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Judul Artikel	Platform Design Canvas Adaptation for Rapid Prototyping and Project-based Learning amid Covid-19 Pandemic
Penulis	Irwan Alnarus Kautsar, M. Ruslianor Maika
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Topic(s):
- COVID-19 ETC Distance Learning (C-19DL): Transitioning Engineering, Technology & Computing (ETC) Education from face-to-face to Distance Learning strategies, equity-focused best practices & experiences
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Keywords: Platform Design Canvas, rapid prototyping, Project-based Learning, Covid-19

Abstract: This article discusses how students can use Platform Design Canvas to help them construct a prototype for a Project-based Learning assignment. Project-based Learning was carried out by students with an interdisciplinary background. The Platform Design Canvas is a new approach to software development that aims to improve alignment between design thinking and business goals. The Platform Design Canvas was introduced as an acceleration tool for rapid prototyping, based on the Business Model Canvas, to assure the efficiency and productivity of platform ecosystems. As a result, more than 65 percent of students think that Platform Design Canvas adaptation is suitable for examining features and defining business goals for prototyping. According to the Log Metric Analysis, Students accomplished a designated task in less than 5 minutes with minimal repetition. This shows that the proposed adaption is uncomplicated to use and that the Platform Design Canvas is effective for rapid prototyping.

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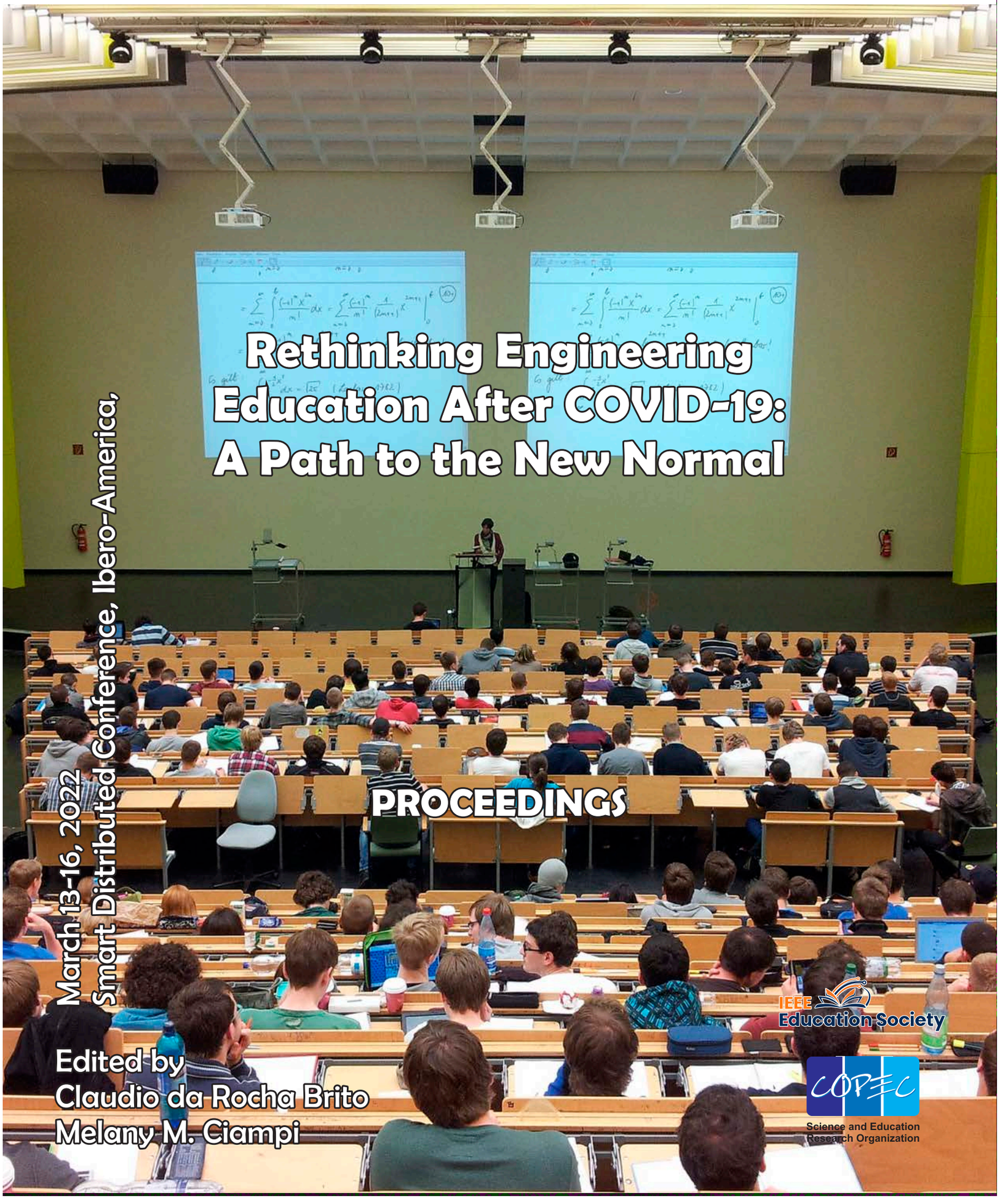

Rethinking Engineering Education After COVID-19: A Path to the New Normal

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Gabriel Gomes de Oliveira
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Jauberth Abijaude
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Katsuyuki Umezawa

L

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O

Onintra Poobrasert
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Pablo C Herrera
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Svetlana Firsova

W

Willian Rochadel

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TABLE OF CONTENTS

Analysis of the Impact of Robotics and Intelligent Systems in the Teaching of Engineering

Publisher: IEEE

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Manuel Darío Hernández Ripalda ; María Teresa Villalón Guzmán ; Paloma Teresita Guti… **All Authors**

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Abstract: An analysis is presented for the teaching of Robotics and Intelligent Systems in an Industrial Engineering program. The formation of design culture in Robotics and Intell... **View more**

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Abstract:
An analysis is presented for the teaching of Robotics and Intelligent Systems in an Industrial Engineering program. The formation of design culture in Robotics and Intelligent Systems is considered, for multidisciplinary teams where different specialists must participate in the development of common solutions, prototypes, and tests. An expected result of the analysis for teaching is a sequence of learning experiences that allow starting the acquisition of design culture in robotics and another associated result is the decision about the material elements that best contribute to these experiences. An analysis based on design theories and similar experiences was carried out and a proposal was built covering the indicated criteria.

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Contents

Digital Culture is the set of responses that a human group has with digital capabilities to act. Communication and information technologies have changed the responses to the various

problems we face, amplifying, multiplying, making behaviors faster, more diverse and at the same time more selective.

Authors

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Research Results on System Development of the Research Project of a Self-Study System for Language Learning

Publisher: IEEE

Cite This PDF

Katsuyuki Umezawa ; Makoto Nakazawa ; Manabu Kobayashi ; Yutaka Ishii ; Michiko ... All Authors

Abstract: This study proposes to develop a self-study system equipped with an artificial instructor who detects and advises learners and evaluates their language learning in a cons... **View more**

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Abstract:
This study proposes to develop a self-study system equipped with an artificial instructor who detects and advises learners and evaluates their language learning in a consolidated framework. Detecting the learners mean that the self-study system understands their learning conditions. In this paper, we describe the results of system development among our projects. In particular, we describe a study that detects various errors necessary for a self-study system and propose a system for efficiently collecting EEG (brain waves), which are biological information for detecting the learners.

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Contents

Recently, with the spread of large-scale open online courses, asynchronous distance learning where learners learn at their own pace has become widespread (Academic eXchange for Information Environment and Strategy [AXIES]). For this reason, there has been an increase in the demand for remote self-study. Nowadays, flipped classrooms are an emergent methodology to increase student independence during conventional classroom lectures. In the flipped classroom, self-study conducted before the face-to-face class plays an important role [1]. Unlike face-to-face learning where the learning time and content can be adjusted by looking at the student's facial expressions and learning attitudes, the current self-study system uses only pre-prepared learning content. In other words, the current self-study system treats all students equally, and it is not possible to provide detailed support according to the learning situation of each learner. We are confident that understanding the learning situation of each student in self-study will improve the quality and effectiveness of online learning.

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Work in Progress: Programmable Online Experiment Platform for Intelligent Information Network Courses: A Case Study

Publisher: IEEE

Boyang Lin ; Rentao Gu ; Ziyi Xi ; Zeyuan Yang ; Yuefeng Ji **All Authors**

Abstract: Engineering practice education for college students is very important in the higher education system. It requires students to carry out practical and innovative learning ... **View more**

Metadata

Abstract:
Engineering practice education for college students is very important in the higher education system. It requires students to carry out practical and innovative learning except for knowledge. However, the traditional offline education cannot provide enough practice opportunities for students, which limits students' in-depth concept understanding and restricts their practical ability and innovative thinking. During the period of COVID-19 spreading, the course can be taken online; but it will be quite difficult for conducting experiments, especially for the courses in the electronic and telecommunication systems, which usually requires expensive equipment. In this paper, taking the course "Intelligent Information Network" as example, we designed and implemented an online experiment platform, including optical switching equipment and data packet network equipment. Using remote programmable techniques and separated Algorithm Center, this platform allows students to deploy their own algorithm into the physical telecommunication equipment in web-based approach, and validate the network performance.

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Engineering practice education for college students has always been an important part of the national education system [1]. The face-to-face education system ensures universal education under a large population scale with low cost [2]. However, the development of the Internet has brought opportunities for educational reforms, and the original teaching methods have exposed the following disadvantages: 1)

The knowledge system of communication network courses is huge. The paper-based final assignments conducted by students according to the course do not necessarily go deep into the essence of the knowledge system, so that they cannot effectively help students understand what they have learned and its application value [3]. It is often difficult for students to apply their knowledge to specific problems, which brings difficulties to the cultivation of students' practical ability and innovative ability [4], [5].

2)
The existing teaching platform cannot cover the teaching needs of the network laboratory. Most platforms support experiments on analog electronic components, but the large-scale networks platforms for engineering applications have not been widely used in schools. [6], [7].

Work in progress: Educational Technology and Knowledge Tracing Models

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Abstract: Nowadays, the rapid development of computing technology and its contribution to the creation and widespread availability of information, have changed the data in the scho... **View more**

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Abstract:
Nowadays, the rapid development of computing technology and its contribution to the creation and widespread availability of information, have changed the data in the school environment in all areas. However, having a lot of information available is not the same as learning from it. Cognitive psychology, artificial intelligence, and informatics have advanced to the level where it is achievable to create computer systems for intelligent tutoring. Also, educational technology can strengthen the learning process both inside and outside the classroom. In this paper, a specific discussion is conducted on how computer science and specifically Knowledge Tracing Models can support learning with the use of educational technology.

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Conference Location: Santos, Brazil

Serafeim A. Triantafyllou
Computer Science Teacher in school of Secondary Education of Greek Ministry of Education and Religious Affairs, Greece

Contents

Intelligent Tutoring Systems are computer systems that are being created with main purpose to provide learners with the same learning advantage as a human tutor [16, 24, 26]. Computer systems for intelligent tutoring are based on useful pedagogical principles derived from the ACT-R theory of cognition. ACT-R is a general theory of cognition developed by John Anderson and colleagues at Carnegie Mellon Univeristy that focuses on memory processes [28].

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Platform Design Canvas Adaptation for Rapid Prototyping and Project-based Learning amid Covid-19 Pandemic

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***Abstract*—This article discusses how students can use Platform Design Canvas to help them construct a prototype for a Project-based Learning assignment. Project-based learning was carried out by students with an interdisciplinary background. The Platform Design Canvas is a new approach to software development that aims to improve alignment between design thinking and business goals. The Platform Design Canvas was introduced as an acceleration tool for rapid prototyping, based on the Business Model Canvas, to assure the efficiency and productivity of platform ecosystems. As a result, more than 65 percent of students think that Platform Design Canvas adaptation is suitable for examining features and defining business goals for prototyping. According to the Log Metric Analysis, Students accomplished a designated task in less than 5 minutes with minimal repetition. This shows that the proposed adaption is uncomplicated to use and that the Platform Design Canvas is effective for rapid prototyping.**

Keywords—Platform Design Canvas, rapid prototyping, Project-based Learning, Covid-19

I. Introduction

Covid 19 pandemic not only affects on the economic and humanitarian aspect [1]–[4]. But also in the academic/education sectors [5]–[7]. Positively Covid-19 pushes human creativity into new cultures such as remote work or work from home [7]–[9]. The most appropriate learning model for implementing a social distance and a self-quarantine is remote learning [6], [10], [11].

On the other hand, to create Innovation, students need to implement their knowledge from the classroom into real-world problem solving [12]–[14]. In the context of the educational system, those activities are normally called Project-based Learning [15].

Students need to be supported by some prototyping framework and supportive tools to help implement Project-based learning in a remote culture [12], [16], [17]. Furthermore, lecturers need to monitor and analyze the student activities for evaluation matters [17].

This paper presents the adaptation of Platform Design Canvas on the current development supportive tool that helps lecturers and students not only to implement Project-based learning but also accelerate some innovation amid the Covid19 pandemic.

II. Problem Analysis

A. Project-based Learning

Project-based Learning (PBL) is one kind of learning model that challenges students to solve real-world problems [18]–[20]. The key of PBL method's key components includes challenging students with the need for some systems or incomplete existing digital service, then encouraging them to complete it, promoting self-discipline and self-regulation by allowing students to define their working hours, timeline and outcome, encouraging teamwork, and interdisciplinary collaboration [16], [19], [21].

Especially, the Indonesian Government pushed lecturers to adopt Project-based Learning and or Outcome-based Education through the program named *Merdeka Belajar Kampus Merdeka* (MBKM) [22], [23]. To Implement Project Based Learning, students were assigned to develop a real-world application by choosing one topic from the following:

1. Digital product that is needed by Students themselves
2. Digital product that is needed to mitigate Covid-19
3. Digital product that is needed by people with disabilities
4. Digital product that enhanced from existing product
5. Digital product that aligns with sharia compliance on commerce transaction

Next, students were asked to form a group with 10 members each. From this point, it has some research questions (**RQ 1**): "How to support lecturers and students to implement Project-Based Learning amid Covid-19 pandemic?"

B. Rapid Prototyping

Rapid prototyping is a software development method that emphasizes fast, iterative development cycles and a modest number of features [24]–[26]. Rapid prototyping does not aim to create a finished product [24], [27]. The idea is to construct something that uses technology or platform as rapidly as possible so that it can deliver or grasp the technology or platform's strengths and drawbacks [24], [27]. The Rapid Prototyping simple phase is illustrated in Fig. 1.

Fig. 1. Three simple phases of rapid prototyping

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The detail of three simple phases that can easily be followed by students to start to develop some platform are explained below:

1. Ideation

   The team discusses one or more initial platform ideas. The idea is presented in some visual representation that describes the design specifications, user interaction, or just an explanation of the existing real-world problems.

2. Evaluation

   In this phase, the idea that has been developed into a prototype is shared with other team members and stakeholders. Students could conduct some focus group discussions to align the developed platform to the intended end-users.

3. Enhancement

   The goal of the evaluation phase is mainly to get feedback. After that, the design process returns to the evaluation phase for more feedback. This process is repeated until no more changes are made or a defined cut-off is achieved (either a date, iterations, or a finished product). It also includes developing a new version of the developed platform.

From those three simple steps that are required in rapid prototyping, bring up another research question: (**RQ 2**): "What is the suitable platform design framework that helps students conduct rapid prototyping and it can be used by lecturers to implement Project-based Learning?"

III. Proposed Method

To answer previous research questions, we propose to develop a web-based supportive tool that can be used in both online and offline conditions. Today's web-based framework like Flask and Python library called WSGI made it possible to develop web-based supportive tools that are being used in both online and offline conditions [28], [29]. When students have an internet connection, students can access it online on designated URLs. And when students are offline, students could access the developed supportive tool with their computer locally [16], [30].

In this paper, we propose the use of Platform Design Toolkit to help students design platforms and prototypes as their assignments. Also, we have developed extended features on current development supportive tools to assist students adapting a Platform Design Canvas as part of Platform Design Toolkit.

A. Platform Design Toolkit

Platform Design Toolkit (PDT) has been developed to help developers not only understand business models but also align the design process with design thinking [31], [32].

To use PDT, developers need to explore the existing system and needed features. After exploration, the developer team designs a platform strategy. Furthermore, the developer team validates the exploration features to then define the strategies needed in developing the platform so that it has grown. The stages of PDT are illustrated in Fig. 2.

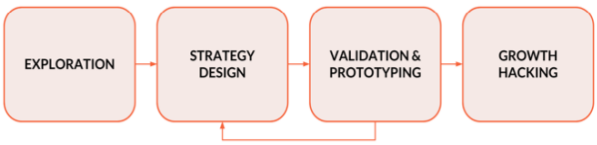

Fig. 2. Platform Design Toolkit macro phases [33].

The detail of the PDT four macro phases are as follows:

1. Exploration
   In this phase, students explore the platform ecosystem that is being developed.
2. Strategy Design
   In this phase, students define the core value platform by designing the business model.
3. Validation & Prototyping
   In this phase, students validate the proposed business model with several prospective users by developing a Minimum Viable Product (MVP)
4. Growth Hacking
   In this phase, students design a strategy about how the platform built becomes more relevant and growing (Growth/Scale-Up).

The PDT method was chosen in this study because the PDT framework was aligned with the basic objectives which are Project-based Learning. Moreover, the new PDT version 2.2 was released in May 2021 so students were involved in this study have the opportunity to obtain learning materials and experience in implementing the up-to-date platform development framework. The adaptations of the proposed method were illustrated in Fig. 3.

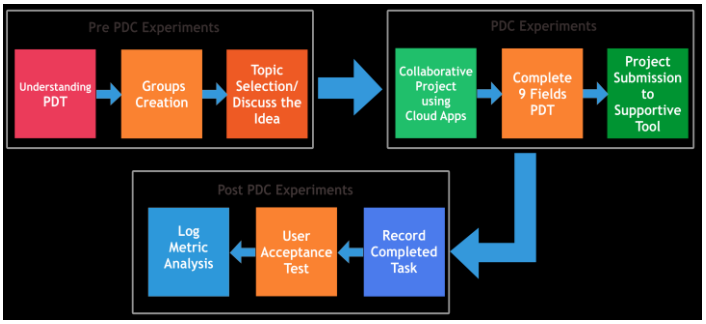

Fig. 3. Proposed Platform Design Toolkit adaptation.

B. Platform Desain Canvas

Design Toolkit (PDT). Platform Design Canvas is fully inspired by Business Model Canvas [34]. Using PDC, students were asked to describe 9 elements of it which are Value Propositions, Peers, Partners, Transactions, Channels and Contexts, Infrastructure and Core Components, Services, Platform Owner, and Platform Stakeholders. The detailed description element of PDC in following:

1. Platform Owners

   In this element, students need to define the Platform Owner. Platform Owners are the platform's "owners" who have the vision for the market's manifestation and are responsible for ensuring that the platform is always engaged in productive activities.

2. Platform Stakeholders

   After defining the platform owner, students need to describe the platform stakeholders. Platform Stakeholders are entities with a vested interest in the platform's success or failure, in managing platform externalities and outcomes, in regulating the platform, or in exercising platform governance functions.

3. Peers

   Different from Platform Owner and Stakeholder, other elements of PDC that need to be described are Peers. Peers are individuals or small-to-medium-sized businesses who act as a single distinct entity with a specific interest and purpose that the platform's value proposition must match. There are 2 kinds of peers on the platform design toolkit, namely:

   a. Peer Producers (PP): Peer producers can be called producers or providers are entities that provide value on the supply side of the market ecosystem as an opportunity to increase professionalism and hone skills towards better performance.

   b. Peer Consumers (PC): Peer Consumers (or they can be called users) are entities that are interested in consuming, utilizing, accessing the value created through and on the platform.

4. Partner

   After Peers, students need to define the Partner of the developed platform. Partners (PA) is an entity that seeks to create additional professional value, not the main value but is closely related in collaboration with the platform owner. The partner's role in the platform facilitates, serves, and increases production value by acting as brokers, facilitators, and connectors.

5. Transactions

   Next, students need to describe the Transactions. Transactions are sub-actions in which value is created, assigned, transferred, or traded between entities. Such transactions consist of exchanges or transfers between Peers and Partners through the platform. Transactions may include the exchange of services or resource access.

6. Channel and Context

   In this phase, students are requested to describe how Platform Value Propositions are delivered to Peers.

7. Services

   Students need to describe what services that need to exist on the developed platform. The platform service will support continuous improvement of participant performance from the producing entity and also complements the experience provided by the ecosystem through a platform targeted to customers. There are 3 kinds of services in the platform design canvas that students need to describe:

   a. Enabling Services

      Services that are aimed at assisting partners in generating value from their professional talents, expanding their markets, increasing their visibility, and making significant improvements as professionals.

   b. Empowering Services

      Services that are aimed at assisting peer producers in starting transactions, honing their skills, improving on the platform, and beginning the development phase.

   c. Other Services

      Service that can be delivered to Peer Consumers (PC) as complimentary of platform ecosystems.

8. Value Propositions

   Using PDC, students are required to describe two kinds of Value Propositions: Core Value Propositions and Ancillary Value Propositions. Core Value Proposition is the main value of the platform that tries to produce. Ancillary Value Propositions are the extended value from the platform that can be produced to gain more profits.

9. Infrastructure & Core Components

   In this section, students are requested to describe several entities/assets that are controlled and owned by the platform owner and governed by the platform governance. These components ensure that the platform is functional and usable by the ecosystem. Infrastructure and structures can be tangible such as applications or offices and intangible such as platform standardization agreements.

Next, we discuss the proposed web-based supportive tool to help students adapt Platform Design Canvas.

C. Collaboration Supportive Tool

To adapt Platform Design Canvas (PDC) as Project-based Learning, we have developed a Supportive Tool that will be used by students to collaborate designing the platform as Project-based learning activities. For the collaboration, students have been provided PDC templates on developed supportive tools (shown in Fig. 4). After conducting collaboration, students also provided a PDC online form (shown in Fig. 5) to submit their PDC's final version of the proposed platform. The developed supportive tool records the student's activities while accessing PDC templates. This recording is saved as Log Data (shown in Fig. 6). Later, the log data are used to analyze the ease of use of Platform Design Canvas for rapid prototyping.

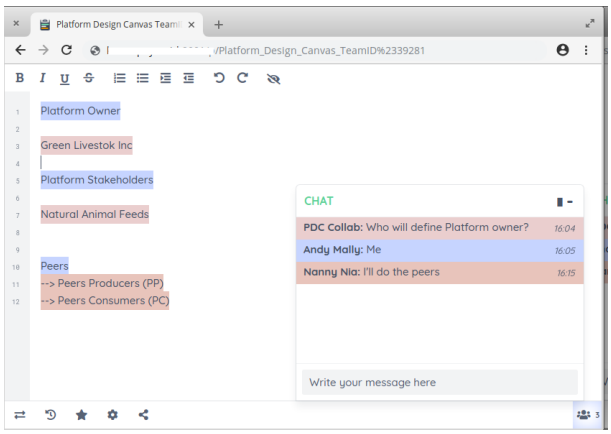

Fig. 4. Collaborative PDC Templates at developed Supportive Tool

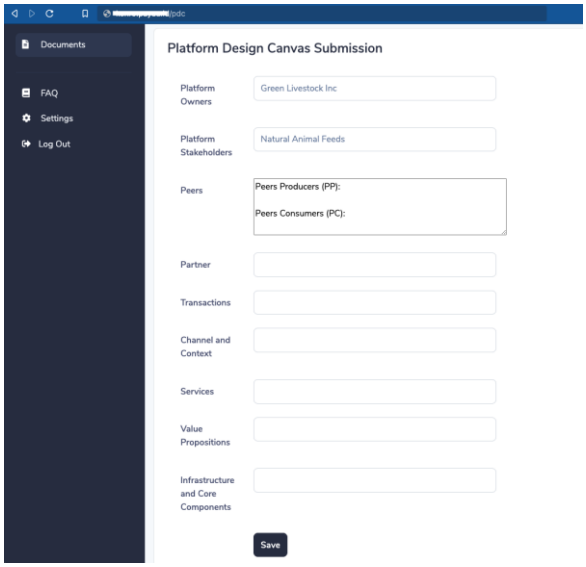

Fig. 5. PDC Templates web form

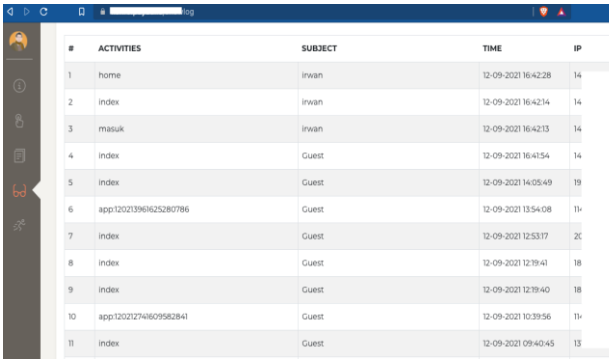

Fig. 6. Supportive Tool Log Systems

IV. Results and Discussions

This section will cover the results of the questionnaire and log metrics regarding the use of PDC for rapid prototyping. Furthermore, all participants were asked to complete the designated questionnaire before using or learning PDC.

A. Results

The total number of students that have participated is 134 students which formed into 18 groups. The questionnaire's questions are shown in Table I.

TABLE I. PRE-EXPERIMENT QUESTIONS FOR STUDENTS

#	Response and Percentage		
	Questions	*Yes (%)*	*No (%)*
1	Have students experienced Project-based Learning?	86	14
2	Have students developed some platforms?	79	21
3	Are students familiar with some rapid prototyping tools?	24	76
4	Do students ever collaboratively develop platforms?	28	72
5	Do Students ever learn or use Platform Design Toolkit/Platform Design Canvas?	2	98

After implementing Platform Design Canvas and Project-based Learning, students were asked to fill out the questionnaire to know their perceptions about the proposed method with 5 indicators (Strongly Agree, Agree, Neutral, Disagree, and Strongly Disagree). The questionnaire is shown in Table II

TABLE II. POST-EXPERIMENT QUESTIONS FOR STUDENTS

#	Item Description
1	Project-based learning suitable as a learning model amid Covid 19
2	PDC helps explore the business models
3	PDC helps validate the proposed idea
4	PDC helps to scale up the prototype
5	Using PDC as the framework for the next project
6	The developed supportive tool helps collaboration in a remote manner
7	Developed Supportive tool accommodate the prototyping using PDC
8	Given instructions are easy to follow

Then, using the formulas below, a Likert scale was utilized to assess how all participants felt about using PDC in their prototyping process.

$$P = \frac{N \times R}{I} \times 100\% \quad (1)$$

Which:
P = Each question's percentage value
N = The value of each instrument's response
R = The frequency of answered value
I = The number of participants multiplied by the highest value of the answer ($134 \times 5 = 670$)

The Likert percentage from Eq. (1) is shown in Fig. 7.

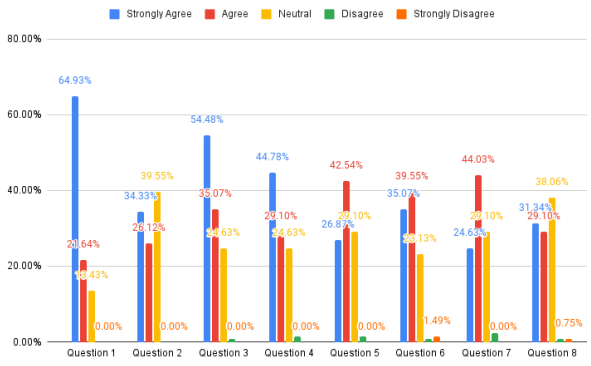

Fig. 7. Likert percentage of students perceptions

Next, we record the accomplished time each student uses a built-in developed logger. This logger was used for knowing how much time is needed by students to finish each field in the PDC. Based on the required finished time, we had categorized 134 students into 3 groups. Which are students that finished the given task in less than 5 minutes, 5 to 10 minutes, and more than 10 minutes. The results are shown in Fig. 8.

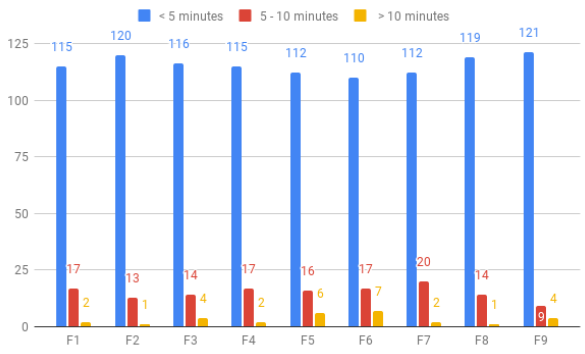

Fig. 8. Log Metric Data

B. *Discussions*

From Fig. 7, the use of existing cloud applications and supporting tools allows students to collaborate remotely. And 64.93% of students thought Project-based Learning is suitable as a learning model amid covid 19 pandemic. Even Though 39.55% of students felt neutral about PDC helping define business models, 54.48% of students felt PDC could validate the proposed idea, and 42.54% of students were willing to use PDC in the next project. From this perspective, using PDC for turning an idea into a real-world application is far more feasible. As part of the learning process, fully online collaboration among group members will foster a new culture of the creative process, which will have a beneficial impact for lecturers implementing Project-based Learning during/post covid 19.

From Fig. 8, according to Log Metric Data, students mostly accomplished the PDC elements in less than 5 minutes. This indicates that students are not having difficulties while adapting Platform Design Canvas on the current development supportive tools.

V. Conclusions and Future Works

The Platform Design Canvas (PDC) is a new software development approach that tries to better match design thinking with business goals To ensure the efficiency and productivity of platform ecosystems, PDC was designed as an acceleration tool for fast prototyping based on the Business Model Canvas. While designing a platform, PDC assists in prototyping more quickly and defining a more in-depth grasp of the essential requirements. In addition, the utilization of cloud applications and proposed supportive tools allow students to collaborate while implementing remote learning during a pandemic. In the conclusion, over 60% of students confirm Platform Design Canvas adaption is appropriate for assessing business models and more than 64% of students agree that the developed supportive tools could accommodate prototyping using PDC.

It is possible to explore and combine the PDC with other tools such as Design Sprint for prototyping in future work.

Acknowledgment

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CB4

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Platform Design Canvas Adaptation for Rapid Prototyping and Project-based Learning amid Covid-19 Pandemic

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***Abstract*—This article discusses how students can Platform Design Canvas to help them construct a prototype for a Project-based Learning assignment. Project-based learning was carried out by students with an interdisciplinary background. The Platform Design Canvas is a new approach to software development that aims to improve alignment between design thinking and business goals. The Platform Design Canvas was introduced as an acceleration tool for rapid prototyping, based on the Business Model Canvas, to assure the efficiency and productivity of platform ecosystems. As a result, more than 65 percent of students think that Platform Design Canvas adaptation is suitable for examining features and defining business goals for prototyping. According to the Log Metric Analysis, Students accomplished a designated task in less than 5 minutes with minimal repetition. This shows that the proposed adaption is uncomplicated to use and that the Platform Design Canvas is effective for rapid prototyping.**

***Keywords*—Platform Design Canvas, rapid prototyping, Project-based Learning, Covid-19**

I. Introduction

Covid 19 pandemic not only affects on the economic and humanitarian aspect [1]–[4]. But also in the academic/education sectors [5]–[7]. Positively Covid-19 pushes human creativity into new cultures such as remote work or work from home [7]–[9]. The most appropriate learning model for implementing a social distance and a self-quarantine is remote learning [6], [10], [11].

On the other hand, to create Innovation, students need to implement their knowledge from the classroom into real-world problem solving [12]–[14]. In the context of the educational system, those activities are normally called Project-based Learning [15].

Students need to be supported by some prototyping framework and supportive tools to help implement Project-based learning in a remote culture [12], [16], [17]. Furthermore, lecturers need to monitor and analyze the student activities for evaluation matters [17].

This paper presents the adaptation of Platform Design Canvas on the current development supportive tool that helps lecturers and students not only to implement Project-based learning but also accelerate some innovation amid the Covid19 pandemic.

II. Problem Analysis

A. Project-based Learning

Project-based Learning (PBL) is one kind of learning model that challenges students to solve real-world problems [18]–[20]. The key of PBL method's key components includes challenging students with the need for some systems or incomplete existing digital service, then encouraging them to complete it, promoting self-discipline and self-regulation by allowing students to define their working hours, timeline and outcome, encouraging teamwork, and interdisciplinary collaboration [16], [19], [21].

Especially, the Indonesian Government pushed lecturers to adopt Project-based Learning and or Outcome-based Education through the program named *Merdeka Belajar Kampus Merdeka* (MBKM) [22], [23]. To Implement Project Based Learning, students were assigned to develop a real-world application by choosing one topic from the following:

1. Digital product that is needed by Students themselves
2. Digital product that is needed to mitigate Covid-19
3. Digital product that is needed by people with disabilities
4. Digital product that enhanced from existing product
5. Digital product that aligns with sharia compliance on commerce transaction

Next, students were asked to form a group with 10 members each. From this point, it has some research questions (**RQ 1**): "How to support lecturers and students to implement Project-Based Learning amid Covid-19 pandemic?"

B. Rapid Prototyping

Rapid prototyping is a software development method that emphasizes fast, iterative development cycles and a modest number of features [24]–[26]. Rapid prototyping does not aim to create a finished product [24], [27]. The idea is to construct something that uses technology or platform as rapidly as possible so that it can deliver or grasp the technology or platform's strengths and drawbacks [24], [27]. The Rapid Prototyping simple phase is illustrated in Fig. 1.

Fig. 1. Three simple phases of rapid prototyping

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The detail of three simple phases that can easily be followed by students to start to develop some platform are explained below:

1. Ideation

   The team discusses one or more initial platform ideas. The idea is presented in some visual representation that describes the design specifications, user interaction, or just an explanation of the existing real-world problems.

2. Evaluation

   In this phase, the idea that has been developed into a prototype is shared with other team members and stakeholders. Students could conduct some focus group discussions to align the developed platform to the intended end-users.

3. Enhancement

   The goal of the evaluation phase is mainly to get feedback. After that, the design process returns to the evaluation phase for more feedback. This process is repeated until no more changes are made or a defined cut-off is achieved (either a date, iterations, or a finished product). It also includes developing a new version of the developed platform.

From those three simple steps that are required in rapid prototyping, bring up another research question: (**RQ 2**): "What is the suitable platform design framework that helps students conduct rapid prototyping and it can be used by lecturers to implement Project-based Learning?"

III. Proposed Method

To answer previous research questions, we propose to develop a web-based supportive tool that can be used in both online and offline conditions. Today's web-based framework like Flask and Python library called WSGI made it possible to develop web-based supportive tools that are being used in both online and offline conditions [28], [29]. When students have an internet connection, students can access it online on designated URLs. And when students are offline, students could access the developed supportive tool with their computer locally [16], [30].

In this paper, we propose the use of Platform Design Toolkit to help students design platforms and prototypes as their assignments. Also, we have developed extended features on current development supportive tools to assist students adapting a Platform Design Canvas as part of Platform Design Toolkit.

A. *Platform Design Toolkit*

Platform Design Toolkit (PDT) has been developed to help developers not only understand business models but also align the design process with design thinking [31], [32].

To use PDT, developers need to explore the existing system and needed features. After exploration, the developer team designs a platform strategy. Furthermore, the developer team validates the exploration features to then define the strategies needed in developing the platform so that it has grown. The stages of PDT are illustrated in Fig. 2.

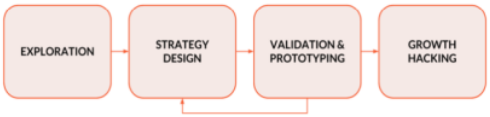

Fig. 2. Platform Design Toolkit macro phases [33].

The detail of the PDT four macro phases are as follows:

1. Exploration
   In this phase, students explore the platform ecosystem that is being developed.
2. Strategy Design
   In this phase, students define the core value platform by designing the business model.
3. Validation & Prototyping
   In this phase, students validate the proposed business model with several prospective users by developing a Minimum Viable Product (MVP)
4. Growth Hacking
   In this phase, students design a strategy about how the platform built becomes more relevant and growing (Growth/Scale-Up).

The PDT method was chosen in this study because the PDT framework was aligned with the basic objectives which are Project-based Learning. Moreover, the new PDT version 2.2 was released in May 2021 so students were involved in this study have the opportunity to obtain learning materials and experience in implementing the up-to-date platform development framework. The adaptations of the proposed method were illustrated in Fig. 3.

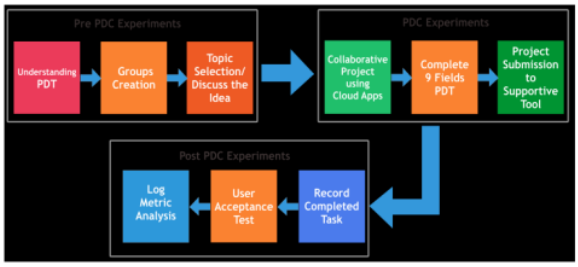

Fig. 3. Proposed Platform Design Toolkit adaptation.

B. *Platform Desain Canvas*

Design Toolkit (PDT). Platform Design Canvas is fully inspired by Business Model Canvas [34]. Using PDC, students were asked to describe 9 elements of it which are Value Propositions, Peers, Partners, Transactions, Channels and Contexts, Infrastructure and Core Components, Services, Platform Owner, and Platform Stakeholders. The detailed description element of PDC in following:

1. Platform Owners

   In this element, students need to define the Platform Owner. Platform Owners are the platform's "owners" who have the vision for the market's manifestation and are responsible for ensuring that the platform is always engaged in productive activities.

2. Platform Stakeholders

After defining the platform owner, students need to describe the platform stakeholders. Platform Stakeholders are entities with a vested interest in the platform's success or failure, in managing platform externalities and outcomes, in regulating the platform, or in exercising platform governance functions.

3. Peers

Different from Platform Owner and Stakeholder, other elements of PDC that need to be described are Peers. Peers are individuals or small-to-medium-sized businesses who act as a single distinct entity with a specific interest and purpose that the platform's value proposition must match. There are 2 kinds of peers on the platform design toolkit, namely:

a. Peer Producers (PP): Peer producers can be called producers or providers are entities that provide value on the supply side of the market ecosystem as an opportunity to increase professionalism and hone skills towards better performance.

b. Peer Consumers (PC): Peer Consumers (or they can be called users) are entities that are interested in consuming, utilizing, accessing the value created through and on the platform.

4. Partner

After Peers, students need to define the Partner of the developed platform. Partners (PA) is an entity that seeks to create additional professional value, not the main value but is closely related in collaboration with the platform owner. The partner's role in the platform facilitates, serves, and increases production value by acting as brokers, facilitators, and connectors.

5. Transactions

Next, students need to describe the Transactions. Transactions are sub-actions in which value is created, assigned, transferred, or traded between entities. Such transactions consist of exchanges or transfers between Peers and Partners through the platform. Transactions may include the exchange of services or resource access.

6. Channel and Context

In this phase, students are requested to describe how Platform Value Propositions are delivered to Peers.

7. Services

Students need to describe what services that need to exist on the developed platform. The platform service will support continuous improvement of participant performance from the producing entity and also complements the experience provided by the ecosystem through a platform targeted to customers. There are 3 kinds of services in the platform design canvas that students need to describe:

a. Enabling Services

Services that are aimed at assisting partners in generating value from their professional talents, expanding their markets, increasing their visibility, and making significant improvements as professionals.

b. Empowering Services

Services that are aimed at assisting peer producers in starting transactions, honing their skills, improving on the platform, and beginning the development phase.

c. Other Services

Service that can be delivered to Peer Consumers (PC) as complimentary of platform ecosystems.

8. Value Propositions

Using PDC, students are required to describe two kinds of Value Propositions: Core Value Propositions and Ancillary Value Propositions. Core Value Proposition is the main value of the platform that tries to produce. Ancillary Value Propositions are the extended value from the platform that can be produced to gain more profits.

9. Infrastructure & Core Components

In this section, students are requested to describe several entities/assets that are controlled and owned by the platform owner and governed by the platform governance. These components ensure that the platform is functional and usable by the ecosystem. Infrastructure and structures can be tangible such as applications or offices and intangible such as platform standardization agreements.

Next, we discuss the proposed web-based supportive tool to help students adapt Platform Design Canvas.

C. Collaboration Supportive Tool

To adapt Platform Design Canvas (PDC) as Project-based Learning, we have developed a Supportive Tool that will be used by students to collaborate designing the platform as Project-based learning activities. For the collaboration, students have been provided PDC templates on developed supportive tools (shown in Fig. 4). After conducting collaboration, students also provided a PDC online form (shown in Fig. 5) to submit their PDC's final version of the proposed platform. The developed supportive tool records the student's activities while accessing PDC templates. This recording is saved as Log Data (shown in Fig. 6). Later, the log data are used to analyze the ease of use of Platform Design Canvas for rapid prototyping.

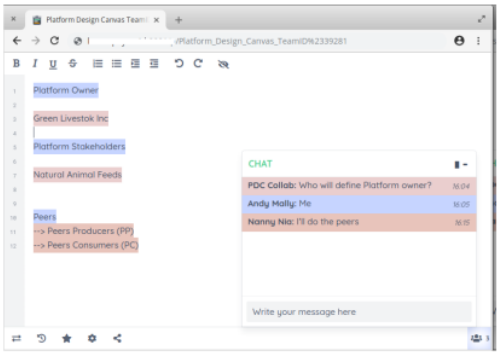

Fig. 4. Collaborative PDC Templates at developed Supportive Tool

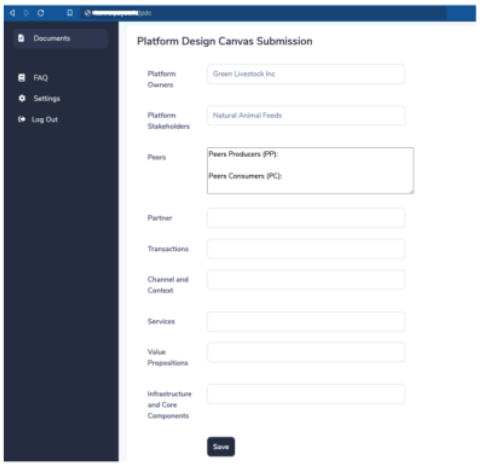

Fig. 5. PDC Templates web form

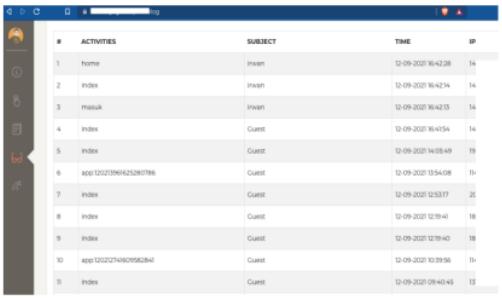

Fig. 6. Supportive Tool Log Systems

IV. Results and Discussions

This section will cover the results of the questionnaire and log metrics regarding the use of PDC for rapid prototyping. Furthermore, all participants were asked to complete the designated questionnaire before using or learning PDC.

A. Results

The total number of students that have participated is 134 students which formed into 18 groups. The questionnaire's questions are shown in Table I.

TABLE I. PRE-EXPERIMENT QUESTIONS FOR STUDENTS

#	Response and Percentage		
	Questions	*Yes (%)*	*No (%)*
1	Have students experienced Project-based Learning?	86	14
2	Have students developed some platforms?	79	21
3	Are students familiar with some rapid prototyping tools?	24	76
4	Do students ever collaboratively develop platforms?	28	72
5	Do Students ever learn or use Platform Design Toolkit/Platform Design Canvas?	2	98

After implementing Platform Design Canvas and Project-based Learning, students were asked to fill out the questionnaire to know their perceptions about the proposed method with 5 indicators (Strongly Agree, Agree, Neutral, Disagree, and Strongly Disagree). The questionnaire is shown in Table II

TABLE II. POST-EXPERIMENT QUESTIONS FOR STUDENTS

#	Item Description
1	Project-based learning suitable as a learning model amid Covid 19
2	PDC helps explore the business models
3	PDC helps validate the proposed idea
4	PDC helps to scale up the prototype
5	Using PDC as the framework for the next project
6	The developed supportive tool helps collaboration in a remote manner
7	Developed Supportive tool accommodate the prototyping using PDC
8	Given instructions are easy to follow

Then, using the formulas below, a Likert scale was utilized to assess how all participants felt about using PDC in their prototyping process.

$$P = \frac{N \times R}{I} \times 100\% \quad (1)$$

Which:
P = Each question's percentage value
N = The value of each instrument's response
R = The frequency of answered value
I = The number of participants multiplied by the highest value of the answer ($134 \times 5 = 670$)

The Likert percentage from Eq. (1) is shown in Fig. 7.

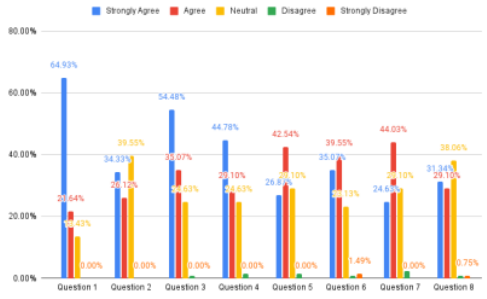

Fig. 7. Likert percentage of students perceptions

Next, we record the accomplished time each student uses a built-in developed logger. This logger was used for knowing how much time is needed by students to finish each field in the PDC. Based on the required finished time, we had categorized 134 students into 3 groups. Which are students that finished the given task in less than 5 minutes, 5 to 10 minutes, and more than 10 minutes. The results are shown in Fig. 8.

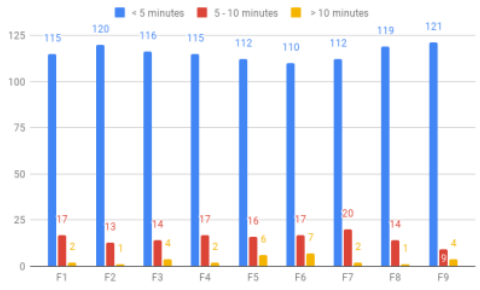

Fig. 8. Log Metric Data

B. *Discussions*

From Fig. 7, the use of existing cloud applications and supporting tools allows students to collaborate remotely. And 64.93% of students thought Project-based Learning is suitable as a learning model amid covid 19 pandemic. Even Though 39.55% of students felt neutral about PDC helping define business models, 54.48% of students felt PDC could validate the proposed idea, and 42.54% of students were willing to use PDC in the next project. From this perspective, using PDC for turning an idea into a real-world application is far more feasible. As part of the learning process, fully online collaboration among group members will foster a new culture of the creative process, which will have a beneficial impact for lecturers implementing Project-based Learning during/post covid 19.

From Fig. 8, according to Log Metric Data, students mostly accomplished the PDC elements in less than 5 minutes. This indicates that students are not having difficulties while adapting Platform Design Canvas on the current development supportive tools.

V. Conclusions and Future Works

The Platform Design Canvas (PDC) is a new software development approach that tries to better match design thinking with business goals To ensure the efficiency and productivity of platform ecosystems, PDC was designed as an acceleration tool for fast prototyping based on the Business Model Canvas. While designing a platform, PDC assists in prototyping more quickly and defining a more in-depth grasp of the essential requirements. In addition, the utilization of cloud applications and proposed supportive tools allow students to collaborate while implementing remote learning during a pandemic. In the conclusion, over 60% of students confirm Platform Design Canvas adaption is appropriate for assessing business models and more than 64% of students agree that the developed supportive tools could accommodate prototyping using PDC.

It is possible to explore and combine the PDC with other tools such as Design Sprint for prototyping in future work.

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