja.

Justeru, pengkaji berminat untuk mengkaji pengukuran tahap kompetensi pemantauan pengajaran dan pembelajaran Jabatan Pengajian Am Politeknik Ungku Omar selepas

pandemik COVID 19. Ini kerana tahun 2023 merupakan tahun pertama pelaksanaan pemantauan PdP secara bersemuka selepas pelaksanaan atas talian.

3. OBJEKTIF KAJIAN

Mengukur tahap kompetensi para pensyarah berkaitan dengan lima (5) domain berkenaan :
i. Perancangan pembelajaran & pengajaran
ii. Instruksional
iii. Kompetensi dan profesionalisme pensyarah
iv. Pengurusan kelas
v. PPSMTI (Pengajaran Dan Pembelajaran Dalam Bahasa Inggeris).

4. SKOP KAJIAN

Kajian ini bertujuan mengenal pasti pengukuran tahap kompetensi pemantauan pengajaran dan pembelajaran Jabatan Pengajian Am untuk pengajian Diploma dan ijazah Sarjana Muda. Kajian tinjauan ini melibatkan 40 orang responden pensyarah kursus mata pelajaran umum seperti Bahasa Inggeris, Pengajian Islam, Pendidikan Moral dan lain-lain. Pemantauan ini melibatkan 16 kursus yang ditawarkan kepada semua pelajar.

5. KAJIAN LITERATUR

Menurut Musalifah (2013), amalan PdP yang berkualiti perlu kepada pemantauan pengajaran dan pembelajaran supaya memberi impak yang berkesan kepada pelajar dan guru itu sendiri. Justeru usaha yang dilakukan oleh guru bagi mewujudkan suasana pengajaran dan pembelajaran yang menyeronokkan di dalam kelas akan dapat membangkitkan semangat dan motivasi pelajar untuk belajar dan seterusnya meningkatkan pencapaian akademik mereka. Ini selari dengan apa yang dinyatakan oleh Ishak et al. (2013), di mana ianya menyebutkan bahawa keupayaan pengajar untuk mengaplikasikan pengetahuan dan mengimplimentasikan aspek penambahbaikan khususnya meningkatkan kualiti dalam PdP di institusi pendidikan adalah sangat penting. Tang dan Lim (2002) pula menekankan bahawa pelajar berhak untuk mendapatkan pendidikan yang berkualiti dan telah menjadi kewajipan institusi pendidikan untuk menjamin kualiti kursus dan program yang ditawarkan. Tang dan Lim (2002) juga menambah bahawa penilaian keberkesanan proses PdP oleh pelajar adalah pedekatan utama bagi mengukur kualiti proses PdP oleh pensyarah.

Manakala Abd. Ghani dan Mohd Arshad (2010) pula menyebutkan adalah penting untuk mengetahui persepsi pelajar terhadap pensyarah yang mengajarnya bagi menilai keberkesanan pengajaran pensyarah terhadap pembelajaran pelajar terbabit. Pengajaran yang berkesan bukan sahaja melibatkan penyampaian isi pembelajaran yang betul dan berkualiti, tetapi juga melibatkan interaksi positif antara pensyarah dan pelajar. Dengan mengetahui persepsi pelajar terhadap pensyarah, institusi pendidikan dapat mengukur sejauh mana keberkesanan pengajaran tersebut. Pelajar adalah penerima utama proses pembelajaran, jadi pendapat mereka tentang pengajaran pensyarah memberi pandangan penting mengenai keberkesanan pengajaran tersebut. Menilai persepsi pelajar terhadap pensyarah juga merupakan cara untuk

mengukur reaksi mereka terhadap cara pengajaran dan interaksi dengan pensyarah. Jika pelajar memberi maklum balas positif, ini mungkin mencerminkan pengajaran yang berkesan yang dapat merangsang minat dan pemahaman mereka terhadap subjek. Sebaliknya, maklum balas negatif mungkin menunjukkan masalah dalam pengajaran yang perlu diperbaiki. Secara keseluruhannya, mengetahui persepsi pelajar terhadap pensyarah adalah aspek penting dalam menilai keberkesanan pengajaran pensyarah. Ini memberi pandangan yang penting tentang pengaruh pensyarah terhadap pembelajaran pelajar dan membantu institusi pendidikan dalam usaha meningkatkan kualiti pengajaran dan pembelajaran.

Menurut Mardhiah Johari dan Rabiatul-Adawiah Ahmad Rashid (2016), penyeliaan terhadap PdP dari semasa ke semasa penting sebagai satu rujukan kepada pengurusan kawalan dalam kualiti pengajaran guru. Penyeliaan PdP merujuk kepada proses pemantauan, penilaian, dan bimbingan yang dilakukan oleh penyelia atau pihak pengurusan terhadap aktiviti pengajaran dan pembelajaran dalam konteks pendidikan. Ini bertujuan untuk memastikan bahawa pengajaran yang disampaikan oleh pensyarah adalah berkualiti dan mencapai objektif pendidikan yang ditetapkan. Pentingnya penyeliaan berkala terhadap PdP adalah untuk memastikan bahwa pensyarah mengamalkan kaedah pengajaran yang berkesan, mematuhi garis panduan kurikulum, dan memenuhi standard prestasi yang telah ditetapkan oleh institusi pendidikan. Dengan penyeliaan yang berterusan, pensyarah diberi peluang untuk mengidentifikasi kelemahan dan melakukan peningkatan berterusan dalam pengajaran mereka. Ini juga membantu dalam memastikan keseragaman kualiti pengajaran di seluruh institusi pendidikan.

Maka garis panduan yang dibekalkan oleh pihak JPPKK amatlah bersesuaian untuk melaksanakan pemantauan PdP bukan sahaja penilaian dibuat daripada pihak pemantau yang dilantik tetapi pelajar juga tidak terkecuali untuk menilai pensyarah yang terlibat.

6. DAPATAN KAJIAN DAN PERBINCANGAN

Penilaian PdP pensyarah yang dilaksanakan oleh pensyarah pemantau berdasarkan borang instrumen pemantauan pengajaran dan pembelajaran Politeknik Malaysia yang mempunyai skor markah untuk 5 domain utama seperti yang ditunjukkan dalam jadual 1.

Jadual 1: Domain pemantauan pensyarah

Item	Perkara	Peratus
Domain 1	Perancangan Pengajaran dan Pembelajaran	15%
Domain 2	Instruksional	50%
Domain 3	Kompetensi dan Profesionalisma Pensyarah	15%
Domain 4	Pengurusan dan Kawalan kelas	10%
Domain 5	Pemerkasaan Penggunaan Bahasa Inggeris dalam penyampaian PdP	10%

Sumber : Garis panduan pemantauan pembelajaran dan pengajaran politeknik dan kolej komuniti edisi 2019

Manakala penilaian PdP pensyarah oleh pelajar pula dilaksanakan secara atas talian dengan menggunakan sistem iPUO. Selepas pensyarah pemantau memasukkan markah, pelajar boleh membuat penilaian PdP terhadap pensyarah berkenaan. Semua pelajar dalam kelas berikut perlu melaksanakan penilaian PdP pensyarah berikut. Setiap pelajar perlu memberi maklumbalas berdasarkan 10 item soalan melibatkan penggunaan 4 kategori skor Skala Likert. Soalan yang berkaitan adalah seperti yang ditunjukkan dalam jadual 2 manakala skor Skala Likert pula adalah seperti yang ditunjukkan dalam jadual 3.

Jadual 2: Item aspek penilaian

Bil	Aspek yang dinilai
1	Saya telah diterangkan mengenai hasil pembelajaran.
2	Saya telah diterangkan mengenai course outline dengan jelas.
3	Pensyarah menyampaikan pengajaran dengan suara dan intonasi yang jelas.
4	Pensyarah memberi peluang kepada pelajar untuk bertanyakan soalan.
5	Pensyarah melaksanakan aktiviti yang boleh menarik minat pelajar.
6	Pensyarah memastikan suasana persekitaran kelas yang selamat, bersih dan teratur.
7	Bahan pengajaran membantu meningkatkan kefahaman pelajar.
8	Pensyarah sentiasa menampilkan perwatakan positif yang boleh dicontohi.
9	Pensyarah menepati masa.
10	Pensyarah menggunakan Bahasa Inggeris yang mudah difahami. Catatan : Hanya melibatkan kursus yang menggunakan Bahasa Inggeris.

Sumber : Garis panduan pemantauan pembelajaran dan pengajaran politeknik dan kolej komuniti edisi 2019

Jadual 3: Skala Likert

Skor	Pilihan
1	Tidak setuju
2	Kurang setuju
3	Setuju
4	Sangat setuju

Sumber : Garis panduan pemantauan pembelajaran dan pengajaran politeknik dan kolej komuniti edisi 2019

Berikut jadual 4 hasil pemantauan PdP yang dilaksanakan oleh pensyarah pemantau.

Jadual 4: Bilangan pensyarah yang memperolehi skor markah mengikut domain

DOMAIN	JUMLAH SKOR MAKSIMA	BILANGAN PENSYARAH YANG MEMPEROLEHI PERATUSAN SKOR BAGI DOMAIN SEPERTI BERIKUT :						JUMLAH PEN-SYARAH DIPANTAU
		%50>	%59-50	%69-60	%79-70	%89-80	%100-90	
Domain 1 - Perancangan Pembelajaran & Pengaja-ran	15				2	3	35	40
Domain 2 - Instruksional	50						40	40
Domain 3 - Kompetensi & Profesionalisma Pen-syarah	15						40	40
Domain 4 - Pengurusan dan Kawalan Kelas	10						40	40
Domain 5 - Pemerkasaan Penggunaan Bahasa Inggeris dalam Penyampaian P&P	10						22	22

Berdasarkan kepada jadual analisa di atas, domain 1 mempunyai 3 item yang dapat menyokong aspek perancangan pembelajaran dan pengajaran PdP. eFRP disediakan dengan lengkap dan mengandungi semua rekod yang berkaitan seperti rekod kehadiran pelajar, rekod markah pelajar mengikut keperluan Prosedur Kualiti ISO dikemaskini dengan baik. Rancangan mengajar disediakan secara komprehensif bagi menunjukkan pencapaian CLO dibuat. Proses PdP kuliah didapati melibatkan pelbagai kaedah penyampaian, penggunaan ABM yang sesuai dan memenuhi keperluan kurikulum. Pensyarah juga didapati mampu menyediakan nilai tambah atau *Continual Quality Improvement CQI* pada catatan refleksi dalam rancangan mengajar. Domain 1 yang memperolehi markah 90-100% seramai 35 orang, 3 orang memperolehi markah antara 80-89% dan 2 orang mendapat markah antara 70-79%., komen yang diberikan oleh pemantau, terdapat pensyarah yang tidak mengemaskini eFRP sebelum pemantauan PdP dijalankan. Komen berikut 1 daripada 3 item berikut. Ini menunjukkan domain 1 masih lagi pada tahap yang baik.

Bagi domain 2 pelaksanaan OBE dalam PdP, Politeknik Ungku Omar telah mewajibkan sesi pemantauan dilaksanakan secara bersemuka selepas pandemik COVID 19. Bagi tahun 2020, 2021 dan 2022 pemantauan dilaksanakan secara atas talian. Oleh sebab itu semua pensyarah bersedia dan berjaya mempraktikkan dasar, prinsip dan amalan PdP terkini dalam menyokong pembelajaran pelajar sama sebelum negara dilanda COVID 19. Pensyarah didapati melaksanakan penyampaian dengan mengambilkira kepelbagaian pelajar di samping penggunaan strategi dan teknologi yang berkesan. Set induksi telah disediakan dengan baik dan pensyarah berjaya menarik perhatian pelajar agar menumpukan perhatian terhadap topik atau LLO yang hendak dibincangkan, (Tamuri 2015). Semasa proses penyampaian, pensyarah menyampaikan pengajaran secara 2 hala, pelajar terlibat secara aktif, pengajaran yang teratur dengan menggunakan *body language*, intonasi suara dan tulisan yang jelas akan melahirkan suasana pembelajaran yang kondusif (Afandi et al. 2013).

Aplikasi Teknologi Maklumat memainkan peranan yang penting dalam PdP abad ke-21. Dalam konteks Malaysia, hal ini sejajar dengan visi dan tuntutan yang dinyatakan dalam Pelan Pembangunan Pendidikan Malaysia 2015-2025 (Pendidikan Tinggi). Sehubungan dengan itu, para pensyarah telah berusaha menggunakan sumber pendidikan yang sesuai dan didapati berjaya menarik minat pelajar, yang mana akhirnya berjaya meneguhkan pembelajaran

mereka. Menurut John & Wheeler, 2008. teknologi pendidikan ialah gabungan manusia, peralatan, teknik dan peristiwa yang bertujuan untuk memberi kesan baik kepada pembelajaran. Semua pensyarah berjaya menerapkan unsur kreativiti dan inovasi dalam penggunaan teknologi bagi mencapai hasil pembelajaran pelajar. Usaha ini membantu berupaya menarik minat pelajar dan mengukuhkan pembelajaran. Menurut Musalifah, (2013) aktiviti PdP berasaskan OBE dikesan membawa kejayaan bersama pelajar. Majoriti pensyarah berjaya menerapkan aktiviti-aktiviti nilai tambah hasil pembelajaran pelajar dengan melaksanakan aktiviti pembelajaran.

Para pensyarah amat digalakkan melaksanakan penilaian formatif atau pengujian pada akhir sesi pembelajaran. Menurut (Hariatul Hafidzah et al.2021), strategi ini dibuat bagi memantau pencapaian pelajar sama ada pelajar boleh mengikuti kursus dengan baik, sederhana atau lemah. Daripada hasil itu, pensyarah akan dapat menilai pelajar, atau juga dapat menyediakan strategi lain bagi mengatasi masalah jika ada pelajar yang lemah dalam mengikuti kursus. Teknik penilaian adalah pelbagai dan aras pengujiannya juga dipelbagaikan bagi menepati kesesuaian mencapai hasil pembelajaran tempoh berkenaan (Pusat Perkembangan Kurikulum KPM, 2001). Semua pensyarah menyediakan rumusan hasil pembelajaran setiap kali kuliah/ perbincangan dijalankan. Rumusan dihujung sesi pembelajaran membantu dan memperkukuhkan pencapaian LLO dan kesediaan untuk sesi PdP seterusnya. Bagi domain 3 kompetensi dan profesionalisme pensyarah. Seramai 40 orang pensyarah mencapai markah skor 90-100% sasaran penilaian kompetensi dan profesionalime pensyarah. Pensyarah yang mempunyai nilai-nilai profesionalisme didapati menunjukkan bukti pematuhan etika kerja dan amalan nilai yang positif ke arah mewujudkan keyakinan dan kepercayaan pelajar. Para pensyarah didapati mampu memastikan elemen-elemen dalam teras pengajaran yang perlu bermatlamat pengajaran berkesan dan menarik, juga dapat memotivasikan pelajar, serta menyediakan contoh-contoh sesuai dan relevan serta mampu mempamerkan penguasaan bagi menyediakan peluang meningkatkan pencapaian pelajar melalui pelbagai kaedah penyelesaian masalah. Hasil pembelajaran pelajar diperolehi dengan usaha bijak pensyarah mengaitkan isu semasa atau pengalaman pelajar itu sendiri serta menghormati harta intelek.

Semua pensyarah menunjukkan kesungguhan yang tinggi dalam memupuk keperibadian yang positif. Kesungguhan dan komitmen serta mampu menarik minat pelajar dengan melaksanakan kaedah/ teknik pembelajaran yang sesuai semasa mengendalikan proses P&P mereka. Menurut Rosmilawati (2006), pendidik yang bersifat mesra, fleksibel, penyabar, berminat terhadap pelajar dan boleh bergurau dengan pelajar adalah lebih berkesan berbanding pendidik yang kurang mempunyai sifat tersebut. Selain itu menurut (Ee Ah Meng 2001) komunikasi pensyarah yang berkesan mendorong pelajar memberi tumpuan dan idea yang baik dalam menyelesaikan sesuatu permasalahan. Ini kerana, komunikasi yang baik akan memberi keselesaan kepada pelajar untuk bertanya jika pelajar tidak memahami sesuatu dalam pembelajarannya. Pandangan ini disokong oleh (Haslinda et.al 2017) bahawa nteraksi secara bersemuka juga berjaya dibentuk dan ianya mampu membentuk rasa hormat yang tinggi sesama mereka, serta dapat memberi pemahaman yang lebih mendalam kepada pelajar.

Dapatan pada domain 4 iaitu pengurusan kelas menunjukkan 40 pensyarah telah mengurus persekitaran kelas yang kondusif dengan nilai mod skor 10 seramai 30 dan skor 9 seramai 10. Semua pensyarah dapat menyediakan persekitaran pembelajaran yang kondusif seterusnya berjaya meningkatkan kesediaan minat pembelajaran pelajar. Kebersihan dan keselamatan di bilik kuliah/perbincangan dijaga bersama. Susun atur kedudukan ruang kelas digunakan

secara optimum untuk tujuan pembelajaran. Kehadiran dan ketepatan masa pelajar dititikberatkan. Pelajar sentiasa diingatkan agar dapat menjaga tatasusila diri dan mematuhi peraturan yang ditetapkan. Menegur salah laku pelajar secara berhemah sekiranya berlaku. Pengurusan masa sangat dititik beratkan seperti memulakan dan menamatkan kuliah/amali tepat pada masanya. Menurut Hamdan et. al (2022) kepentingan keberkesanan proses PdP ini tidak dapat dinafikan dalam melahirkan pensyarah menggunakan pelbagai kaedah yang bersesuaian supaya proses pembelajaran boleh berlaku dengan berkesan, teratur, jelas dan bersepadu. Semua pensyarah juga berjaya menyampaikan isi pengajaran dalam tempoh masa yang sesuai dan optimum. Kesimpulannya, keberkesanan proses PdP adalah penting dalam membentuk pensyarah yang berkualiti. Melalui penggunaan kaedah yang sesuai, pendekatan bersepadu, dan penekanan kepada pembelajaran aktif, proses pembentukan pensyarah dapat berlaku dengan lebih berkesan, menghasilkan individu yang berdaya saing dan bersedia untuk memberi sumbangan kepada dunia pendidikan dan masyarakat.

Dapatan domain 5 pemerkasaan penggunaan Bahasa Inggeris dalam penyampaian PdP. Seramai 22 orang pensyarah memberi pengajaran menggunakan Bahasa Inggeris. Penilaian dan nota disediakan sepenuhnya dalam Bahasa Inggeris. Dalam memperkukuhkan pemerkasaan penggunaan Bahasa Inggeris dalam PdP, penting untuk menerapkan pendekatan yang menyeluruh. Ini termasuklah pengajaran yang menggabungkan bahasa dengan kandungan pengajaran, menggunakan pelbagai sumber media, dan mendorong interaksi berbahasa Inggeris antara pelajar. Dengan cara ini, pelajar dapat memperoleh kemahiran Bahasa Inggeris sambil memahami konsep pembelajaran secara lebih efektif.

Berikut jadual 5 bilangan pensyarah yang memperolehi skor markah dalam penilaian PdP oleh pelajar.

Jadual 5: Bilangan pensyarah yang memperolehi skor markah dalam penilaian PdP oleh pelajar

BILANGAN PENSYARAH YANG MEMPEROLEHI PERATUSAN SKOR MARKAH DALAM PENILAIAN PdP OLEH PELAJAR					JUMLAH
%59-50	%69-60	%79-70	%89-80	%100-90	
			2	38	40

Berdasarkan kepada Jadual 5, kesimpulan tentang penilaian pelajar terhadap prestasi pensyarah dalam proses pengajaran dan pembelajaran (PdP). Secara umumnya, terdapat 38 orang pelajar yang memberikan skor markah antara 90 hingga 100 peratus. Ini menunjukkan bahawa majoriti pelajar berpuas hati dengan prestasi pensyarah dan memberikan penilaian yang tinggi terhadap cara pensyarah menjalankan PdP.

Selain itu, terdapat juga 2 orang pelajar yang memberikan skor markah dalam julat 89 hingga 90 peratus. Meskipun jumlah ini lebih kecil berbanding dengan kumpulan pertama, tetap menunjukkan bahawa terdapat beberapa pelajar yang memberikan penilaian positif walaupun sedikit di bawah kumpulan utama.

Kesimpulannya, berdasarkan data dalam Jadual 5, kebanyakan pelajar memberikan penilaian yang baik terhadap prestasi pensyarah dalam PdP, dengan majoriti pelajar memberikan skor markah tinggi antara 90 hingga 100 peratus. Ini mencerminkan usaha pensyarah dalam menjalankan proses pengajaran dan pembelajaran dengan berkesan.

Berikut jadual 6 perbandingan purata skor markah antara pemantau dan pelajar.

Jadual 6: Perbandingan purata skor markah antara pemantau dan pelajar

PERKARA	SKOR MARKAH		
	TERENDAH	PURATA	TERTINGGI
SKOR PEMANTAU	90	94.5	99
SKOR PELAJAR	85.76	92.55	99.34

Jadual 6 menunjukkan perbandingan skor markah antara pemantau dan pelajar. Pemantau telah mencapai skor markah sebanyak 94.5%, manakala pelajar mendapat skor markah sebanyak 92.55%. Perbezaan dalam skor markah ini memberi gambaran tentang prestasi relatif di antara kedua-dua kumpulan. Pemantau telah mencatatkan skor markah yang lebih tinggi iaitu 94.5%, menunjukkan pencapaian yang baik dalam penilaian. Ini mungkin menunjukkan kecekapan dan pemahaman yang mendalam mengenai kursus tersebut. Sementara itu, pelajar memperoleh skor markah 92.55%, yang masih merupakan pencapaian yang baik, walaupun sedikit lebih rendah berbanding pemantau. Ini mungkin menunjukkan usaha yang diberikan oleh pelajar dalam memahami dan menjawab soalan atau tugasan yang diberikan. Secara keseluruhannya, jadual ini memberikan gambaran tentang prestasi pemantau dan pelajar dari segi skor markah. Walaupun pemantau memperoleh skor yang lebih tinggi, kedua-dua pihak masih menunjukkan usaha yang baik dalam mencapai keputusan yang memuaskan.

7. KESIMPULAN

Kesimpulannya ialah prestasi pensyarah dalam proses PdP adalah sangat baik, dengan majoriti pelajar memberikan penilaian yang tinggi terhadap cara pensyarah menjalankan PdP. Pemantau juga memberikan penilaian yang sangat positif, menunjukkan prestasi yang hampir sempurna. Ini membuktikan usaha pensyarah dalam memberikan pengajaran yang berkualiti dan berkesan kepada pelajar. Impak daripada penilaian ini adalah peningkatan dalam kualiti PdP. Penilaian yang baik dari pelajar dan pemantau menunjukkan bahawa strategi pengajaran dan pendekatan pensyarah berjaya menyampaikan maklumat dengan berkesan dan memberikan pengalaman pembelajaran yang positif kepada pelajar.

Bagi mengekalkan proses pemantauan bagi kualiti PdP, terdapat beberapa cadangan yang boleh diambil kira antaranya penilaian berkala iaitu melakukan penilaian berkala oleh pemantau dan pelajar untuk terus mengukur kualiti PdP. Ini membantu memastikan tahap prestasi yang tinggi dikekalkan dan memberi peluang untuk membuat penyesuaian jika perlu. Kedua, latihan dan pembangunan iaitu menawarkan program latihan dan pembangunan kepada pensyarah untuk memperkukuhkan kemahiran pengajaran mereka. Penggunaan teknik

pengajaran terkini dan inovatif akan membantu meningkatkan efektiviti dalam PdP. Ketiga, kerjasama dan perbincangan iaitu mewujudkan platform perbincangan antara pensyarah, pelajar dan pemantau untuk berkongsi pandangan dan cadangan bagi penambahbaikan. Ini membina persekitaran terbuka untuk perbincangan tentang kualiti PdP. Kempat, membuat kajian kes khusus seperti mengenal pasti kajian kes khusus untuk menyiasat aspek tertentu dalam PdP yang mungkin memerlukan peningkatan. Ini membolehkan tindakan spesifik diambil untuk mengatasi isu-isu tersebut. Kelima, penilaian kendiri oleh pensyarah mendorong pensyarah untuk melaksanakan penilaian kendiri terhadap prestasi mereka dalam PdP. Ini membantu mereka mengenal pasti kekuatan dan kelemahan mereka sendiri untuk penambahbaikan berterusan dan keenam perkongsian pengalaman. Bagi mewujudkan platform perkongsian pengalaman antara pensyarah yang berbeza bagi saling berkongsi pendekatan terbaik dalam PdP. Dengan mengamalkan cadangan ini, pensyarah dapat terus menjaga dan meningkatkan kualiti PdP mereka, menjadikan pengalaman pembelajaran pelajar lebih baik dan memberi kesan positif terhadap perkembangan mereka dalam pelbagai bidang.

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ENHANCING ACADEMIC DATA MANAGEMENT AND LECTURERS' WORK PERFORMANCE: AN EVALUATION OF THE COURSE PLANNER PLATFORM IN IPUO

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ABSTRACT

This study was carried out to improve the effectiveness of existing academic information system called Integrated Politeknik Ungku Omar System (iPUO) at Ungku Omar Polytechnic. It aims to evaluate the effectiveness of the Course Planner (CP) platform addition in the iPUO system to address records management issues, improve time efficiency, enhance quality of work and improve lecturers' satisfaction. CP platform combines the course outline (CO) and student attendance record modules to provide a user-friendly interface for lecturers to update attendance records and reflection notes after each class session during the semester. A quantitative study was conducted using a purposive sampling method. Data was collected through online questionnaire which is constructed by adapting the Technology Acceptance Model (TAM). The survey was conducted among 113 lecturers who were the iPUO users as participants. Data analysis was done using percentage calculations. The research findings highlight the positive impact and effectiveness of the CP platform in addressing records management issues, improving time efficiency, enhancing quality of work and meeting lecturers' needs at iPUO. The CP platform has proven its ability to streamline administrative tasks, increase efficiency and enable effective academic operations.

1. Introduction

Academic institutions strive to provide efficient and effective educational experiences for their students, faculty members, and administrators. In the modern digital age, academic institutions are increasingly adopting technology-driven solutions to improve efficiency, streamline administrative processes, and enhance the overall educational experience. Efficient and effective educational experiences for students, faculty members, and administrators encompass various elements that contribute to a successful learning environment. In order to achieve the above-mentioned goals, academic institutions often turn to technology-driven solutions such as academic information systems (Duţă &

Martnez-Rivera, 2015, Indrayani, 2013; Utomo et al., 2017; Bon et al., 2018) which integrate various components of academic management into a cohesive platform. Higher education institutions have seen significant changes in the way they conduct their daily activities related to supporting students after the installation of these academic information system (Duţă & Martnez-Rivera, 2015). These systems integrate various components of academic management into a cohesive platform, streamlining processes and enhancing overall efficiency. An academic information system is a collection of procedures and methods used in higher education institutions to organize, process, and utilise information (Indrayani, 2013; Utomo et al., 2017; Bon et al., 2018). The adoption of ICT raises management quality, which in turn raises service quality (Khanam et al., 2013). Different Academic Information Systems (AISs) have been established to support daily operations as a result of ICT adaptation, which has been proved to improve working efficiency in various higher education institutions (Mahenge & Sanga, 2016).

Ungku Omar Polytechnic (UOP) has used Academic Information System (AIS) called iPUO to streamline and enhance various administrative tasks associated with academic operations. iPUO is a centralized platform that enables lecturers and administrators to efficiently manage student-related data, such as attendance records, grading, and course reflections. One major benefit of the iPUO is its ability to mark attendance digitally, eliminating the need for manual paper-based processes. This feature significantly reduces administrative workload and enhances accuracy in attendance records, making it easier to monitor student attendance patterns and identify any issues promptly. iPUO also allows lecturers to provide reflections or comments on their lessons. This feature helps in evaluating teaching methodologies, identifying areas for improvement, and facilitating ongoing professional development.

However, despite these advantages, iPUO has several drawbacks that hinder its effectiveness in achieving its goals and objectives. These drawbacks impact various aspects of the system's functionality and overall performance. Here are some key areas of challenges with iPUO:

(a) Inconsistent Teaching and Learning Hours;
One of the drawbacks affecting iPUO's effectiveness is the inconsistency between the actual teaching and learning hours and the required hours specified by the syllabus. The inconsistency happens because lecturers have to key-in the teaching and learning hours manually and it leads to insufficient coverage of course content or excessive time allocation for certain topics. As a result, students may not receive the intended depth of knowledge and skills, potentially affecting their academic performance and readiness for future endeavours.

(b) Errors in Dates of Teaching and Learning;
Lecturers are required to key-in the dates and time of teaching and learning manually in iPUO. The manual insertion of dates and time of teaching and learning activities sometimes cause human errors i.e. inserting date and time which are inconsistent with given official timetable. The inconsistent data entry can lead to confusion and inaccuracies in tracking and managing educational progress. Lecturers, students, and administrators may struggle to coordinate their activities and keep track of important milestones or deadlines. Such errors can disrupt the overall flow of teaching and learning, impacting the effectiveness of the educational process.

(c) Inaccurate Course Outline Remarks;
Another drawback is the occurrence of errors in filling in the course outline remarks at incorrect dates. This can result in inaccurate documentation of crucial information such as lesson reflections, updates, or additional resources. Inaccurate remarks can create confusion among lecturers and students, making it challenging to understand and follow the intended course structure and objectives. This can impact the effectiveness of teaching and learning, as well as the overall quality of educational delivery.

(d) Data Integrity and Reliability:
The presence of errors in data entry and inconsistent information can compromise the integrity and reliability of academic data within iPUO. Inaccurate data can lead to incorrect assessments, grading, and reporting, which can have significant consequences for academic decision-making and evaluation processes. It becomes challenging for lecturers, administrators, and other stakeholders to rely on the system for accurate and dependable information.

(e) Lecturer Dissatisfaction and Work Performance;
The drawbacks in iPUO's effectiveness also have implications for lecturers' satisfaction and work performance. Frustration and dissatisfaction may arise due to the challenges faced with the system, including data entry errors, inconsistencies in course information, and difficulties in utilizing the platform. Such drawbacks somewhat affect lecturers' ability to effectively plan, deliver, and evaluate teaching, potentially impacting their overall performance and dedication to their roles.

Therefore, Course Planner (CP) platform is designed to address the above-mentioned drawbacks faced by the administrators and lecturers in using the Integrated Politeknik Ungku Omar System (iPUO). CP is developed using the PHP programming language, connecting to a SQL-based database. This allows users to access this innovative Course Planner online. CP combines the Course Outline (CO) and student attendance record under a single interface, making it easier for lecturers to update student attendance and reflections on the CO after each teaching and learning session throughout the semester. CP also automates the procedure of updating the student attendance record, where lecture dates are automatically scheduled. Lecturers no longer need to manually input lecture dates, which reduce the errors in date entry. The reflection section is also included within the same tab as the attendance record, saving lecturers' time to going back and forth between two tabs; Course Outline and student attendance record.

It offers a centralized platform where faculty members and administrators can effectively plan, organize, and manage courses, ensuring a well-structured and coordinated curriculum. Additionally, CP enables the tracking of student attendance, enabling institutions to monitor and address attendance issues proactively. The integration of CP within the larger iPUO system creates an ecosystem where academic processes and information flow seamlessly, contributing to a more efficient and effective educational environment.

This paper aims to evaluate the effectiveness of the Course Planner platform within the integrated iPUO and its impact on the academic ecosystem. The evaluation of the Course Planner platform within the iPUO aims to assess its effectiveness and the impact it has on the academic ecosystem by analyzing the platform's features, usability, and user satisfaction.

2. Materials and Methods

This study is quantitative in nature and adopted the survey research design i.e., a cross-sectional survey design. This design is adopted because it is aligned with the aim of the study and effective for providing a glimpse of the CP users' attitudes and perceptions (Mills et al. 2019). The primary data collection instrument is a questionnaire. It was constructed by adapting the Technology Acceptance Model (TAM) developed by Venkatesh (2008). The questionnaire was designed to elicit data related to participants' attitudes, perceptions, and acceptance towards the Course Planner platform. The data collection method employed was an online survey using a Google Form. The survey questionnaire was distributed to the respondents electronically via mail, allowing for convenient and efficient data collection. This is because it is inexpensive, easy to target the respondents and offers prompt result (Mills et al. 2019). The sampling technique employed was purposive sampling, which involved deliberately selecting respondents who are considered relevant and representative of the target population (Mills et al. 2019). The study participants were selected based on two main criteria which are participants who experienced using iPUO before and after the introduction of CP. In this case, 113 teaching staff members who have experience using iPUO before and after the introduction of CP platform were selected as respondents. The data analysis method utilized was the percentage calculation. The collected survey responses were analyzed by calculating the percentage of participants who answered according to the 4-likert scale questionnaire i.e., strongly disagree, disagree, agree, and totally agree. The 4-likert scale questionnaire was developed to elicit definitive responses of participants' attitudes, perceptions, and acceptance towards the CP platform. The collected data was analyzed using a percentage calculation method to uncover patterns and trends. The findings of this study will contribute to enhancing the CP platform and improving the overall academic operations within the institution.

3. Results

This section provides a comprehensive overview of the data collected from the survey questionnaire administered to the teaching staff members. The results section begins with an overview of the response rate and participant characteristics to establish the representativeness of the sample. Descriptive statistics will be provided to present a quantitative summary of participants' responses to the questionnaire items. This will include frequencies and percentages, allowing for a comprehensive understanding of the participants' perceptions and experiences with the CP platform. The analysis aims to gain insights into their perceptions, attitudes, and acceptance of the CP platform.

3.1 Reduced Errors

The utilization of the CP module within the iPUO system has resulted in the reduced errors in recording the number of hours, dates of teaching and learning activities, and inaccuracies in documenting reflection entries on incorrect dates within the iPUO system. CP manages to overcome the following drawbacks:

i. Inconsistencies in recording the number of teaching and learning hours.
ii. Inaccuracies in recording teaching and learning dates.
iii. Writing reflections on incorrect dates.

The finding from the survey shows that 96.2% respondents agreed that they do not have to key

in each teaching and learning date and total teaching and learning hours manually. This indicates that the problems with inconsistencies in recording the number of teaching and learning hours and inaccuracies in recording teaching and learning dates are reduced.

In addition, the finding also shows that 98.5% of the respondents agreed that the automatic generation of teaching hours and dates based on the lecturers' timetables eases the record management. This feature reduced the problem of writing reflections on incorrect dates. The findings are shown in the table 1 below:

Table 1. Excerpt of Survey Analysis

No	Item	Strongly disagree	Disagree	Total	Agree	Totally Agree	Total
1.	After using 'Course Planner' I do not have to key-in the teaching and learning dates and total number of teaching and learning in the absenteeism record tab manually	0.8%	1.5%	2.3%	27.3%	70.5%	97.7%
2.	The use of 'Course Planner' eliminates errors in keying in the teaching and learning dates and total number of teaching and learning.	0%	3.8%	3.8%	25.8%	70.5%	96.2%
3.	The automatic generation of teaching and learning dates eases me to update the absenteeism record and teaching and learning remarks.	0%	1.5%	1.5%	28.8%	69.7%	98.5%

3.2 Time Saving

The use of CP has resulted in time saving for lecturers in updating attendance records and reflection entries of teaching and learning activities. This is attributed to the utilization of the CP module, which has reduced the steps required to update both records within the iPUO system. Prior to the implementation of the CP module, lecturers had to go through 16 steps to update attendance records, which consumed a considerable amount of time. However, after the use of the 'Course Planner' module, lecturers only need to go through 8 steps to update both records simultaneously without the need to navigate to another tab. See table 2 for the steps involved before and after the use of CP:

Table 2. Steps involved before and after the use of CP.

Steps involved before using CP	Steps involved after using CP:
1. Start - login & select user role. 2. Click tab teaching & learning and click attendance. 3. Click update absenteeism record for the respective class. 4. Select day, month & year. 5. Select time. 6. Click add meeting. 7. Date slot added. 8. Click pencil icon to update the absenteeism record. 9. Look for student name and mark 0 or K if the student is absent or absent with exemption. 10. Click OK to update. 11. Click OK to verify the update. 12. Click tab E-FRP. 13. Select course outline tab. 14. Select course. 15. Select teaching and learning date. 16. Write teaching & learning remarks & update. - End	1. Start - login & select user role 2. Click E-FRP 3. Click tab Course Planner 4. Select class section & course outline 5. Click the pencil on the day & date of the class 6. Select update absenteeism record & reflection or reflection only 7. Mark 0 or K and scroll down to update reflection 8. Click OK to update - End

3.3 Quality of Work Procedures

The implementation of the CP module has enhanced the quality of work for lecturers in terms of updating and storing quality records. This is because the finding depicts that 94.7% of the

respondents agreed that the use of CP has increased the quality of their work output. Furthermore, nearly three-quarter of the respondents agreed that the appearance of the updated date and time stamps in the teaching and learning reflection section in CP motivated them to update the teaching and learning reflections right after their lessons. Finally, the enhanced quality of work for lecturers also can be seen in the time saved by the lecturers. This is because nearly 100% of the respondent agreed that updating the absenteeism record and reflection remarks of teaching and in CP saved their time.

Table 3. Excerpt of Survey Analysis

No	Item	Strongly disagree	Disagree	Total	Agree	Totally Agree	Total
6.	The use of 'Course Planner' increases the quality of my work output because the absenteeism record and teaching and learning reflection remarks tabs are placed at the same interface.	0%	5.3%	5.3%	28.8%	65.9%	94.7%
7.	The appearance of the updated date and time stamps in the teaching and learning reflection section in 'Course Planner' motivates me to update the teaching and learning reflections right after my lessons.	9.8%	15.9%	25.7%	33.3%	40.9%	74.3%
8.	The use 'Course Planner' saves my time to update the absenteeism record and reflection remarks of teaching and learning.	0%	0.8%	0.8%	34.1%	65.2%	99.2%

3.4 Level of Lecturer Satisfaction

The survey and interviews conducted with lecturers who use the CP module have indicated a high level of satisfaction, with overall positive feedback regarding its usage. A total of 96.2% of the respondents agreed that they like using CP. In addition, lecturers' satisfaction also can be seen in their motivation and their perception over the ease of CP use. This is because, nearly 100% of the respondents agreed that the use of CP eased their teaching and learning activities record management and almost three-fourth of the respondents agreed that the appearance of updated date and time stamps in the teaching and learning reflection section in CP platform motivates them to update the teaching and learning reflections right after their lessons.

Table 4. Excerpt of survey analysis

No	Item	Strongly disagree	Disagree	Total	Agree	Totally Agree	Total
3.	The automatic generation of teaching and learning dates eases me to update the absenteeism record and teaching and learning remarks.	0%	1.5%	1.5%	28.8%	69.7%	98.5%
4.	The use of 'Course Planner' eases me to write teaching and learning reflections and update the attendance record simultaneously because both items are placed at the same tab.	0%	0.8%	0.8%	25.8%	73.5%	99.2%
7.	The appearance of the updated date and time stamps in the teaching and learning reflection section in 'Course Planner' motivates me to update the teaching and learning reflections right after my lessons.	9.8%	15.9%	25.7%	33.3%	40.9%	74.3%
9.	I like using 'Course Planner' because I do not make mistakes while keying-in the dates and the total number of teaching & learning.	0%	3.8%	3.8%	36.4%	59.8%	96.2%

3.5 Lecturers' Complaints

Several complaints raised by lecturers during the problem identification phase of the feedback process have been addressed and eliminated through the use of the CP module. The complaints were as follows:

i) Keying-in the teaching and learning dates and time manually for absenteeism record is time consuming.
ii) The placement of the teaching and learning absenteeism record tab and course outline tab involves more steps and requires more time to update.

iii) The errors made while keying-in teaching and learning dates and time and lesson remarks in the course planner.

Table 5. Excerpt of Survey Analysis

No	Item	Strongly disagree	Disagree	Total	Agree	Totally Agree	Total
8.	The use 'Course Planner' saves my time to update the absenteeism record and reflection remarks of teaching and learning.	0%	0.8%	0.8%	34.1%	65.2%	99.2%

3.6 Value Added in Quality Control

The utilization of the CP module has created value in quality control. This is attributed to the presence of time and date stamps (see Figure 3) that are generated after lecturers update their reflection entries in the CP module. These timestamps motivate lecturers to update their reflection entries immediately after the teaching and learning activities have concluded.

Figure 1. Time and date stamps available in CP

Table 6. Excerpt of Survey Analysis

No	Item	Strongly disagree	Disagree	Total	Agree	Totally Agree	Total
7.	The presence of time and date stamps that are generated after lecturers update their reflection entries in the 'Course Planner' module motivate me to update the reflection as soon as I have completed my teaching and learning sessions.	9.8%	15.9%	25.7%	33.3%	40.9%	74.3%

4. Discussion

The section provides an in-depth analysis and interpretation of the results obtained from the survey conducted on the usage of the Course Planner platform. This section aims discuss the various aspects of the platform's usage and its impact on academic operations within UOP with the support of existing academic literatures. The following key points are discussed based on the survey results:

4.1 Effectiveness in addressing errors in quality record

The implementation of the Course Planner platform has effectively addressed the previously identified issues related to errors in recording the number of teaching and learning hours, dates, and reflection entries. The automated features of the Course Planner, such as the automatic generation of teaching hours and dates based on the lecturer's schedule, have significantly reduced errors in the record management. This finding is in line with the claims given by other existing academic studies. The studies found that Student Information System (SIS) can improve data accuracy and reduce errors in academic records by providing a centralized store for student data (Miller, 2023) and leads to more objective education-enhancement decisions

(Ngoma and Candidate, 2009). On the other hand, the utilisation of Academic Information System (AIS) has proven to be beneficial and effective for the quality of service to both students (Iswan et. al., 2022), staff and decision making (Kayanda et al., 2020).

4.2 Time efficiency and streamlined processes

The CP platform has proven to be a time-saving tool for lecturers in updating attendance records and reflection entries. The reduced number of steps required for record updates has streamlined the process and eliminated the need to navigate to different tabs or interfaces. This improvement has enhanced efficiency in managing academic records. This finding is consistent with the assertions made by other studies. According to Blackbaud, a student information system (SIS) can save time for both students and faculty by providing online attendance records. This feature allows students and faculty to easily review attendance history, eliminating the need for manual record-keeping and saving time in updating attendance records (Student Information System (SIS) Software, n.d.). Furthermore, the automated attendance systems save time for both lecturers and students by eliminating the need for manual record-keeping and reducing errors in attendance tracking (Admin, 2022). AIS also can help lecturers organize their reflection entries and retrieve them when needed. With features such as tagging, categorization, and search functionalities, lecturers can easily locate specific reflection entries based on topics, dates, or other criteria. This saves time and allows for a more systematic approach to reflection (Facilitating Reflection: A Manual for Leaders and Educators Facilitating Reflection a Manual for Leaders and Educators, n.d.)

4.3 Improvement in work quality

The implementation of the CP has contributed to the enhancement of lecturers' work quality. The platform's features, such as the inclusion of timestamps for reflection entries, have motivated lecturers to update their entries promptly after each teaching and learning session. This timely updating ensures accurate and comprehensive record-keeping, positively impacting work quality. This finding supports the claim made by Iswan et al., (2022) that the use AIS enhances the quality of service provided to students, leading to improved student outcomes (Iswan et al., 2022).

4.4 Lecturer satisfaction and user acceptance

The survey results indicate a high level of satisfaction among lecturers using the CP platform. The majority of respondents expressed positive feedback and a liking for the platform's features and functionalities. The user acceptance of the CP platform further confirms its effectiveness in meeting lecturers' needs and expectations. This finding corroborates with the previous studies conducted by Kayanda et al., (2020) Elshami et al., (2021) and Iswan et al., (2022) that the use of AIS heightens the users' satisfaction level.

4.5 Addressing lecturers' complaints

The CP platform has successfully addressed and resolved various complaints raised by lecturers. The platform's features and streamlined processes have eliminated the identified issues, enhancing lecturers' overall experience and work satisfaction. This finding is consistent with the claim pointed out by Awan Setiawan et al., (2022) that the utilization of AIS can streamline processes, improve data quality, and enhance the overall experience of lecturers and staff. Similarly, Kayanda et al., (2020) suggest that AIS usage can eliminate identified issues and enhance the overall experience and work satisfaction of lecturers and staff.

4.6 Value addition in quality control

The CP platform has added value to quality control measures. The presence of timestamps for reflection entries motivates lecturers to update their entries immediately after teaching and learning sessions, ensuring accurate and timely record-keeping. This value addition contributes to maintaining and improving the quality of academic operations. This finding supports the claims made by two studies. The study carried out by Bharati & Berg, (2003) suggests that AIS has a positive impact on service quality which i.e., it contributes to quality control measures by ensuring accurate and reliable information. Similarly, Iswan et al., (2022) claim that that the utilization of AIS adds value to quality control measures by improving information management and enhancing service delivery.

5. Conclusion

The conclusion of this research study highlights the significant positive impact and effectiveness of the Couse Planner (CP) platform in overcoming various challenges related to records management. The survey results provide compelling evidence that the implementation of CP has successfully reduced errors in recording the number of teaching and learning hours, dates and reflection entries. Lecturers no longer need to enter these details manually as the platform automates the process based on their schedules. This automation has significantly reduced the error rate and provides more accurate and reliable record management.

In addition, the CP platform has proven to be a valuable tool for improving time efficiency within the academic institution. By streamlining the process of updating attendance records and reflection entries, the platform has significantly reduced the number of steps required for these tasks. Lecturers no longer have to navigate through multiple tabs or interfaces, resulting in time savings and increased productivity. This improvement in time efficiency has a direct impact on the overall efficiency of academic operations, allowing lecturers to manage their time more effectively and focus on other important tasks.

Another important outcome is the improvement in the quality of work achieved through the use of the CP platform. The inclusion of timestamps for reflection entries has motivated lecturers to promptly update their records after each teaching and learning session. This timely updating ensures the accuracy and completeness of the records, which ultimately contributes to better quality of work. The CP platform enables lecturers to keep more organised and detailed records, which allow for better monitoring and evaluation of their teaching performance.

In addition, the survey results show a high level of satisfaction among lecturers who have used the CP platform. The positive feedback and appreciation for the features and functions of the platform show that it meets the needs and expectations of lecturers. This high level of user satisfaction is a strong indicator of the platform's success in providing a user-friendly and intuitive interface that facilitates efficient records management and overall academic operations.

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ENHANCING ACADEMIC DATA MANAGEMENT AND LECTURERS' WORK PERFORMANCE: AN EVALUATION OF THE COURSE PLANNER PLATFORM IN IPUO

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ABSTRACT

This study was carried out to improve the effectiveness of existing academic information system called Integrated Politeknik Ungku Omar System (iPUO) at Ungku Omar Polytechnic. It aims to evaluate the effectiveness of the Course Planner (CP) platform addition in the iPUO system to address records management issues, improve time efficiency, enhance quality of work and improve lecturers' satisfaction. CP platform combines the course outline (CO) and student attendance record modules to provide a user-friendly interface for lecturers to update attendance records and reflection notes after each class session during the semester. A quantitative study was conducted using a purposive sampling method. Data was collected through online questionnaire which is constructed by adapting the Technology Acceptance Model (TAM). The survey was conducted among 113 lecturers who were the iPUO users as participants. Data analysis was done using percentage calculations. The research findings highlight the positive impact and effectiveness of the CP platform in addressing records management issues, improving time efficiency, enhancing quality of work and meeting lecturers' needs at iPUO. The CP platform has proven its ability to streamline administrative tasks, increase efficiency and enable effective academic operations.

1. Introduction

Academic institutions strive to provide efficient and effective educational experiences for their students, faculty members, and administrators. In the modern digital age, academic institutions are increasingly adopting technology-driven solutions to improve efficiency, streamline administrative processes, and enhance the overall educational experience. Efficient and effective educational experiences for students, faculty members, and administrators encompass various elements that contribute to a successful learning environment. In order to achieve the above-mentioned goals, academic institutions often turn to technology-driven solutions such as academic information systems (Duţă &

Martnez-Rivera, 2015, Indrayani, 2013; Utomo et al., 2017; Bon et al., 2018) which integrate various components of academic management into a cohesive platform. Higher education institutions have seen significant changes in the way they conduct their daily activities related to supporting students after the installation of these academic information system (Duţă & Martnez-Rivera, 2015). These systems integrate various components of academic management into a cohesive platform, streamlining processes and enhancing overall efficiency. An academic information system is a collection of procedures and methods used in higher education institutions to organize, process, and utilise information (Indrayani, 2013; Utomo et al., 2017; Bon et al., 2018). The adoption of ICT raises management quality, which in turn raises service quality (Khanam et al., 2013). Different Academic Information Systems (AISs) have been established to support daily operations as a result of ICT adaptation, which has been proved to improve working efficiency in various higher education institutions (Mahenge & Sanga, 2016).

Ungku Omar Polytechnic (UOP) has used Academic Information System (AIS) called iPUO to streamline and enhance various administrative tasks associated with academic operations. iPUO is a centralized platform that enables lecturers and administrators to efficiently manage student-related data, such as attendance records, grading, and course reflections. One major benefit of the iPUO is its ability to mark attendance digitally, eliminating the need for manual paper-based processes. This feature significantly reduces administrative workload and enhances accuracy in attendance records, making it easier to monitor student attendance patterns and identify any issues promptly. iPUO also allows lecturers to provide reflections or comments on their lessons. This feature helps in evaluating teaching methodologies, identifying areas for improvement, and facilitating ongoing professional development.

However, despite these advantages, iPUO has several drawbacks that hinder its effectiveness in achieving its goals and objectives. These drawbacks impact various aspects of the system's functionality and overall performance. Here are some key areas of challenges with iPUO:

(a) Inconsistent Teaching and Learning Hours;
One of the drawbacks affecting iPUO's effectiveness is the inconsistency between the actual teaching and learning hours and the required hours specified by the syllabus. The inconsistency happens because lecturers have to key-in the teaching and learning hours manually and it leads to insufficient coverage of course content or excessive time allocation for certain topics. As a result, students may not receive the intended depth of knowledge and skills, potentially affecting their academic performance and readiness for future endeavours.

(b) Errors in Dates of Teaching and Learning;
Lecturers are required to key-in the dates and time of teaching and learning manually in iPUO. The manual insertion of dates and time of teaching and learning activities sometimes cause human errors i.e. inserting date and time which are inconsistent with given official timetable. The inconsistent data entry can lead to confusion and inaccuracies in tracking and managing educational progress. Lecturers, students, and administrators may struggle to coordinate their activities and keep track of important milestones or deadlines. Such errors can disrupt the overall flow of teaching and learning, impacting the effectiveness of the educational process.

(c) Inaccurate Course Outline Remarks;
Another drawback is the occurrence of errors in filling in the course outline remarks at incorrect dates. This can result in inaccurate documentation of crucial information such as lesson reflections, updates, or additional resources. Inaccurate remarks can create confusion among lecturers and students, making it challenging to understand and follow the intended course structure and objectives. This can impact the effectiveness of teaching and learning, as well as the overall quality of educational delivery.

(d) Data Integrity and Reliability:
The presence of errors in data entry and inconsistent information can compromise the integrity and reliability of academic data within iPUO. Inaccurate data can lead to incorrect assessments, grading, and reporting, which can have significant consequences for academic decision-making and evaluation processes. It becomes challenging for lecturers, administrators, and other stakeholders to rely on the system for accurate and dependable information.

(e) Lecturer Dissatisfaction and Work Performance;
The drawbacks in iPUO's effectiveness also have implications for lecturers' satisfaction and work performance. Frustration and dissatisfaction may arise due to the challenges faced with the system, including data entry errors, inconsistencies in course information, and difficulties in utilizing the platform. Such drawbacks somewhat affect lecturers' ability to effectively plan, deliver, and evaluate teaching, potentially impacting their overall performance and dedication to their roles.

Therefore, Course Planner (CP) platform is designed to address the above-mentioned drawbacks faced by the administrators and lecturers in using the Integrated Politeknik Ungku Omar System (iPUO). CP is developed using the PHP programming language, connecting to a SQL-based database. This allows users to access this innovative Course Planner online. CP combines the Course Outline (CO) and student attendance record under a single interface, making it easier for lecturers to update student attendance and reflections on the CO after each teaching and learning session throughout the semester. CP also automates the procedure of updating the student attendance record, where lecture dates are automatically scheduled. Lecturers no longer need to manually input lecture dates, which reduce the errors in date entry. The reflection section is also included within the same tab as the attendance record, saving lecturers' time to going back and forth between two tabs; Course Outline and student attendance record.

It offers a centralized platform where faculty members and administrators can effectively plan, organize, and manage courses, ensuring a well-structured and coordinated curriculum. Additionally, CP enables the tracking of student attendance, enabling institutions to monitor and address attendance issues proactively. The integration of CP within the larger iPUO system creates an ecosystem where academic processes and information flow seamlessly, contributing to a more efficient and effective educational environment.

This paper aims to evaluate the effectiveness of the Course Planner platform within the integrated iPUO and its impact on the academic ecosystem. The evaluation of the Course Planner platform within the iPUO aims to assess its effectiveness and the impact it has on the academic ecosystem by analyzing the platform's features, usability, and user satisfaction.

2. Materials and Methods

This study is quantitative in nature and adopted the survey research design i.e., a cross-sectional survey design. This design is adopted because it is aligned with the aim of the study and effective for providing a glimpse of the CP users' attitudes and perceptions (Mills et al. 2019). The primary data collection instrument is a questionnaire. It was constructed by adapting the Technology Acceptance Model (TAM) developed by Venkatesh (2008). The questionnaire was designed to elicit data related to participants' attitudes, perceptions, and acceptance towards the Course Planner platform. The data collection method employed was an online survey using a Google Form. The survey questionnaire was distributed to the respondents electronically via mail, allowing for convenient and efficient data collection. This is because it is inexpensive, easy to target the respondents and offers prompt result (Mills et al. 2019). The sampling technique employed was purposive sampling, which involved deliberately selecting respondents who are considered relevant and representative of the target population (Mills et al. 2019). The study participants were selected based on two main criteria which are participants who experienced using iPUO before and after the introduction of CP. In this case, 113 teaching staff members who have experience using iPUO before and after the introduction of CP platform were selected as respondents. The data analysis method utilized was the percentage calculation. The collected survey responses were analyzed by calculating the percentage of participants who answered according to the 4-likert scale questionnaire i.e., strongly disagree, disagree, agree, and totally agree. The 4-likert scale questionnaire was developed to elicit definitive responses of participants' attitudes, perceptions, and acceptance towards the CP platform. The collected data was analyzed using a percentage calculation method to uncover patterns and trends. The findings of this study will contribute to enhancing the CP platform and improving the overall academic operations within the institution.

3. Results

This section provides a comprehensive overview of the data collected from the survey questionnaire administered to the teaching staff members. The results section begins with an overview of the response rate and participant characteristics to establish the representativeness of the sample. Descriptive statistics will be provided to present a quantitative summary of participants' responses to the questionnaire items. This will include frequencies and percentages, allowing for a comprehensive understanding of the participants' perceptions and experiences with the CP platform. The analysis aims to gain insights into their perceptions, attitudes, and acceptance of the CP platform.

3.1 Reduced Errors

The utilization of the CP module within the iPUO system has resulted in the reduced errors in recording the number of hours, dates of teaching and learning activities, and inaccuracies in documenting reflection entries on incorrect dates within the iPUO system. CP manages to overcome the following drawbacks:

i. Inconsistencies in recording the number of teaching and learning hours.
ii. Inaccuracies in recording teaching and learning dates.
iii. Writing reflections on incorrect dates.

The finding from the survey shows that 96.2% respondents agreed that they do not have to key

in each teaching and learning date and total teaching and learning hours manually. This indicates that the problems with inconsistencies in recording the number of teaching and learning hours and inaccuracies in recording teaching and learning dates are reduced.

In addition, the finding also shows that 98.5% of the respondents agreed that the automatic generation of teaching hours and dates based on the lecturers' timetables eases the record management. This feature reduced the problem of writing reflections on incorrect dates. The findings are shown in the table 1 below:

Table 1. Excerpt of Survey Analysis

No	Item	Strongly disagree	Disagree	Total	Agree	Totally Agree	Total
1.	After using 'Course Planner' I do not have to key-in the teaching and learning dates and total number of teaching and learning in the absenteeism record tab manually	0.8%	1.5%	2.3%	27.3%	70.5%	97.7%
2.	The use of 'Course Planner' eliminates errors in keying in the teaching and learning dates and total number of teaching and learning.	0%	3.8%	3.8%	25.8%	70.5%	96.2%
3.	The automatic generation of teaching and learning dates eases me to update the absenteeism record and teaching and learning remarks.	0%	1.5%	1.5%	28.8%	69.7%	98.5%

3.2 Time Saving

The use of CP has resulted in time saving for lecturers in updating attendance records and reflection entries of teaching and learning activities. This is attributed to the utilization of the CP module, which has reduced the steps required to update both records within the iPUO system. Prior to the implementation of the CP module, lecturers had to go through 16 steps to update attendance records, which consumed a considerable amount of time. However, after the use of the 'Course Planner' module, lecturers only need to go through 8 steps to update both records simultaneously without the need to navigate to another tab. See table 2 for the steps involved before and after the use of CP:

Table 2. Steps involved before and after the use of CP.

Steps involved before using CP	Steps involved after using CP:
1. Start - login & select user role. 2. Click tab teaching & learning and click attendance. 3. Click update absenteeism record for the respective class. 4. Select day, month & year. 5. Select time. 6. Click add meeting. 7. Date slot added. 8. Click pencil icon to update the absenteeism record. 9. Look for student name and mark 0 or K if the student is absent or absent with exemption. 10. Click OK to update. 11. Click OK to verify the update. 12. Click tab E-FRP. 13. Select course outline tab. 14. Select course. 15. Select teaching and learning date. 16. Write teaching & learning remarks & update. - End	1. Start - login & select user role 2. Click E-FRP 3. Click tab Course Planner 4. Select class section & course outline 5. Click the pencil on the day & date of the class 6. Select update absenteeism record & reflection or reflection only 7. Mark 0 or K and scroll down to update reflection 8. Click OK to update - End

3.3 Quality of Work Procedures

The implementation of the CP module has enhanced the quality of work for lecturers in terms of updating and storing quality records. This is because the finding depicts that 94.7% of the

respondents agreed that the use of CP has increased the quality of their work output. Furthermore, nearly three-quarter of the respondents agreed that the appearance of the updated date and time stamps in the teaching and learning reflection section in CP motivated them to update the teaching and learning reflections right after their lessons. Finally, the enhanced quality of work for lecturers also can be seen in the time saved by the lecturers. This is because nearly 100% of the respondent agreed that updating the absenteeism record and reflection remarks of teaching and in CP saved their time.

Table 3. Excerpt of Survey Analysis

No	Item	Strongly disagree	Disagree	Total	Agree	Totally Agree	Total
6.	The use of 'Course Planner' increases the quality of my work output because the absenteeism record and teaching and learning reflection remarks tabs are placed at the same interface.	0%	5.3%	5.3%	28.8%	65.9%	94.7%
7.	The appearance of the updated date and time stamps in the teaching and learning reflection section in 'Course Planner' motivates me to update the teaching and learning reflections right after my lessons.	9.8%	15.9%	25.7%	33.3%	40.9%	74.3%
8.	The use 'Course Planner' saves my time to update the absenteeism record and reflection remarks of teaching and learning.	0%	0.8%	0.8%	34.1%	65.2%	99.2%

3.4 Level of Lecturer Satisfaction

The survey and interviews conducted with lecturers who use the CP module have indicated a high level of satisfaction, with overall positive feedback regarding its usage. A total of 96.2% of the respondents agreed that they like using CP. In addition, lecturers' satisfaction also can be seen in their motivation and their perception over the ease of CP use. This is because, nearly 100% of the respondents agreed that the use of CP eased their teaching and learning activities record management and almost three-fourth of the respondents agreed that the appearance of updated date and time stamps in the teaching and learning reflection section in CP platform motivates them to update the teaching and learning reflections right after their lessons.

Table 4. Excerpt of survey analysis

No	Item	Strongly disagree	Disagree	Total	Agree	Totally Agree	Total
3.	The automatic generation of teaching and learning dates eases me to update the absenteeism record and teaching and learning remarks.	0%	1.5%	1.5%	28.8%	69.7%	98.5%
4.	The use of 'Course Planner' eases me to write teaching and learning reflections and update the attendance record simultaneously because both items are placed at the same tab.	0%	0.8%	0.8%	25.8%	73.5%	99.2%
7.	The appearance of the updated date and time stamps in the teaching and learning reflection section in 'Course Planner' motivates me to update the teaching and learning reflections right after my lessons.	9.8%	15.9%	25.7%	33.3%	40.9%	74.3%
9.	I like using 'Course Planner' because I do not make mistakes while keying-in the dates and the total number of teaching & learning.	0%	3.8%	3.8%	36.4%	59.8%	96.2%

3.5 Lecturers' Complaints

Several complaints raised by lecturers during the problem identification phase of the feedback process have been addressed and eliminated through the use of the CP module. The complaints were as follows:

i) Keying-in the teaching and learning dates and time manually for absenteeism record is time consuming.
ii) The placement of the teaching and learning absenteeism record tab and course outline tab involves more steps and requires more time to update.

iii) The errors made while keying-in teaching and learning dates and time and lesson remarks in the course planner.

Table 5. Excerpt of Survey Analysis

No	Item	Strongly disagree	Disagree	Total	Agree	Totally Agree	Total
8.	The use 'Course Planner' saves my time to update the absenteeism record and reflection remarks of teaching and learning.	0%	0.8%	0.8%	34.1%	65.2%	99.2%

3.6 Value Added in Quality Control

The utilization of the CP module has created value in quality control. This is attributed to the presence of time and date stamps (see Figure 3) that are generated after lecturers update their reflection entries in the CP module. These timestamps motivate lecturers to update their reflection entries immediately after the teaching and learning activities have concluded.

Figure 1. Time and date stamps available in CP

Table 6. Excerpt of Survey Analysis

No	Item	Strongly disagree	Disagree	Total	Agree	Totally Agree	Total
7.	The presence of time and date stamps that are generated after lecturers update their reflection entries in the 'Course Planner' module motivate me to update the reflection as soon as I have completed my teaching and learning sessions.	9.8%	15.9%	25.7%	33.3%	40.9%	74.3%

4. Discussion

The section provides an in-depth analysis and interpretation of the results obtained from the survey conducted on the usage of the Course Planner platform. This section aims discuss the various aspects of the platform's usage and its impact on academic operations within UOP with the support of existing academic literatures. The following key points are discussed based on the survey results:

4.1 Effectiveness in addressing errors in quality record

The implementation of the Course Planner platform has effectively addressed the previously identified issues related to errors in recording the number of teaching and learning hours, dates, and reflection entries. The automated features of the Course Planner, such as the automatic generation of teaching hours and dates based on the lecturer's schedule, have significantly reduced errors in the record management. This finding is in line with the claims given by other existing academic studies. The studies found that Student Information System (SIS) can improve data accuracy and reduce errors in academic records by providing a centralized store for student data (Miller, 2023) and leads to more objective education-enhancement decisions

(Ngoma and Candidate, 2009). On the other hand, the utilisation of Academic Information System (AIS) has proven to be beneficial and effective for the quality of service to both students (Iswan et. al., 2022), staff and decision making (Kayanda et al., 2020).

4.2 Time efficiency and streamlined processes

The CP platform has proven to be a time-saving tool for lecturers in updating attendance records and reflection entries. The reduced number of steps required for record updates has streamlined the process and eliminated the need to navigate to different tabs or interfaces. This improvement has enhanced efficiency in managing academic records. This finding is consistent with the assertions made by other studies. According to Blackbaud, a student information system (SIS) can save time for both students and faculty by providing online attendance records. This feature allows students and faculty to easily review attendance history, eliminating the need for manual record-keeping and saving time in updating attendance records (Student Information System (SIS) Software, n.d.). Furthermore, the automated attendance systems save time for both lecturers and students by eliminating the need for manual record-keeping and reducing errors in attendance tracking (Admin, 2022). AIS also can help lecturers organize their reflection entries and retrieve them when needed. With features such as tagging, categorization, and search functionalities, lecturers can easily locate specific reflection entries based on topics, dates, or other criteria. This saves time and allows for a more systematic approach to reflection (Facilitating Reflection: A Manual for Leaders and Educators Facilitating Reflection a Manual for Leaders and Educators, n.d.)

4.3 Improvement in work quality

The implementation of the CP has contributed to the enhancement of lecturers' work quality. The platform's features, such as the inclusion of timestamps for reflection entries, have motivated lecturers to update their entries promptly after each teaching and learning session. This timely updating ensures accurate and comprehensive record-keeping, positively impacting work quality. This finding supports the claim made by Iswan et al., (2022) that the use AIS enhances the quality of service provided to students, leading to improved student outcomes (Iswan et al., 2022).

4.4 Lecturer satisfaction and user acceptance

The survey results indicate a high level of satisfaction among lecturers using the CP platform. The majority of respondents expressed positive feedback and a liking for the platform's features and functionalities. The user acceptance of the CP platform further confirms its effectiveness in meeting lecturers' needs and expectations. This finding corroborates with the previous studies conducted by Kayanda et al., (2020) Elshami et al., (2021) and Iswan et al., (2022) that the use of AIS heightens the users' satisfaction level.

4.5 Addressing lecturers' complaints

The CP platform has successfully addressed and resolved various complaints raised by lecturers. The platform's features and streamlined processes have eliminated the identified issues, enhancing lecturers' overall experience and work satisfaction. This finding is consistent with the claim pointed out by Awan Setiawan et al., (2022) that the utilization of AIS can streamline processes, improve data quality, and enhance the overall experience of lecturers and staff. Similarly, Kayanda et al., (2020) suggest that AIS usage can eliminate identified issues and enhance the overall experience and work satisfaction of lecturers and staff.

4.6 Value addition in quality control

The CP platform has added value to quality control measures. The presence of timestamps for reflection entries motivates lecturers to update their entries immediately after teaching and learning sessions, ensuring accurate and timely record-keeping. This value addition contributes to maintaining and improving the quality of academic operations. This finding supports the claims made by two studies. The study carried out by Bharati & Berg, (2003) suggests that AIS has a positive impact on service quality which i.e., it contributes to quality control measures by ensuring accurate and reliable information. Similarly, Iswan et al., (2022) claim that that the utilization of AIS adds value to quality control measures by improving information management and enhancing service delivery.

5. Conclusion

The conclusion of this research study highlights the significant positive impact and effectiveness of the Couse Planner (CP) platform in overcoming various challenges related to records management. The survey results provide compelling evidence that the implementation of CP has successfully reduced errors in recording the number of teaching and learning hours, dates and reflection entries. Lecturers no longer need to enter these details manually as the platform automates the process based on their schedules. This automation has significantly reduced the error rate and provides more accurate and reliable record management.

In addition, the CP platform has proven to be a valuable tool for improving time efficiency within the academic institution. By streamlining the process of updating attendance records and reflection entries, the platform has significantly reduced the number of steps required for these tasks. Lecturers no longer have to navigate through multiple tabs or interfaces, resulting in time savings and increased productivity. This improvement in time efficiency has a direct impact on the overall efficiency of academic operations, allowing lecturers to manage their time more effectively and focus on other important tasks.

Another important outcome is the improvement in the quality of work achieved through the use of the CP platform. The inclusion of timestamps for reflection entries has motivated lecturers to promptly update their records after each teaching and learning session. This timely updating ensures the accuracy and completeness of the records, which ultimately contributes to better quality of work. The CP platform enables lecturers to keep more organised and detailed records, which allow for better monitoring and evaluation of their teaching performance.

In addition, the survey results show a high level of satisfaction among lecturers who have used the CP platform. The positive feedback and appreciation for the features and functions of the platform show that it meets the needs and expectations of lecturers. This high level of user satisfaction is a strong indicator of the platform's success in providing a user-friendly and intuitive interface that facilitates efficient records management and overall academic operations.

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PENGGUNAAN APLIKASI PEMBELAJARAN ECOMPNET DALAM PROSES PENGAJARAN DAN PEMBELAJARAN

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ABSTRAK

Sejajar dengan perkembangan penggunaan aplikasi dalam sistem pendidikan, aplikasi eCompNet telah dibangunkan dan digunakan di PSMZA untuk membantu proses pengajaran dan pembelajaran (PdP). Tujuan kajian ini untuk menilai kebolehgunaan aplikasi dalam konteks membantu meningkatkan kefahaman pelajar terhadap PdP bagi kursus Introduction To Networks di JTMK, Politeknik Sultan Mizan zainal Abidin (PSMZA). Terdapat tiga objektif kajian iaitu mengenal pasti tahap pengetahuan sedia ada pelajar bagi kursus Introduction To Network, melaksanakan penambahbaikan proses PdP menggunakan platform digital dan mengenal pasti keberkesanan aplikasi eCompNet. Kaedah kuantitatif digunakan iaitu melibatkan satu set ujian pra, ujian pasca dan borang soal selidik menggunakan skala likert. Responden kajian adalah 66 orang pelajar semester 2 bagi program Diploma Teknologi Digital (DDT), PSMZA. Keseluruhan dapatan kajian mendapati 71.19% mendapat keputusan baik bagi ujian pasca. Ini menunjukkan bahawa para pelajar lebih memahami setiap topik selepas mereka menggunakan aplikasi ini. Berdasarkan hasil dapatan dari soal selidik pula, didapati aspek yang dinilai berjaya diterapkan di dalam aplikasi yang telah dibangunkan, di mana purata min bagi setiap aspek mencapai pada tahap yang tinggi (min > 4.52) bagi aspek keberkesanan dan (min > 4.53) bagi aspek antaramuka. Ini menunjukkan bahawa penggunaan aplikasi ini telah memberi manfaat kepada pelajar dari segi kefahaman dan mampu meningkatkan kefahaman di samping menyediakan persekitaran pembelajaran yang menyeronokkan. Oleh itu, aplikasi ini boleh digunakan dalam PdP bagi kursus Introduction To Networks di PSMZA.

1. Pengenalan

Perubahan pesat dalam sistem pendidikan bukanlah sesuatu yang asing pada masa kini. Perubahan ini adalah berasaskan kepada penggunaan kaedah pembelajaran melalui teknologi pendidikan. Dengan menggunakan teknologi, proses pengajaran dan pembelajaran (PdP) akan lebih berkesan berbanding kaedah manual. Roblyer & Schwier (2003) menyokong kenyataan

tersebut dan menyatakan bahawa teknologi telah dibuktikan dapat meningkatkan produktiviti, menyokong pengajaran secara tidak langsung, menambahkan motivasi, kebolehan pengajaran yang bersifat unik dan meningkatkan literasi maklumat.

Teknologi pendidikan begitu penting dalam PdP kerana ianya memfokuskan kepada isi-isi penting kepada topik yang ingin disampaikan disamping menjimatkan masa, tenaga dan kos perbelanjaan. Disamping itu, ianya juga dapat mengelakkan perasaan bosan kepada pelajar seterusnya menimbulkan minat kepada pelajar untuk terus belajar. Menurut Basiron (2012) pula, teknologi pendidikan merupakan satu sistem yang terdiri dari alat dan bahan media dan organisasi yang terancang bagi menghasilkan kecekapan dalam pengajaran dan keberkesanan dalam pembelajaran. Menurut Roslin & Salleh (2021) berdasarkan kajian yang telah dijalankan menunjukkan bahawa aplikasi PdP yang menarik pasti akan dapat membantu pelajar dalam menjana ilmu pengetahuan seterusnya memahami pembelajaran dengan lebih baik. Selain itu, ianya mampu menjana lebih banyak idea dan maklumbalas pelajar semasa PdP.

Aplikasi e-CompNet dibangunkan bagi menambah baik sistem pembelajaran yang dilakukan secara manual kepada sistem berkomputer untuk digunakan oleh pensyarah dan pelajar. Komputer adalah pelengkap kepada penyampaian pengajaran yang berkesan. Melalui sistem manual, pelajar dan pensyarah menggunakan buku atau nota-nota yang difotostat. Kebanyakan nota-nota ini diberi pada awal semester pengajian. Selain itu, melalui kaedah manual, pelajar juga cepat menjadi bosan dan menurunkan minat pelajar untuk belajar. Menurut Abd Nasir, Yahya & Romli, (2023) menyatakan bahawa kaedah tradisional boleh mendatangkan kebosanan, menurunkan minat dan motivasi pelajar untuk belajar. Selain itu, pelajar juga cepat menjadi bosan dengan hanya membaca nota dan mendengar penerangan daripada pensyarah. Oleh yang demikian, e-CompNet dibangunkan bagi melancarkan proses PdP serta memberi pemahaman kepada pelajar bagi kursus Introduction To Networks.

1.1 Penyataan Masalah

Penggunaan aplikasi pendidikan dalam PdP pada masa kini dilihat sebagai satu medium alternatif dalam memperkasakan lagi pendidikan di negara ini. Pengaplikasian aplikasi ini akan menjadi satu isu yang besar jika ianya tidak memberi kesan kepada pelajar. Sebelum aplikasi eCompNet dibangunkan, terdapat beberapa masalah telah dikenal pasti dalam PdP secara manual bagi kursus *Introduction To Networks* di JTMK, PSMZA. Antaranya penggunaan kertas yang banyak untuk mencetak nota dan latihan pengukuhan bagi salinan pelajar. Nota bagi setiap bab akan diberikan kepada pelajar pada setiap awal semester dan pelajar perlu mencetak nota tersebut. Nota secara bercetak membosankan dan tidak menarik minat pelajar menyebabkan mereka tidak menumpukan perhatian, gagal mendapat markah tinggi dalam peperiksaan, kurang berminat pada subjek tertentu dan seterusnya berputus asa. (Baharin Abu, 2000). Tambahan pula, nota bercetak ini tiada kombinasi elemen-elemen multimedia. Menurut kajian Arsat & Hasnisham Khalip (2011) menyatakan bahawa dengan menggunakan aplikasi semasa proses PdP berbantukan komputer, dapat memberikan keseronokan dan keyakinan semasa mengajar. Pelajar juga perlu menyalin nota tambahan semasa proses PdP berjalan. Disamping Selain itu, pelajar perlu memberi lebih perhatian semasa pengajaran di dalam kelas kerana penerangan bagi sesuatu topik tidak akan dilakukan secara berulang bagi topik yang sama.

1.2 Objektif Kajian

Bagi mencapai tujuan kajian, beberapa objektif telah ditetapkan iaitu :

i. Mengenal pasti tahap pengetahuan sedia ada pelajar bagi kursus *Introduction To Network.*
ii. Melaksanakan penambahbaikan proses PdP menggunakan platform digital.
iii. Mengenal pasti keberkesanan aplikasi eCompNet

1.3 Persoalan Kajian

Dalam kajian ini, beberapa persoalan kajian telah dinyatakan untuk mencapai objektif kajian. Persoalan kajian yang telah dikenalpasti iaitu:-

i. Sejauh manakah tahap pengetahuan sedia ada pelajar bagi kursus *Introduction To Network*?
ii. Bagaimanakah perlaksanaan penambahbaikan proses PdP menggunakan platform digital?
iii. Sejauh manakah keberkesanan aplikasi eCompNet?

2. Kajian Literatur

Pelbagai usaha telah diperkenalkan bagi mencapai keberkesanan dalam bidang Pendidikan masakini. Proses PdP pada abad ke - 21 adalah merupakan elemen yang paling penting dalam Pelan Pembangunan Pendidikan Malaysia (PPPM) di mana elemen ini telah memfokuskan kepada kaedah pengajaran yang berpusatkan murid dan dilihat seimbang bagi meningkatkan keberkesanan dalam proses pembelajaran. Pada zaman digital ini juga, penggunaan teknologi telah menjadi keperluan yang paling utama dalam kehidupan seharian bermula iaitu penggunaan komputer peribadi, rangkaian internet dan penggunaan telefon pintar. Kebanyakannya memiliki komputer peribadi atau komputer riba dan telefon pintar yang mana penggunaan aplikasi ini turut digunakan dalam bidang Pendidikan sebagai satu medium untuk penyampaian dalam proses PdP. Pendapat ini disokong oleh kajian yang telah dibuat oleh Israil dan Ahmad, (2023) menyatakan bahawa penggunaan peranti mudah alih berkait rapat dengan pendekatan e-pembelajaran yang terdapat dalam anjakan ke -7 Pelan Pembangunan Pendidikan Negara iaitu penggunaan ICT dalam pengajaran dan pembelajaran yang memperkenalkan e-pembelajaran sebagai salah satu pendekatan pendidikan.

Aplikasi eCompnet merupakan satu aplikasi digital yang diperkenalkan sebagai satu alat pemudahcara dalam membantu pelajar yang mengambil kursus Introduction To Network di Politeknik dimana ia merupakan satu kursus yang memberikan penekanan yang mendalam kepada pemahaman teori dalam konsep rangkaian komputer bagi memastikan penguasaan pelajar dalam pencapaian yang cemerlang. Kaedah pengajaran berbantukan aplikasi digital ini sangat diiperlukan oleh pelajar sebagai pemudahcara semasa proses ulangkaji kendiri pelajar tersebut selain dapat meningkat motivasi serta minat pelajar. Pendapat ini disokong oleh Baharudin, Razalli, & Shaffeei (2023) menyatakan bahawa kaedah PdP menggunakan aplikasi melalui telefon pintar di dalam kelas perlu dipelbagaikan untuk menarik minat murid. Menurut Mutambara & Bayaga (2021) pula, para pendidik perlu kreatif dengan mempelbagaikan pendekatan dalam pengajaran mereka dan tidak semata-mata melaksanakan PdP dengan teknik konvensional iaitu ‘chalk and talk’. Ini kerana penggunaan kaedah tradisional oleh para pendidik bukan sahaja akan mengurangkan

motivasi serta minat pelajar malah akan menjadikan pelajar bosan untuk terus mengulangkaji pelajaran. Pendapat ini disokong oleh Abd Nasir, Yahya & Romli, (2023) yang menyatakan bahawa kaedah tradisional boleh mendatangkan kebosanan, menurunkan minat dan motivasi pelajar untuk belajar. Sehubungan dengan itu, penggunaan aplikasi digital eCompnet ini dapat mengurangkan kebosanan, meningkatkan minat dan motivasi seterusnya memastikan kefahaman serta penguasaan pelajar bagi kursus ini dapat dipertingkatkan.

3. Metodologi Kajian

3.1 Reka bentuk Kajian

Reka bentuk kajian tindakan berdasarkan model Kemmis dan Mctaggart (1998) seperti rajah 1.1. Kajian ini dilaksanakan secara kaedah kuantitatif dengan menggunakan ujian pra dan ujian pasca serta borang soal selidik sebagai instrumen kajian yang utama. Kajian awal dimulakan dengan meninjau pelaksanaan PdP bagi kursus *Introduction To Network* untuk mengenal pasti tahap pencapaian pelajar bagi kursus ini dan menilai sejauh mana kefahaman pelajar dalam kursus tersebut. Ujian pra diberikan kepada pelajar sebelum aplikasi eCompNet diperkenalkan kepada pelajar manakala ujian pasca pula diberikan setelah pelajar mempelajari setiap topik dengan menggunakan aplikasi eCompnet. Hasil tinjauan awal, tahap pencapaian pelajar dalam pembelajaran telah dikenal pasti.

Kedua-dua ujian ini menggunakan set soalan yang sama dan markah akan diambil dan direkodkan untuk mengkaji keberkesanan penggunaan aplikasi eCompNet dalam meningkatkan pemahaman pelajar. Ujian pra dan pasca ini adalah bertujuan untuk membuat perbandingan prestasi pelajar sebelum dan selepas penggunaan eCompNet.

Rajah 1.1: Model Kemmis & Mctaggart (1988)

Seterusnya proses merancang tindakan dan perlaksanaan tindakan intervensi (eCompNet) untuk melihat keberkesanan serta kelemahan intervensi (eCompNet) yang telah dilakukan.

3.2 Populasi Dan Sampel

Sampel kajian terdiri daripada pelajar semester 2 bagi program Diploma Teknologi Digital (DDT), PSMZA. Sampel yang dipilih adalah seramai 66 orang pelajar daripada jumlah keseluruhan populasi. Borang Soal selidik diedarkan kepada pelajar semester 2 bagi program Diploma Teknologi Digital (DDT) bagi menguji keberkesanan antaramuka dan keberkesanan eCompNet yang dihasilkan.

3.3 Instrumen Kajian

Terdapat 3 instrumen yang digunakan iaitu soalan ujian Pra bagi kursus *Introduction To Network*, soalan ujian pasca bagi kursus *Introduction To Network* dan soal selidik berkaitan keberkesanan dan antaramuka eCompNet.

Pengumpulan data dimulai dengan memberi ujian pra kepada pelajar sebelum aplikasi eCompNet diperkenalkan, dengan tujuan bagi mengenal pasti tahap pencapaian pelajar sebelum aplikasi tersebut diperkenalkan. Soalan ujian pra berbentuk 1 set soalan yang terdiri dari 20 soalan mewakili 100 markah. Setelah selesai menjawab, pelajar diperkenalkan dengan aplikasi eCompNet dan diberikan kepada pelajar untuk digunakan di dalam kelas. Kemudian, soalan ujian pasca pula diedarkan kepada pelajar yang sama untuk menguji tahap pemahaman pelajar setelah menggunakan aplikasi eCompNet ini. Markah ujian pra dan pasca dikumpulkan untuk dianalisis dan direkodkan berdasarkan kepada jadual pengelasan peratusan yang telah dikaji oleh Mohd Najib (1999) seperti jadual 1.1.Markah ujian pra dan pasca dikumpulkan untuk dianalisis dan direkodkan berdasarkan kepada jadual pengkelasanpengelasan peratusan yang telah dikaji oleh Mohd Najib (1999) seperti jadual 1.1.

Jadual 1.1 : Tahap Peratusan; Sumber oleh Mohd Najib (1999)

Tahap	Peratusan
Baik	71-100
Sederhana	51-70
lemah	20-50

Bagi menilai tahap keberkesanan eCompNet pula, soal selidik diedarkan kepada responden dan dikumpulkan untuk dianalisis. Pengkaji memilih instrumen soal selidik dengan rasional bahawa maklum balas daripada responden akan diperolehi dalam jangka masa yang singkat. Responden juga dikatakan tidak mungkin terpengaruh dengan unsur luar dan bersifat berat sebelah. Menurut Majid Konting (1990), dengan menggunakan kaedah soal selidik dapat meningkatkan ketepatan data dan kebenaran yang diberikan oleh responden. Ini kerana jawapan responden tidak akan dipengaruhi oleh penyelidik. Data-data yang diterima akan dikumpulkan dan diproses serta dianalisis.

3.4 Analisis

3.4.1 Ujian pra dan pasca

Ujian pra dan pasca dilaksanakan untuk membuat perbandingan peningkatan kepada pencapaian pelajar setelah pelaksanaan aplikasi eCompNet ini. Soalan ujian pra dan ujian pasca di ambil daripada soalan-soalan peperiksaan akhir sesi lepas. Soalan ujian pra diberikan kepada pelajar bagi menguji tahap pengetahuan sedia ada pelajar dalam kursus Introduction To Network manakala soalan ujian pasca adalah bagi menguji tahap pemahaman pelajar. Data untuk ujian ini dianalisis dengan menggunakan peratus. Peratusan pelajar untuk setiap tahap pencapaian telah direkodkan. Kemudian data pencapaian untuk ujian pasca yang telah dilaksanakan akan direkodkan dengan menentukan peratusan bilangan pelajar bagi setiap tahap pencapaian. Penyelidik

merekodkan nilai perbezaan peratusan bilangan pelajar samada positif atau negatif bagi melihat tahap pemahaman pelajar.

3.4.2 Soal Selidik

Instrumen yang ketiga ialah soal selidik yang bertujuan untuk mengenal pasti sejauh manakah kebolehgunaan aplikasi eCompnet dalam membantu meningkatkan pemahaman pelajar dalam kursus yang dipelajari. Soal selidik merupakan satu instrumen yang kerap digunakan dalam kajian deskriptif kerana menerusi kaedah ini kerjasama daripada sampel diperolehi dengan mudah. Menurut Najib (1999), saiz sampel untuk kajian rintis memadai 6 hingga 10 orang sahaja serta mempunyai ciri-ciri yang sama dengan kumpulan sebenar yang digunakan dalam penyelidikan. Soal selidik ini terlebih dahulu diuji dengan 10 orang responden bagi mendapatkan kebolehpercayaan kandungan soalan dan kemudian diperiksa serta disahkan oleh Ketua Unit Penyelidikan dan Inovasi, Politeknik Sultan Mizan Zainal Abidin sebelum diagihkan kepada responden.

Dalam menguji keberkesanan eCompNet pula, soalan soal selidik menggunakan skala Likert. Soal selidik yang diedarkan kepada pelajar mengandungi 3 bahagian. Bahagian A mengandungi soalan berkaitan latar belakang responden. Bahagian B pula merangkumi soalan berkaitan keberkesanan aplikasi yang dibangunkan dan Bahagian C adalah berkaitan dengan antaramuka eCompNet.

Pengukuran nilai penunjuk aras persetujuan untuk borang soal selidik yang dibina menggunakan skala likert untuk menjawab soalan-soalan yang diperuntukkan dalam Bahagian B dan Bahagian C. Nilai 1 merupakan sangat tidak setuju manakala nilai 2 menjadi indikator terhadap tidak setuju. Nilai 3 pula menjadi penunjuk aras kepada sederhana. Manakala bagi kelompok setuju nilainya adalah 4. Manakala kelompok sangat setuju bernilai 5. Sebanyak 13 item telah dibina dengan tujuan untuk mendapatkan maklumat tentang keberkesanan dan antaramuka eCompNet dari pandangan pelajar. Jadual 1.2 menjelaskan jumlah keseluruhan item mengikut pembolehubah yang ditetapkan:

Jadual 1.2: Jumlah Item Soal Selidik Pelajar

Pembolehubah	Jumlah item
Keberkesanan eCompNet	7
Antaramuka eCompNet	6

Jadual 1.3 pula menunjukkan ukuran tahap Kecenderungan Skor Min yang digunakan untuk mengukur nilai min bagi setiap item yang dikemukakan dalam soal selidik (Landell, 1997)

Jadual 1.3: Pentafsiran Skor Min

Kod Kumpulan	Nilai Min	Tahap
1	1.00 – 2.33	Rendah
2	2.34 – 3.67	Sederhana
3	3.68 – 5.00	Tinggi

(Sumber: Diadaptasi dari Landell, 1997)

3.5 Kajian Rintis

Tujuan kajian rintis dijalankan adalah bagi menentukan nilai indeks kebolehpercayaan kandungan soal selidik. Ianya membolehkan penyelidik mengenal pasti kekurangan item soal selidik dalam membuat beberapa perubahan supaya tidak menjejaskan kajian. Menurut Mohd Najib (2003), kajian rintis adalah satu aktiviti yang penting bagi setiap kajian. Ianya digunakan bagi menentukan kesahan kandungan dan bagi mendapatkan nilai indeks kebolehpercayaan soal selidik. Selain itu, ia juga digunakan bagi menguji kaedah terbaik dalam mentadbir instrumen, mengenal sampel dan kesesuaian kaedah analisis. Disamping itu, ia juga digunakan bagi memastikan instrumen kajian yang digunakan mempunyai kesahan dan kebolehpercayaan. Menurut Mohd Najib (1999), jika nilai pekali Alpha Cronbach diantara 0.8 hingga 1.0, ia menunjukkan item kajian yang telah dibuat boleh diterima dan tidak perlu ditukar seperti yang terdapat dalam jadual 1.4.

Jadual 1.4: Pekali Alpha Cronbach

Nilai	Tahap	Rumusan
0.0 – 0.2	Rendah	Ubah semua item
0.2 – 0.8	Sederhana	Ubah sebilangan item
0.8 – 1.0	Tinggi	Item boleh diterima

Berdasarkan analisis yang dibuat, purata nilai pekali Alpha Cronbach adalah 0.816 . Ini menunjukkan bahawa semua item kajian sesuai digunakan sebagai instrument kajian sebenar

3.6 Perancangan Tindakan

Perancangan inovasi eCompNet bermula apabila timbul isu kurang pemahaman pelajar dan penggunaan modul sepenuhnya dalam PdP bagi kursus *Introduction To Networks* sekaligus melibatkan penggunaan kertas yang banyak serta menimbulkan kebosanan dikalangan pelajar. Rentetan dari isu tersebut, perbincangan telah dibuat di antara pensyarah yang mengajar kursus tersebut bersama penyelaras kursus. Dalam perbincangan tersebut, pelbagai idea dan cadangan telah diberikan mengenai aspek serta elemen yang perlu dimasukkan ke dalam aplikasi yang akan dibangunkan. enambahbaikan terus dibuat dengan membangunkan aplikasi eCompNet.

4. Dapatan Kajian dan Perbincangan

Persoalan Kajian 1: Sejauh manakah tahap pengetahuan sedia ada pelajar bagi kursus *Introduction To Network*?

Berdasarkan kepada tinjauan dan hasil analisa ujian pra yang telah dilaksanakan, didapati bahawa tahap pengetahuan sedia ada pelajar bagi kursus Introduction To Network berada pada tahap sederhana. Ini berdasarkan dapatan yang telah diperolehi melalui analisa markah ujian pra seperti dalam Jadual 1.5 dibawah.

Jadual 1.5 : Analisa Pencapaian pelajar dalam Ujian Pra

Markah	Tahap Pencapaian	Bilangan Pelajar	Peratusan
71-100	Baik	13	19.69
51-70	Sederhana	24	36.37
20-50	Lemah	29	43.94
Jumlah		66	100

Analisis mendapati bahawa jumlah pelajar yang mendapat markah pada tahap lemah lebih ramai iaitu sebanyak 43.94% dengan jumlah seramai 29 orang. Manakala pelajar yang berada pada tahap sederhana seramai 24 orang iaitu sebanyak 36.37%. Hanya 13 orang sahaja pelajar yang berada pada tahap baik iaitu sebanyak 19.69% sahaja. Jumlah markah terkumpul untuk semua pelajar iaitu sebanyak 3385 manakala nilai min skor untuk markah ujian pra iaitu sebanyak 51.29 yang berada pada tahap sederhana. Jadi secara keseluruhannya, dapatlah disimpulkan disini bahawa tahap pengetahuan sedia ada pelajar bagi kursus *Introduction To Network* berada pada tahap sederhana. (Mohd Najib, 1999).

Persoalan Kajian 2 : Bagaimanakah perlaksanaan penambahbaikan proses PdP menggunakan platform digital?

Bagi melaksanakan penambahbaikan dalam proses PdP, aplikasi eCompNet telah dibangunkan. Aplikasi ini melibatkan dua pengguna utama iaitu pensyarah dan pelajar.

Rajah 1.2: Antaramuka Halaman Utama dan Halaman Nota serta Video

Rajah 1.2 menunjukkan antaramuka Halaman Utama dan Halaman Nota serta Video bagi aplikasi eCompNet. Aplikasi ini terdiri daripada beberapa menu utama iaitu Terminology, Topology, Hardware dan Quiz. Pada aplikasi ini turut disediakan nota- nota, grafik serta video bagi meningkatkan kefahaman pelajar dalam topik berkenaan bagi kursus *Introduction To Networks*. Penggunaan video mampu mempelbagaikan kaedah pengajaran guru dalam usaha memberi motivasi dan sekaligus menarik minat dalam pembelajaran .(Syamsulaini & Mashitoh, 2019).

Rajah 1.3 : Antaramuka Halaman Quiz

Rajah 1.3 pula menunjukkan Halaman Quiz yang mana pada halaman ini disediakan soalan-soalan quiz kepada pelajar bagi mengukur kefahaman pelajar dalam topik tertentu. Selain itu juga, aplikasi eCompNet boleh digunakan pada bila-bila masa yang diperlukan dan di mana-mana sahaja sekaligus dapat menerapkan konsep pembelajaran kendiri dikalangan pelajar.

Persoalan Kajian 3 : Sejauh manakah keberkesanan aplikasi eCompNet?

Setelah menggunakan aplikasi eCompNet, ujian pasca telah dilaksanakan kepada pelajar. Hasil analisis untuk ujian Pasca dapat ditunjukkan bersama-sama dengan ujian pra seperti Jadual 1.6 dibawah. Keputusan adalah terdiri daripada purata peratusan yang diperoleh oleh kedua-dua ujian dan nilai perbezaan peningkatan peratusan antara kedua-dua ujian tersebut.

Jadual 1.6 : Jadual Pencapaian pelajar bagi Ujian Pra dan Ujian Pasca

Markah	**Tahap Pencapaian**	**Bilangan Pelajar**	**Peratusan**	**Bilangan Pelajar**	**Peratusan**	**Perbezaan peratus (%)**
71-100	Baik	13	19.69	48	72.72	+(53.03%)
51-70	Sederhana	24	36.37	18	27.27	-(9.1%)
20-50	Lemah	29	43.94	0	0	-(43.94%)
Jumlah		66	100	66	100	
Jumlah markah		3365		5075		+(1710)
Min		50.99 (Tahap Sederhana)		71.19 (Tahap Baik)		+(20.2)

Merujuk kepada Jadual 1.6, didapati tiada pelajar yang mendapat gred lemah dalam ujian pasca bahkan terdapat peningkatan peratusan sebanyak 53.03% bagi pencapaian pelajar untuk tahap baik dengan pertambahan bilangan sebanyak 35 orang. Peratusan pelajar yang berada di tahap sederhana seramai 18 orang dengan susut nilai peratusan sebanyak 9.1%. Ini disebabkan oleh ramai pelajar yang berada di tahap sederhana telah mencatatkan pencapaian markah di tahap baik.

Dari segi peningkatan markah pelajar pula, terdapat peningkatan markah sebanyak 1710 markah bagi ujian pasca dari jumlah markah pada ujian pra iaitu 3365 markah kepada 5075 untuk ujian pasca. Nilai min markah juga mencatatkan peningkatan iaitu meningkat kepada 71.19 pada ujian pasca yang mana berada pada tahap baik berbeza dengan pencapaian pada ujian pra yang berada pada tahap sederhana dengan peningkatan sebanyak 20.2. Secara keseluruhannya, peningkatan peratusan pencapaian pelajar dan juga tahap pencapaian pelajar dalam ujian pasca telah menunjukkan bahawa aplikasi eCompNet menyumbang kepada peningkatan dalam pencapaian pelajar bagi kursus *Introduction To Network*.

Bagi menilai keberkesanan aplikasi eCompNet dalam pengurusan PdP pula, data dari soal selidik yang telah dikumpulkan dan dianalisis. Hasil dapatan soal selidik yang diedarkan kepada pelajar dapat dirumuskan dalam bentuk jadual 1.7 berikut:

Jadual 1.7 : Hasil Analisis Data Bagi Keberkesanan eCompNet

Bil	**Item**	**Min**	**Tahap**
1	Aplikasi ini membantu saya untuk mendapatkan maklumat mengenai topik berkenaan	4.58	Tinggi
2	Dengan menggunakan aplikasi ini dapat menjimatkan masa	4.70	Tinggi
3	Aplikasi ini memberi lebih pengetahuan kepada saya	4.74	Tinggi
4	Aplikasi ini memberi lebih pengetahuan kepada saya	4.74	Tinggi
5	Aplikasi ini boleh digunakan sebagai bahan rujukan tambahan kepada saya	4.70	Tinggi
6	Aplikasi ini mudah digunakan	4.68	Tinggi
7	Aplikasi ini mampu memberi gambaran yang lebih jelas tentang sesuatu topik	4.77	Tinggi
Purata Skor Min		**4.69**	**Tinggi**

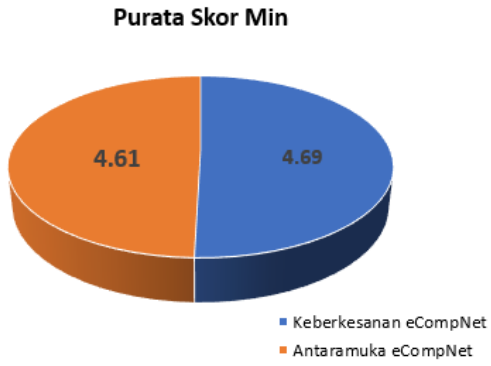
Berdasarkan dapatan data diatas, item tujuh memperolehi skor min yang paling tinggi iaitu 4.77. Ini jelas menunjukkan bahawa pelajar bersetuju dengan menggunakan aplikasi eCompNet dapat memberikan gambaran yang lebih jelas tentang sesuatu topik yang diajar. Mereka turut bersetuju bahawa dengan menggunakan aplikasi eCompNet memberikan pengetahuan yang lebih berkaitan topik yang diajar. Pembelajaran dengan menggunakan aplikasi ini juga dapat menjmatkan masa berbanding pembelajaran secara manual. Selain itu, mereka bersetuju bahawa aplikasi eCompNet boleh digunakan sebagai bahan rujukan tambahan. Secara purata, skor min bagi keberkesanan aplikasi eCompNet adalah 4.69 yang menunjukkan tahap persetujuan keberkesanan aplikasi yang dibangunkan adalah tinggi.

Jadual 1.8 : Hasil Analisis Data bagi Antaramuka eCompNet

Bil	**Item**	**Min**	**Tahap**
1	Antaramuka perisian ini amat menarik	4.53	Tinggi
2	Kandungan perisian ini bersesuaian dengan topik	4.73	Tinggi
3	Antaramuka perisian ini mudah digunakan dan difahami	4.67	Tinggi
4	Perisian ini menggunakan saiz tulisan yang mudah untuk dibaca	4.60	Tinggi
5	Perisian ini menggunakan grafik yang jelas dan baik	4.53	Tinggi
6	Secara keseluruhannya perisian ini adalah menarik	4.60	Tinggi
Purata Skor Min		**4.61**	**Tinggi**

Menurut Adnan, Ali & Ahmad (2015) antaramuka bermaksud satu alat yang membolehkan komunikasi antara pengguna dengan sistem komputer melalui penghantaran maklumat. Hasil analisis data diatas menunjukkan pelajar sangat bersetuju dengan semua item di atas. Item dua menunjukkan skor min yang paling tinggi iaitu 4.73. Ini jelas menunjukkan pelajar sangat bersetuju bahawa kandungan aplikasi adalah bersesuaian dengan topik. Item tiga pula menunjukkan skor min yang kedua tinggi iaitu 4.67. Maklum balas dari pelajar adalah positif apabila aplikasi yang dibina memiliki ciri-ciri mudah digunakan di samping mempunyai reka bentuk grafik yang menarik dan ini akan meningkatkan motivasi dengan pembelajaran yang

gembira dan seronok (Ahmad Fkrudin et al. 2019). Pelajar juga berpendapat secara keseluruhannya aplikasi ini adalah menarik. Secara purata, skor min bagi hasil analisis data antaramuka eCompNet yang dihasilkan adalah pada aras tinggi iaitu sebanyak 4.61.



Rajah 1.4: Purata Skor Min Bagi Keberkesanan dan Antaramuka eCompNet

Berdasarkan rajah 1.4 di atas, jelas menunjukkan kedua-dua item iaitu keberkesanan dan antaramuka aplikasi dari aspek pelajar adalah berada pada tahap tinggi. Ini menunjukkan aplikasi ini amat berkesan digunakan dalam pembelajaran dan antaramuka aplikasi juga adalah menarik. Secara keseluruhannya aplikasi eCompNet amat membantu pelajar dalam pembelajaran sekaligus mampu meningkatkan pencapaian yang cemerlang.

5. Kesimpulan dan Cadangan

Dengan wujudnya aplikasi eCompNet, banyak penambahbaikan yang dapat dilaksanakan dalam proses PdP di JTMK, PSMZA terutamanya kepada pelajar. Aplikasi ini dapat melancarkan proses PdP serta nota-nota dapat diakses dengan lebih cepat berbanding sistem manual. Pembaharuan ini telah menjimatkan masa yang diperuntukan untuk mengakses maklumat yang berkaitan. Hasil kajian ini telah mendapati tiada lagi pelajar yang mendapat gred lemah dalam ujian pasca bahkan terdapat peningkatan peratusan sebanyak 53.03% bagi pencapaian pelajar untuk tahap baik. Ini disebabkan oleh ramai pelajar yang berada ditahap sederhana dalam ujian pra telah mencatatkan peningkatan markah ditahap baik semasa ujian pasca. Dapatan ini menunjukkan pembaharuan bagi penggunaan aplikasi eCompNet telah mengubah tahap pengetahuan pelajar pada tahap sederhana kepada tahap baik.

Penggunaan aplikasi eCompNet sebagai medium digital dalam PdP bagi kursus *Introduction To Network* yang mempunyai ciri-ciri multimedia kreatif telah membantu meningkatkan pencapaian pelajar. Medium digital ini mempunyai ciri-ciri multimedia yang dapat membantu pelajar dalam mendapat gambaran yang lebih jelas tentang sesuatu tajuk dan mudah memahami topik yang diajar. Kaedah ini dapat merangsang proses pembelajaran dalam kalangan pelajar dengan memberi kesan yang positif terhadap minat, meningkatkan kefahaman dan motivasi pembelajaran di samping pembelajaran yang menyeronokkan. Tambahan pula, elemen multimedia ini mampu mewujudkan interaksi serta kolaborasi positif antara sesama pelajar, pelajar dengan guru serta pelajar dengan bahan pengajaran. Penggunaan teknologi multimedia boleh digunapakai untuk mengatasi kelemahan yang dihadapi dalam proses PdP (Hanis Najwa & Maimun 2014) kerana penggunaan multimedia sebagai bahan bantu mengajar banyak

memberi peluang kepada pelajar untuk mengawal pembelajaran dengan lebih baik sama ada secara berkumpulan, bersendirian atau interaktif.

Hasil analisis keberkesanan aplikasi pula menunjukkan purata skor min yang tinggi iaitu 4.69. Keputusan ini juga telah menunjukkan dengan jelas bahawa aplikasi eCompNet telah memberi manfaat dan impak kepada pelajar dari segi kefahaman dan mampu memberi gambaran secara jelas tentang sesuatu tajuk yang diajar. Selain itu, dengan menggunakan aplikasi ini juga dapat memberikan pelajar lebih pengetahuan serta menjimatkan masa. Oleh itu, penghasilan aplikasi ini menyokong kepada penyataan Dick & Reiser (1996) yang menyatakan bahawa teknologi pendidikan merupakan satu sistem yang terdiri dari alat dan bahan media dan organisasi yang terancang bagi menghasilkan kecekapan dalam pengajaran dan keberkesanan dalam pembelajaran.

Secara keseluruhannya, penggunaan aplikasi eCompNet ini telah mengubah tahap pengetahuan pelajar kepada tahap baik, pelajar lebih berminat untuk meneruskan pembelajaran kerana mempunyai ciri-ciri multimedia yang menarik serta telah memberi impak positif terhadap pembelajaran. Pihak pengkaji bercadang supaya aplikasi ini ditambahbaik pada masa akan datang dengan membesarkan lagi skop iaitu merangkumi semua topik yang terdapat di dalam kursus *Introduction To Networks*. Selain itu, pengkaji bercadang agar dapat mengkaji keberkesanan aplikasi ini dari perspektif pelajar dan pensyarah pula.

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E-CONSTRUCTION SAFETY EDUCATION IN AUGMENTED REALITY (ECONS)

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ABSTRACT

This study mainly focuses on creating a safety module using Augmented Reality (AR) for the employees at the construction site known as ECONS. AR is an enhanced version of the physical world achieved using digital visual elements, sound or other sensory stimuli transmitted through technology. Amid increasing data collection and analysis, one of the primary goals of AR is to highlight specific features of the physical world, improve understanding of those features and obtain intelligent and accessible observations that can be applied to real-world applications. This project aims to explore AR in safety construction education complying with IR4.0 by designing an interactive way of learning safety at the workplace, developing an AR system and testing the efficiency and workability of AR technology. The safety module was designed and developed using Blippar apps. There are four main elements in ECONS: hazard, personal protective equipment (PPE), safety training and OSH basic law. Based on the analysis, ECONS is a simple interactive module for users to learn and understand about safety in construction. It offers a lot of information that is necessary for construction site personnel. Moreover, the ECONS can effectively guide people with legal duties under sections 15 and 17 of the Occupational Safety and Health Act (OSHA) 1994.

1. Introduction

The construction industry has the highest number of deaths, making it the most critical sector that requires efficient OSH management to reduce the significant number of fatalities at construction sites. The construction industry plays a vital role in contributing to economic performance. The number of accidents and deaths occurring in the industry affects not only the families of victims but also employers who will suffer the loss of experienced workers and be forced to pay incidental costs due to disruption of project activities, increased insurance premiums and medical expenses.

Frequent injuries and health problems related to construction indicate that this industry is the most dangerous occupation due to the unique nature of the construction industry, where workers face a greater risk of work-related death. In addition, workers working in the construction industry are more likely to be killed in their workplace. According to

Abukhashabah E. et. al (2020), the leading causes of the high number of injuries and deaths in construction industry are:

i. Lack of awareness and experience
ii. Machinery defects and errors
iii. Lack of training
iv. Lack of personal protective equipment PPE
v. No safety and health officer or supervisor and unsafe work environment

Employers must manage safety management to ensure that a safety culture can be created among construction workers. The employer must implement a written safety policy, accident investigation and reporting, safety records, safety manuals, safety checklists, accident statistical analysis and formal organizational structure.

In architecture and construction education, Hajirasouli, A. and Banihashemi, S. (2022) stated that integrating AR in curriculum can provide students with more realistic and practical learning experience, adaptable to real and physical jobsite. AR allows students to adapt their design to the real scale of construction, within the site. It also provides with unlimited access, to otherwise limited opportunities, to participate in jobsite experiences. Meanwhile, referring to Saidin, N.F. et. al. (2015), the advantages and beneficial uses of AR features can engage students in learning processes and help improve their visualization skills. The features can also help teachers to explain well and make the students easily understand what they are taught.

The objectives of this study are to design an interactive way of learning safety at the workplace, to develop an Augmented Reality (AR) module in the workplace's safety and to test the efficiency and workability of the technology.

2. Materials and Methods

The research process in Figure 1 consists of a series of systematic procedures to generate knowledge that will be considered valuable by the project and focus on the relevant topic. The research design of the study consists of three stages.

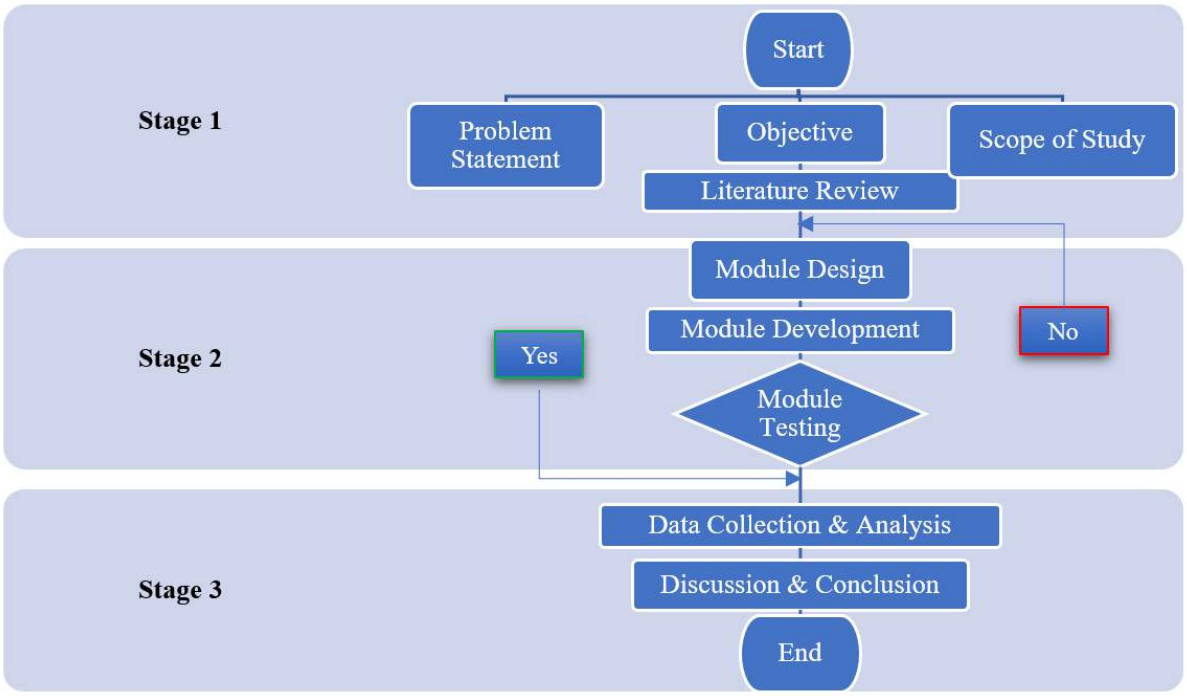

Figure 1. Research Methodology

Stage 1 involves identifying the problem statements, stating the objectives and aims, and planning the scope of study and expectations to be achieved. A well-defined research problem guided all stages of the research process, from setting objectives to choosing a technique. Literature reviews allow for gaining familiarity with the current knowledge and field chosen, as well as the boundaries and limitations. It also helps to understand the theory driving the area, allowing the researcher to contextualize the research question.

In Stage 2, it involves the process of designing, developing and testing the safety module. The module was developed using Blippar apps. It was designed and developed using Blippar apps. Blippar app (Figure 2) is a leading technology content company specialising in Augmented Reality, with the vision of making AR accessible for all. With Blippbuilder, the AR for all creation platforms can easily create and publish augmented reality. In ECONS, four main elements are included: hazard, personal protective equipment (PPE), safety training and OSH basic law. It also comprises the module testing process to verify whether this module can be developed and function as planned.

Kharchencko, Y. V. et. al. (2021) reported the Blippar app has been determined to have great benefits where it is free, the interface is simple and user-friendliness, the possibility of using different file types, the possibility of combining a large amount of information and logically structuring it, loading different types of information of video, images, 3D models, links to sites etc.

Figure 2. Blippar app

Meanwhile, in Stage 3, the discussion and conclusion were made based on the data analysis. Data collection is essential in obtaining the knowledge or information required to answer the research issue. Data was collected among the construction personnel using quantitative research methods through surveys, interviews and observation. These sources provided the primary data.

The safety module will alert construction site workers on what they are doing and what action to take if something happens. The module includes OSH fundamental law, safety, personal protective equipment, and safety training to help construction site workers. The data sampling was chosen among people involved in the architectural, engineering and construction industry (AEC), such as engineers, site supervisors, labour and lecturers and students of Polytechnics of Ungku Omar.

The data collection is taken through:

i. Surveys (Google forms)- do questionnaires and distribute them to AEC personnel.
ii. Interview - Interview the professionals to seek opinions, ideas or feedback.
iii. Observation - Observed by the through-app testing.

3. Results

The primary data collection method was using Google Forms to distribute a questionnaire. The questions on the Google form contain some basic questions and opinions to obtain the data and information required through the questionnaire that has been prepared. This question's findings have also offered outcome data to be studied and improvements on application to increase the application facilities' effectiveness further. Statistics obtained from the respondents by Google Forms showed satisfaction with trying the application built in ECONS. The following data has been received.

The information in the tables and graphs is based on the completed Google Forms Survey questionnaire results. Data were evaluated using tables and bar charts, each with full descriptions and explanations. The answers given in response to the questionnaire are critical to the project's success. The questionnaire was separated into two parts to achieve the project objectives: respondent information and assessment of respondent satisfaction with the project. The results of the survey help explain the effectiveness of the module.

3.1 Demographic Information

A total of 104 respondents completed the questionnaire about the safety education module. Table 1 shows the findings on demographic information of respondents on genders, age, nationality and occupation. About 57% of the respondents are male and aged above 18 years. Most respondents are Malaysian, including students, employers and retired from the AEC industry.

Table 1. Demographic Information

		Frequency	**%**
Gender	Male	60	57
	Female	44	43
Age	18-30	67	64.4
	31-40	4	3.8
	41-50	26	25
	>50	7	6.8
Nationality	Malaysian	102	98
	Non-Malaysian	2	2
Occupation	Student	37	35.6
	Employed	56	53.8
	Retired	11	10.6

Table 2 shows the result of respondent's satisfaction with ECONS. There are five elements measured in satisfaction: effectiveness, user-friendliness, time consumption, suitability and awareness. Most respondents strongly agree on the aspects which are evaluated in the questionnaire. 51% of respondents strongly agree on the effectiveness of ECONS.
Around 94.2% strongly agree on user-friendliness, and 61.5% strongly agree on time consumption. Meanwhile, regarding the suitability of ECONS for construction safety, 48.1% strongly agree with the respondents, and 38.5% strongly agree on ECONS as an awareness spreader to the AEC industry. However, 2.9% of respondents disagree with the awareness element.

3.2 Respondent's Satisfaction on ECONS

Table 2 shows the result of respondent's satisfaction with ECONS. There are five elements measured in satisfaction: effectiveness, user-friendliness, time consumption, suitability, and awareness. Most respondents strongly agree on the aspects which are evaluated in the questionnaire. 51% of respondents strongly agree on the effectiveness of ECONS.

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respondents are 48.1% strongly agree and 38.5% strongly agree on ECONS as an awareness spreader to the AEC industry. However, 2.9% of respondents disagree with the awareness element.

Table 2. Satisfaction on ECONS

		Frequency	**%**
Effectiveness	Strongly Disagree	0	0
	Disagree	0	0
	Fair	9	8.6
	Agree	42	40.4
	Strongly Agree	53	51
User Friendliness	Strongly Disagree	0	0
	Disagree	0	0
	Fair	2	1.9
	Agree	4	3.8
	Strongly Agree	98	94.2
Time Consumption	Strongly Disagree	0	0
	Disagree	0	0
	Fair	2	1.9
	Agree	38	36.5
	Strongly Agree	64	61.5
Suitability	Strongly Disagree	0	0
	Disagree	0	0
	Fair	15	14.4
	Agree	39	37.5
	Strongly Agree	50	48.1
Awareness	Strongly Disagree	0	0
	Disagree	3	2.9
	Fair	23	22.1
	Agree	38	36.5
	Strongly Agree	40	38.5

4. Discussion

Based on data analysis, ECONS is an effective way to learn about safety in construction sites because ECONS contains many elements and information that people in construction sites need to know. Thus, the only things people need to have to use ECONS are smartphones and the internet, which has become necessary these days. Improvement can be made if many construction companies use ECONS.

The limitations in this project have indicated the following areas as recommendations for further work as follows:

i. Upgrade the module from 2D to 3D view to make it more interesting. 3D is preferable as it is eye-catching, attractive, and more realistic.
ii. Insert more languages so more people can understand the module more, and it will make them use the module more easily.
iii. Design ECONS to make it more user-friendly so everyone can easily understand how to use the module.
iv. Focus on the safety training element because understanding safety in construction starts from safety training. Accidents can be prevented even more.
v. Add more information in ECONS to cover most safety education aspects.

5. Conclusion

In conclusion, ECONS can be an effective way to learn about safety in construction because ECONS contains many elements and information that construction site personnel need to know. Thus, the only thing people need to have to use ECONS is a smartphone and internet, which have become necessary. Improvement can be made if ECONS is widely used in many construction companies.

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HAZARD IDENTIFICATION, RISK ASSESSMENT AND RISK CONTROL APPLICATION (A – HIRARC) FOR CIVIL ENGINEERING LABORATORIES

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ABSTRACT

The development of technology based on the development of applications is increasing. Most laboratory assistants at Polytechnic Ungku Omar are required to fill out and print Hazard Identification, Risk Assessment, and Risk Control reports using traditional methods. The Hazard Identification, Risk Assessment and Risk Control (A-HIRARC) application benefits lab assistants and all supervisors on construction sites. The main objective of this research is to design application functions for hazard identification reports, risk assessment and risk control and to create applications for hazard identification reports, risk assessment and risk control using the Internet of Things (IoT) such as Canva and MIT applications and validate the application of the program with an expert. The assessment of this application was validated by 11 experts, including contractors, laboratory assistants, engineers and technicians. The results of this study show that professionals have a moderate mean interpretation of between 2.75 and 3.1 for all questions. This A-HIRARC app makes it easy for all users to understand all data and do better work. App users can also periodically review the reported data. The development of this application is based on OHSAS 18001 (2007), Occupational Health and Safety Test Series and Safety Management System requirements.

1. Introduction

The Hazard Identification, Risk Assessment and Risk Control (A-HIRARC) programme is important in handling received reports of accidents, conserving report data, and excessive report costs (DOSH 2008; Shuaib et al. 2021; Wahab et al. 2021). The influence of various Internet of Things (IoT) and Industrial Revolution 4.0 (I.R 4.0) element combinations on the performance of the proposed model has been investigated, and the efficacy of A-HIRARC has been emphasised (Lam et al. 2017; Xenofontos et al. 2021). A-HIRARC could manage and

solving the problem due to the implementation of IoT for hazard identification and risk assessment in the academic laboratory (Mustafa et al. 2021; Zaman et al. 2023). The goal of this research was to look into the Internet of Things (IoT) as well as the Industrial Revolution 4.0 (I.R. 4.0) in modelling application systems and give an alternative model for reporting accidents in IoT-based mobile apps (Chandanshive & Kazi 2017; Miorandi et al. 2012; Rajendran, Sathyanarayanan & John 2009). A-HIRARC received positive feedback according to the data survey results, and it had great functionality and also helped to solve the problem statements according to the objectives of developing A-HIRARC.

2. Materials and Methods

Canva Design, Firebase, and MIT App Inventor have become benchmark IoT software implementation methods for the A-HIRARC. To ease community challenges at the Civil Engineering Laboratory at Polytechnic Ungku Omar, the implementation is shown in Figure 1.

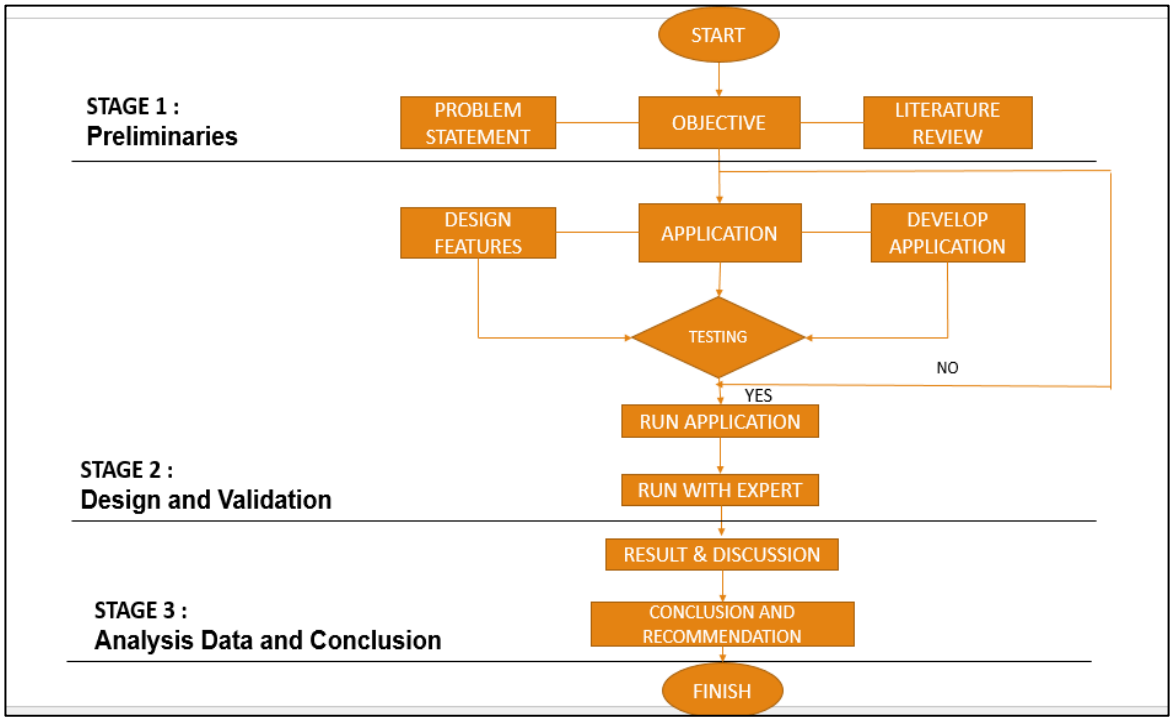


Figure 1: A Project Framework

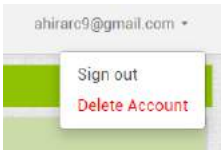
2.1 Designing Applications of HIRARC

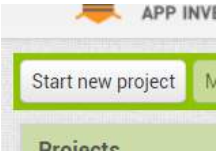
Table 1 shows the steps created for the app using the MIT app inverter. MIT app inverter is used to create all of the features in the safety management report or HIRARC, such as digital reports, guidelines, and maintenance schedules.

Table 1: Application Process

1. The researcher started by going to the MIT app inverter and clicking 'start building apps with App inverter 2" to go directly to designing and building apps

2. Next, the researcher signed up for the website using Facebook, Twitter, or email. The researcher has selected "start a new project".

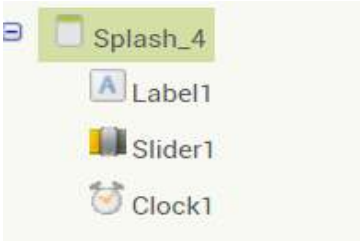




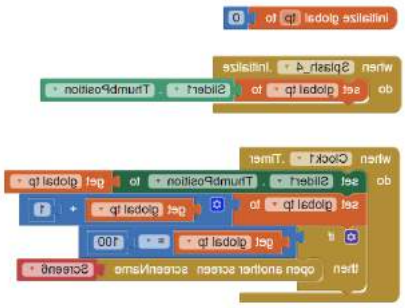
3. Following that, a blank page will show on the researcher's screen because the researcher has not added any features to the HIRARC. A user interface is shown on the left side of the screen, assisting the user in inserting the features that have been included in an app.

4. The splash screen has been used for the first screen. It can be used to promote a service or product or to announce a promotion before a user enters the site and views the rest of the tabs.

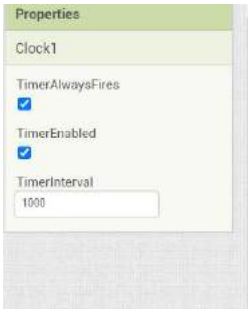
5. The researcher has selected the label in the user interface to build the name of the app and the space between the words that will be included in the apps on this splash page. After finishing editing the label features such as the text font, height, width, and text name also inserted other features like a clock and the slider to make the app function correctly.



6. After finishing the app page design, the researcher moved to the block to code the A-HIRARC app.



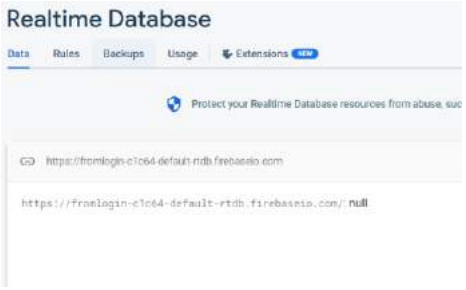
7. Then, the researcher modified the "Timer Interval from 100 to 1 at the clock's settings. The function of the feature is to initial the page.



8. The following page has a sign-in and log-in page. The page makes use of user interface elements such as an image, a button, a label, a password text ox, and a text box. The researchers are then applying "Horizontal and Vertical Arrangement" to present a collection of components that are arranged from left to right and otherwise.

9. The researchers, on the other hand, have been building Firebase to manage data collection in the applications to collect all of the A-HIRARC user data. After clicking the experimental and dragging the Firebase into the "VIEWER" the researcher has been moved the http://firebase.google.com/ to start creating the app database

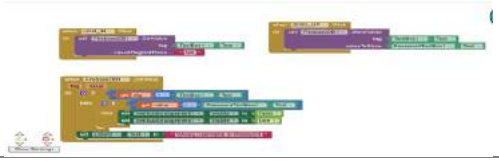
10. After finishing signing up with Firebase, the name of the project has been created and A-HIRARC "Real-time Database" on the left side of the screen has been clicked to bring up the online database collector that the researcher needs.



11. in the "Edit Rule" section, the code has been changed from false to true. The publish button was then clicked to apply the modified code. The Firebase URL has been copied on the "Data" page.

12. At the MIT app inverter, the Firebase URL was pasted to ensure that the user's data is captured and secure in the web base (Firebase)

13. This is the block that appears once the app's code is completed. The researcher can choose which page will show after that one. For example, type "Open Another Screen" and then select a screen by entering "screen" on the keyboard.

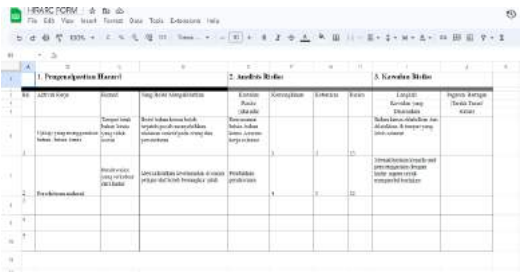


14. The researcher creates 4 app button functionalities for the "Main Page".

15. To navigate to another screen, the researcher typed "Open Another Screen" and then selected a screen by clicking "screen" on the computer. In addition, the researcher included a back button to access the previous page.

16. After finishing the "Main Page" the researcher started with the Report Form which is one of the features in the Hazard Identification, Risk Assessment, and Risk Control Application or A-HIRARC. On this page, the user interface that is used is the Label, Button, Spinner, List-view, and Web.

17. After finishing designing the page layout, the researcher moved to Excel and under "Tools", created a form has been clicked



18. Following that, the researcher began updating the form by filling in all the questions on Hazard safety by the expert.

2.2 Testing

When the download was complete and the A-HIRARC logo was displayed, the user clicked the created account/log-in button to start the process in this software. After completing the login process or creating a new account, the user can access the main page which contains buttons for form, files, history, and logout. By simply clicking the button on the form, users could also create new reports, which they could then fill out and paste into existing files. Users can find reports created and referenced by them by clicking on the files button. The history button feature allows users to search for deleted reports or reference reports that

were filled in incorrectly or deleted. The user can log out of their account after the report is complete so that other people can log in and use it.

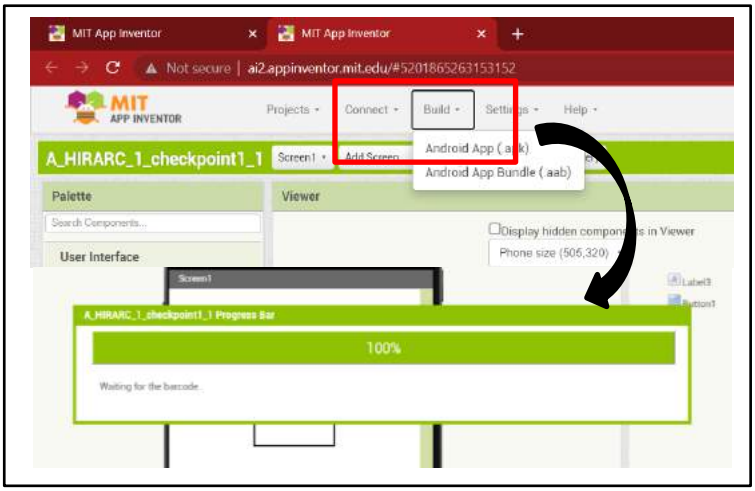


Figure 2: Testing procedure

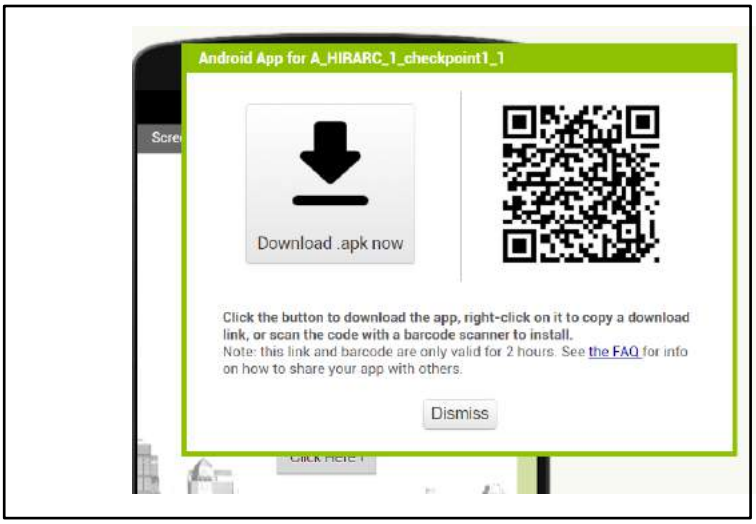


Figure 3: QR Testing

2.3 A-HIRARC Application Interface

Figure 4 shows the final result of the application after running as .apk on Android or iPhone.

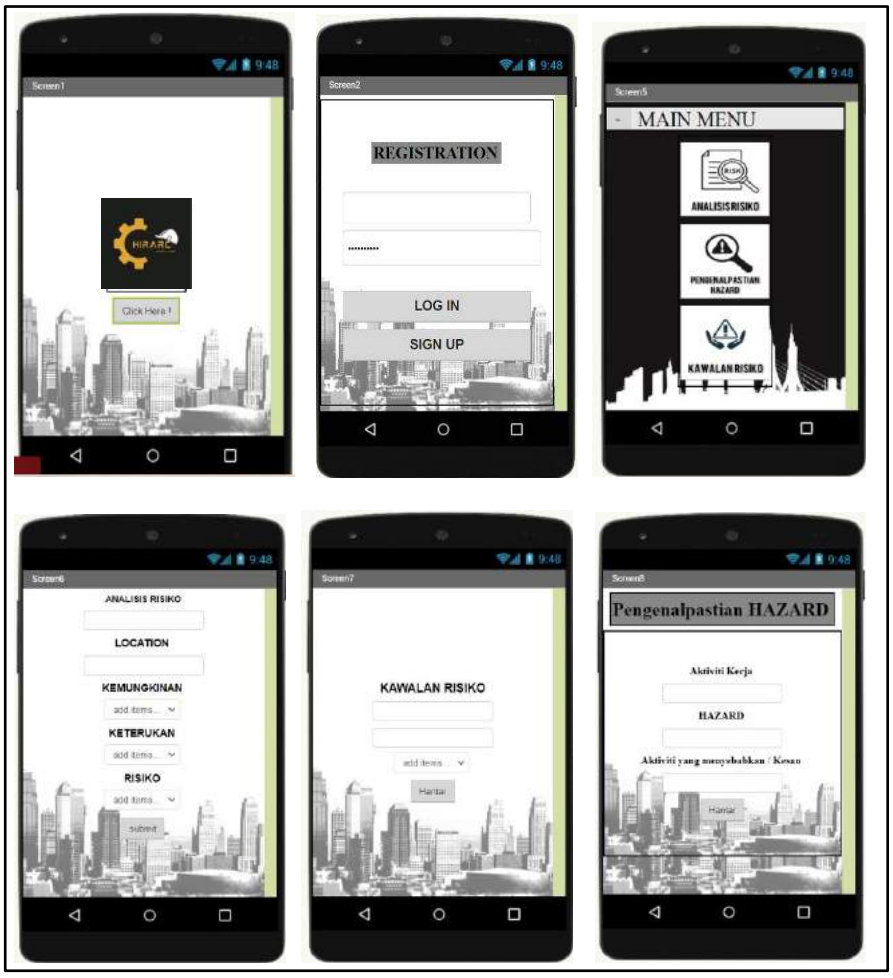


Figure 4: The final interface of Hazard Identification Risk Assessment and Risk Control Application (A – HIRARC)

3. Results

The information has been collected from 11 experts and has been analysed to obtain information such as mean, percentage, and standard deviation. The survey result was related to the data analysis process; the survey result was collected using a Google form to make it easy for an expert to provide ideas and to make it easy to collect data (Colson & Cooke 2017).

3.1 Expert Validation Respond

Data analysis of validation has been done for demographic and user satisfaction as shown in Table 2. This survey has been completed by 11 people. Male experts account for 72.7% of the total (8), while female experts account for 27.3% (3). According to Table 2, the Engineer position had 36.4% (4). The technician position comes with 27.3% (3). Furthermore, the lab assistant and contractor come with 18.2 (2).

Table 2: Summary of Demographic Info

Demographic	Sub-profile	Frequency	%
Gender	Male	8	72.7%
	Female	3	27.3
Age	Below 25 years	0	0%
	26-35 years	5	45.5%
	36-45 years	2	18.2%
	46-55 years	4	36.4%
	56-65 years	0	0%
	66 years above	0	0%
Position	Engineer	4	36.4%
	Technician	3	27.3%
	Laboratory Assistant	2	18.2%
	Contractor	2	18.2%
Experience	Below 5 year	1	9.1%
	6-10 years	5	45.5%
	11-15 years	2	18.2%
	16-20 years	2	18.2%
	Above 20 years	1	9.1%

The result was recorded by Mean, Standard Deviation, and Interpretation as shown in Table 3. In analysing the questionnaire, the source from Pallant (2020) was used for mean interpretation.

Table 3: Mean interpretation

Mean Value	Interpretation
1.00-1.66	**Low**
1.67-3.33	**High**
3.34-5.00	**Medium**

Source: Pallant (2020)

Result from Table 4 for Question 1, which is A HIRARC application provides a straightforward method for reporting any accident, hazard, or risk only one expert strongly disagrees (9.1%), three experts agree (27.3%) and seven votes strongly agree (63.6%). Next for question 2, A HIRARC Application that is simple to use and manages two votes for disagree and agree (18.2%) but seven experts vote for strongly agree (63.6%) for this question. Question 3, A HIRARC Application is convenient and paperless vote disagree is two experts (18.2%), one for agree (9.1%) and eight experts click for strongly agree (72.7%).

Table 4: Result Interpretation

No	Statement	SD	D	A	SA	MEAN	SD	Interpretation
Q1	A HIRARC Application provides a straightforward method for reporting any accident, hazard, or risk.	1 (9.1%)	0 (0%)	3 (27.3%)	7 (63.6%)	2.75	2.7	Moderate
Q2	A HIRARC Application that is simple to use and manage	0 (0%)	2 (18.2%)	2 (18.2%)	7 (63.6%)	2.75	2.6	Moderate
Q3	A HIRARC Application is convenient and paperless.	0 (0%)	2 (18.2%)	1 (9.1%)	8 (72.7%)	2.75	3.1	High
Q4	A HIRARC Application facilitates the department in recording all reports.	0 (0%)	2 (18.2%)	3 (27.3%)	6 (54.5%)	2.75	2.2	Moderate
Q5	A HIRARC Application interface and buttons are convenient.	1 (9.1%)	1 (9.1%)	5 (45.5%)	4 (36.4%)	2.75	1.8	Low

Furthermore, Question 4, which is A HIRARC Application facilitates the department in recording all reports two for disagree (18.2%), three for agree (27.3%) and six for strongly agree (54.5%). Lastly, for Question 5, A HIRARC Application interface and buttons are convenient there is one vote for strongly disagree and disagree (9.1%), five for agree (45.5%) and four experts vote for strongly agree (36.4%).

4. Discussion

A-HIRARC had been approved as capable of managing and solving problems due to the implementation of IoT for hazard identification and risk assessment in the academic laboratory. This study also demonstrated the research framework, research development, data collection, process of production and testing, system development of A HIRARC using MIT, and data analysis process that showed how and step of design for A HIRARC from the beginning, why A HIRARC had been developed, the tools that had assisted the researcher in designing and developing to make A HIRARC a reality to the user. In addition, it had been highly emphasized that the data from the expert validation obtained from the questionnaires showed that A-

HIRARC had received positive feedback according to the data survey results, and it had great functionality also helped to solve the problems statements and according to the objectives of developing A HIRARC at the beginning of the process for developing. In the future, a simple, fast, low-cost, and efficient risk assessment will be required to assist academic laboratories in further enhancing laboratory risk management. It might be necessary to combine qualitative and quantitative risk assessment techniques to improve the process while maximizing the benefits of each method. To effectively communicate the danger to laboratory users and prevent or reduce accident incidents in the academic laboratory, an online risk assessment might be required.

5. Conclusion

The Hazard Identification, Risk Assessment, and Risk Control Application (HIRARC) applications offer the programs a straightforward and immediate user interface and easier to conduct the HIRARC reporting and any other HIRARC-related works and maintenance. To mitigate hazards that potentially risk others and achieve the aim of becoming the greatest application, the safety officers and the maintenance departments should acknowledge A-HIRARC as a technology that will assist users in swiftly reporting any maintenance and hazards found. Designing (A-HIRARC) requires a thorough understanding of the application and product accumulation concepts. It is evident from the findings and discussions that the A-HIRARC system was properly built for this project. Several methods were used in this project to construct this application. Researchers employ a limited number of programs to create A-HIRARC, including the MIT app, Canva, and Firebase. This software was used to ensure the A-HIRARC was created following user needs. In the future, a simple, fast, low-cost, and efficient risk assessment will be required to assist academic laboratories in further enhancing laboratory risk management. It might be necessary to combine qualitative and quantitative risk assessment techniques to improve the process while maximizing the benefits of each method (Alaloul, Liew, and Zawawi 2015). To effectively communicate the danger to laboratory users and prevent or reduce accident incidents in the academic laboratory, an online risk assessment might be required.

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FUTURE LEARNING ECOSYSTEM DESIGN AFFORDANCE TOWARDS EDUCATION 4.0

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ABSTRACT

The 21st century is embraced by the advancement of technology in every discipline. The immense development of Information and Communication Technology (ICT), Artificial Intelligence (AI), digitization, automation, and the Internet of Things (IoT) articulate the term Education 4.0. For learning and teaching development, these advancements have aided educators to accomplish the promise of "anytime, anywhere" learning. Moreover, the infusion of ICT in education nurtures a new learning theory so-called Connectivism learning theory. The study emphasizes students' desired learning ecosystem design affordance for collaborative and self-regulated learning. The study is centred on a survey questionnaire that was engaged by 580 diploma students from Polytechnics. The findings reveal that students preferred eight design affordances in establishing an ideal learning ecosystem. The study permits a vital insight into redesigning higher education institution learning spaces.

1. Introduction

Presently, the outlook of the higher education scenario known as an academic evolution is extensively unprecedented (Ramu et al., 2019; Salinas-navarro et al., 2023; Valtonen et al., 2021). Furthermore, the diligent advancement of ICT confronts the term Industrial Revolution 4.0. The evolving latest learning theory so-call "Connectivism" has encapsulated the pedagogy (Hanh et al., 2021). Higher education institutions currently are altering their old-school learning space into technology-enabled academic learning space to expedite innovation in teaching and learning and improve learning experiences (Ramu et al., 2021; Salinas-navarro et al., 2023; Walcutt & Sae Schatz, 2020; Wangyal & Poh, 2019). Hence, higher education is now shifting away from boundaries into Next-Generation Learning Space (Ramu et al., 2020).

This research aims to distinguish an ideal learning ecosystem design affordances based on students' preferences. This study provides the research findings regarding space design aspects of higher education. It is in line with the expanding number of studies regarding the interconnection between physical learning space ecosystems, the latest learning theory, education 4.0, and 21st-century education (Vujovic et al., 2022). The digital native students are more independent in their learning undertakings and use ICT resources in assertive sufficient information. As matter of fact, emerging technologies not only alter formal education but also transform access to information and affect the soul of how the students think, interact, develop,

and collaborate. Unfortunately, the landscape of pedagogy has magnified. It embraces the complete spectrum of formal, informal and experiential learning (Viberg et al., 2021). The term "future learning ecosystem" coined by scholars demonstrates a transformation away from disconnected, episodic experiences and towards a curated continuum of lifelong learning (Walcutt & Sae Schatz, 2020).

Kim et al., 2019 stated that there is a provocation in how students perceived the new learning space which operates the learning process. Essentially, a desired and compatible campus ecosystem can be reconceptualized into a new learning landscape. Therefore, an authentic future learning ecosystem blueprint is mandatory to interpret the spatial implication of a new way of educating. As pointed out in the literature, due to Covid 19 pandemic and massive online learning, the current direction in designing education-building, consideration is given more to informal learning spaces, self-regulated, and collaborative learning compared to formal and enclosed learning spaces (Al-Mutairi, 2021; Bahasoan et al., 2020; Kamal et al., 2020). For this reason, the whole idea of learning altered from a place that delivers instruction way back in the 19th century into a setting that constitutes knowledge (Ramu et al., 2019). The conventional learning space layout is significantly correlated with the idea of "one-size-fits-all' without considering students' aspirations and needs (Bondie et al., 2019). In addressing this limitation, the new way of learning demands additional space so-called future learning ecosystem.

2. Literature Review

The term "learning ecosystem" is a specified place that leads learning namely formal and informal learning spaces. Furthermore, learning ecosystems are beyond a physical built environment (Beckers et al., 2016). Many researchers point out that 21st-century teaching and learning need to be performed in an environment that "promotes interaction and a sense of community which permit formal and informal learning". Consequently, this study addresses the profound design affordances that manipulate the learning ecosystem design. Teaching and learning are shifting in the 21st century. ICT technologies employed in the education system, namely, interactive whiteboards, individual learning spaces, wireless systems and mobile gadgets, and digital resources. Therefore, all these aspects are modifying the students learning undertakings. Thus, the conceptualization of the learning ecosystem needs to be flexible, creative, supportive and enterprising (Elkington & Bligh, 2019). Malaysia Education Blueprint (MEB) has suggested eleven strategic and operation shifts that are essential to attain the vision (Kementerian Pendidikan Malaysia, 2015). Education is a vital aspect towards accomplishing the nations' aims of developing a high-profit and knowledge-based population. Indeed, the latest ICT kits are always imposed with current teaching and learning properties. There is a sympathetic knowledge guideline that students preferably require to enhance in the 21st century. (Che KU Nuraini Che ku Mohd & Faaizah Shahbodin, 2015).

The theory of affordance was established by Gibson in 1966 and indicated that it was about "what it offers the animal, what it provides or furnishes, either for good or ill" (Masoudi et al., 2019). As mentioned by Gibson (1979) environment and animal complement each other so that a transactional relationship exists in both components. The idea of ecological perceptual psychology indicated that "human were inspired by the ecosystem and inspired the ecosystem". In this study, students recognise the learning ecosystem, that is shaped by the learning milieu. Essentially, in this study, affordances indicate the functionally learning milieu features. Students distinguish these features via action-based and perception-based. Therefore, affordances occur in various forms: objects, surfaces, substances, or places (Chaudhury, 2019). This theory

encompasses two primary mechanisms: i) students' actions and ii) students' perceptions. All the particulars obtained by the students in the learning milieu are essential for students' undertakings. Mostly, in studies concerning the student, academics often applied Gibson's theory of affordances to explore the operationalisation of students learning space perceptiveness (Chaudhury, 2019). The literature discovered that teenagers and adults own various methods of distinguishing environmental affordances. Hence, affordance is unique for each person and construct on human qualities and behaviour.

3. Methodology

The data collection was accomplished at Politeknik Sultan Idris Shah (PSIS). The respondents were chosen from the civil department by applying multistage probability sampling. The respondents (diploma students) were stratified into program and semester, which consisted of semesters one to five. Semester six is excluded due to industrial training. This study used simple random sampling, whereby, one class from each semester was selected. A total of 5 classes were selected from each program. The students' assents were obtained verbally since the participation was voluntary. The survey items were developed to acquire the data encompasses two parts. Part A involves students' demographic. Part B of the survey covers learning ecosystem design affordances. The survey items have been piloted twice in two groups (*n*= 5 and *n=6).* The rationale is to verify the clarity of the survey instruments. The items were reviewed by two expert reviewers to ensure the validity and reliability of the underlying dimension of students' future learning ecosystem design affordances. The two experts' reviewers were from the architecture and education disciplines. The reviewers found that a few items are ambiguous, rephrase, and the items needed to be bilingual. A pilot test was executed to safeguard the suitability, phrasing, arrangement, and instructions. Those students involved during the pre-test are excluded from the actual survey. After the pilot test, a few corrections were done to improve the items. After the second pilot test, the average time to answer the survey was reduced from 15 min to 10 min. The collected data was computed in the Statistical Package for Social Sciences (SPSS). Out of 580 respondents, 565 respondents completed the questionnaire, resulting in an overall response rate of 98%. The survey items were developed to distinguish the learning space design affordances, as shown in Table 1. Students are required to indicate their perceptiveness on the list of proportions, built on a five-point Likert scale ranging from 1 represents "strongly disagree" to 5 represents "strongly agree". Exploratory factor analysis (EFA) is for analysis of the smaller set of the factor structures of learning space design affordances that are best explained by its underlying items. In this research principal component extraction method and varimax rotation were used to produce the uncorrelated extracted factors with eigenvalues greater than 1.0. There are two statistical measures to examine the underlying items for each variable's extracted factor structure: standardized factor loading and Cronbach's alpha. The adopted cut-off value of standardized factor loading (l) is 0.05 and above (Hair et al., 2014), whereas Cronbach's alpha is 0.70 and above (Peterson, 2013).

Table 1: Operationalization of Future Learning Ecosystem Design Affordances

Affordances	Operationalization
Interaction (5 items)	The involvement of students in group and collaborative learning
Autonomy (4 items)	Personal control on what to do, where and when.
Privacy (5 items)	The level of control on interaction
Layout (4 items)	How the physical setting is utilized by students.
ICT Facilities (5 items)	The effectiveness of ICT facilities on campus
Comfort (12 items)	Conducive learning ecosystem
Aesthetic (4 items)	Aspects that enhance learning among students

4. Finding and Analysis

The future learning ecosystem design affordances comprised 39 items, namely: interaction affordances, autonomy affordances, semi-privacy affordances, privacy affordances, comfort affordances, ICT facilities affordances, aesthetic affordances and layout affordances (table 2). The Kaiser-Meyer-Olkin measure of sample adequacy index was 0.92. Meanwhile, bartlett's test of sphericity was significant with x^2 (703, n = 565) = 30,072.066, $p < 0.001$. Thus, this implies that the data were suitable for EFA. EFA attempts to identify factors that explain the pattern of correlation within a set of observed variables. Furthermore, EFA is also used for multivariate analysis of variance to cluster the variables into accomplishable numbers. The analysis distinguishes eight affordances extracted from EFA that represented the future learning ecosystem design affordances, namely: interaction, autonomy, semi-privacy, privacy, comfort, aesthetics, ICT facilities and layout. The items' loading ranged from 0.80 to 0.51, above the cut-off value of 0.50 as recommended by Hair et al., 2014. The EFA validated that all items are measuring the constructs loaded onto the respective factors, and excluded privacy contracts that were loaded onto two factors: privacy and semi-privacy factors. Table 2 shows Cronbach's α, eigenvalue values, cumulative variance explained, and the descriptive data. Consequently, eight factors extracted in this study are grouped as future learning ecosystem design affordances based on the Malaysian education learning context. Hence, those design factors help design an ideal future learning ecosystem that suitable for Malaysian students' learning culture. This study revealed that students demand privacy and semi-privacy learning spaces. Commonly, female students favour privacy space compared to male students. They would like to have their own little confined space with a high autonomy level (Elkington & Bligh, 2019; Masoudi et al., 2019; Xie et al., 2022; Zhang, 2019).

Table 2: Analysis of EFA

Affordances	Cronbach's	Eigenvalue values	M(SD)
Aesthetic	0.87	2.08	4.20(0.68)
Comfort	0.93	15.71	4.13(0.63)
Layout	0.79	1.00	4.01(0.67)
ICT facilities	0.90	2.69	4.00(1.03)
Interaction	0.77	1.21	3.63(1.03)
Privacy	0.80	1.14	3.80(0.94)
Semi-privacy	0.80	1.12	3.63(1.03)
Autonomy	0.80	1.76	3.30(0.93)

5. Conclusion

Those eight future learning ecosystem design affordances are developed in the local learning milieu (refer to Figure 1). Design affordances detailed in the literature are established outside of the Malaysian learning milieu. Those design affordances are established on seven attributes, namely, interaction, autonomy, privacy, comfort, aesthetics, ICT facilities, and layout. The study at Politeknik Sultan Idris Shah revealed that the privacy affordances requires to be listed in two separate entities: privacy and semi-privacy affordances, and correlated with local learning atmosphere. The private learning layout stated is personally assigned for female students in order toobtain additional personal space. Meanwhile, semi-privacy layout is correlated withalongside learning and self-regulated learning. Thus, this study discovered that there are eight design affordances required in designing future learning ecosystems. Consequently,a properly designed learning spaces can promote and enhance learning among students.

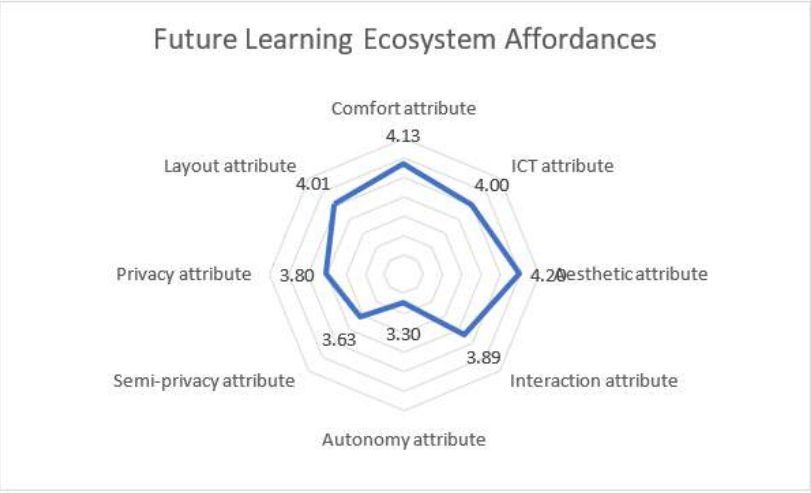

Figure 1: Future Learning Ecosystem Affordance

Study shows that aesthetic affordance attained the greatest mean score. Thus, students revealed that would prefer to perceive an appealing space design. Meanwhile, comfort affordances obtained the 2nd highest mean score. Students felt comfortable and relaxed with small corners that sell food and beverage. They don't have to leave their space in order to buy food at the café. The 3rd listed future design affordances are the layout. Students have a preference to have a learning layout to perform collaborative and self-regulated learning. A suitable layout with flexible furniture aid students with alongside study with colleagues. The 4th ranked affordances is the ICT facilities. A strong wireless internet connection helps students to execute learning anywhere, anytime on campus ground. No doubt, ICT facilities drives a vital role in achieving learning objectives in era Education 4.0. The interaction affordances obtained the 5th rank in the design attributes list. This study found that an ideal learning space must be activated and cultivate group learning, gathering with peers, meetings and multi activities. The 6th and 7th ranked design affordances are privacy and semi-privacy. These two affordances are correlated. These affordances require to be studied throughout the preliminary designing stages grounded by local learning context. Lastly, the lowest ranked is autonomy design affordances. Students prefer to have their homely learning atmosphere, whereby, they can control the ambient. Autonomy implies personal control in determining what to do,where, and when. Thus, as mentioned by Maheran et al., (2018) the reliable learning space design motivates the students' performance and enhances learningoutcomes.

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