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CONTENTS

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i-CHEMTORIALS
(Interactive Chemistry Tutorials)

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Abstract - **For decades, the traditional teaching and learning using textbooks and PowerPoint point slides is very popular in universities and colleges. However, this approach is not the best teaching method, especially for subjects that require critical concepts thinking. Due to the outbreak of the COVID-19 pandemic, many schools, colleges, and other educational institutions have embraced online education platforms for lecture but the students' lacking in performing the tutorials after the online class due to not enough time and not effectively to guide the students during online lecture. So that, the introduction of game-based and gamification of learning is an innovative move to enhance students' experience during immersive learning. Therefore, i-CHEMTORIALS is an educational approach to motivate students to learn by using video tutorial design and game elements in learning environments. The goal is to maximize enjoyment and engagement through capturing the interest of learners and inspiring them to continue learning. In this project, the development of gamification-incorporated learning is introduced in the General Chemistry course. It allows students to perform interactive activities like attending a test, answering the tutorials, submitting a response, working on a chemistry calculation, and more in a virtually connected classroom. A treasure hunt game was implemented using Kahoot, Prezi and Quizizz application. This approach is capable of involving students directly in immersive learning experience such as group discussion. Perceptions and feedback from the students were obtained through questionnaires and reflective assessment. It can be concluded that at the end of the project, the content development in i-CHEMTORIALS has been successfully developed to increase the students' participation and engagement in this limitless and dimensionless new norm era. However, it can be further improved by adding more features for more enjoyable game and learning experience for students.**

Keywords—i-Chemtorials, gamification-incorporated learning, Kahoot, Prezi

I. INTRODUCTION

The Covid-19 pandemic has taken many educators and students off guard. Within a very short time, teaching and learning process was moved online and this has changed the education landscape drastically. The year of 2020 has been extraordinary thus far. The Covid-19 pandemic has brought about significant changes to every domain of our lives. University around the world was quick to adapt to the changes brought about by this pandemic. The greatest implication Covid-19 pandemic has on education is that all lessons in universities all over the world were moved fully online within a very short period of time [1]. Ever since the invention of various new technologies and Information and Communication Technologies (ICTs), methods for teaching and learning have changed into another dimension. This dimension is technically referred to as 'Online Environment' which basically means the use of gadgets of ICTs for teaching and learning. The online teaching and learning is unlimited by

time and space; thus, it increases the accessibility to education created by a physical learning environment such as age limit, time constraint, unavoidable absence of instructor, and distance in space and time [2].

This study focused on students' learning experience while using interactive multimedia content in terms of its interactivity and accessibility. The use of interactive multimedia content might improve students' learning process especially engaging them into instructional content [3]. In this advanced era of communication and media, the process of teaching and learning has become more creative and innovative with the existence of Kahoot, Prezi and Quizizz gamification applications in chemistry tutorials. The 'Open Distance Learning' or so called as ODL has been introduced in UiTM for continuous academic activities even with the current global health issues. The academic activities can be conducted in a blend of asynchronous (without real-time interaction) and synchronous (real-time interaction) online learning [4]. There are many e-learning platforms available to be used depending on the favorability of the lecturers and students to make the tutorial more efficient and attractive for the students.

In education, gamification is used under the assumption that the type of engagement experienced by gamers can be translated to support students' learning. After considering the contexts, learning objectives and distinctive needs of their students, educators in a gamified classroom setting may integrate such game-related elements as progress indicators, fun, narrative, immediate feedback, mastery, player control, social connection and scaffolded learning to impact students' attitudes, behaviors and actions and enhance their motivation, engagement, creativity, retention and overall learning outcomes. By using this gamification in tutorial might be able to trigger intrinsic motivation, yet it relies on multiple internal and external factors that must be aligned. That is, the identification with learning tasks, creating an environment where multiple participants can receive comparable scores or badges, and having the opportunity for authentic gamification; built on and integrating the objectives of tasks and strategic aims of the organisation; and creating energising and engaging experiences. The aim of this study is to merge the gamification elements with the authentic learning tasks in the same time to implement the General Chemistry tutorials using many types application in U-Future so that the students' perception is not biased towards achieving badges but working towards overall objectives.

II. MATERIALS

A. Production of i-Chemtorials

The i-Chemtorials was produced from one of the topics of General Chemistry subject namely Gas Law. i-Chemtorials is a web-based education platform that was supplemented with interactive multimedia elements (images and infographics) using Kahoots, Prezi and Quizziz.

III. METHODS

A. Data Collections and Analysis

The present study used a survey tool to see the students' initial understanding of tutorial questions in their study. A survey was conducted to 125 students from the Faculty of Applied Sciences and the Faculty of Education, Universiti Teknologi MARA (UiTM) that composed of diploma and degree students from July-February 2021. The survey was conducted using a Google Form that was easy to access and reach the respondents through a virtual method. The purpose of the survey was to identify the students' problems with the topic of the targeted subject. This product has been developed to enhance student performance and solve the issues that have been raised. The data were analyzed using Microsoft Excel software as a basic analyzing method.

B. Design of Study

At the beginning of the first class after the completion of the tutorial using Kahoots, Prezi and Quizziz, the instructor asked students to voluntarily complete a short survey (5 min) about tutorial through those medium use in this and other classes. The 10-question survey asked multiple-choice and open-ended questions about General Chemistry tutorials using U-Future. U-Future is a platform developed by UiTM for delivering learning content online to any person who wants to take a course. Figure 1 illustrates the steps or phases involved to design this i-Chemtorials.

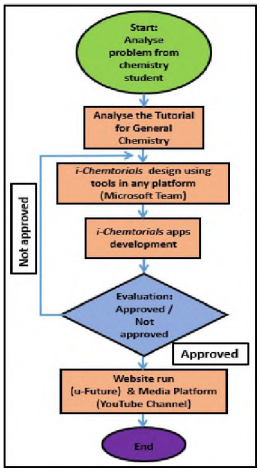

Fig. 1. Process of i-Chemtorials flow chart used in this study

IV. RESULTS AND FINDINGS

The online questionnaire was conducted anonymously by a group of students from the Faculty of Applied Sciences and the Faculty of Education, Universiti Teknologi MARA (UiTM). The number of male and female respondents were 36 and 89, respectively. Respondents were from the chemistry department. Overall, 125 students responded to the survey. The demographic profile of the respondents is present in Table 1.

Table 1: Demographic profile of respondents.

Demographic Characteristics		**Respondents (125 students)**
Age	18-20	31
	21-25	83
	26-30	11
Gender	Male	36
	Female	89
Programme	Degree	80
	Diploma	45

The questions in the survey dealt with the student and faculty populations' awareness of i-Chemtorials existence where the results were encouraging. 35.8% of all respondents were aware of i-Chemtorials. As detailed in the chart (Figure 2), students had a slightly higher awareness of the existence of an i-Chemtorials compared to 64.2 % of students who were not aware of it. The respondents were asked whether they had ever used the i-Chemtorials technique during their classes.

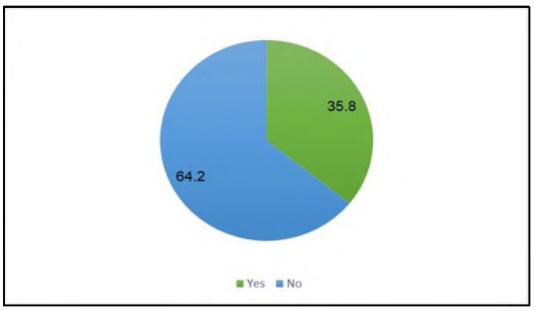

Fig. 2. Have you heard about i-Chemtorials?

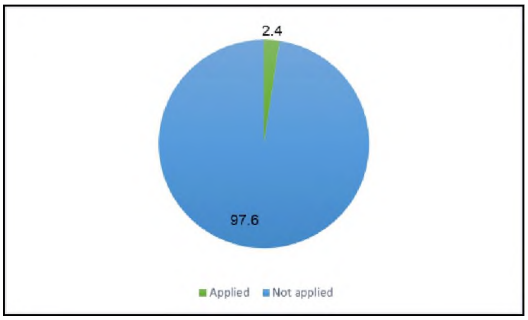

Fig. 3. The technique of Interactive Chemistry Tutorials was applied during the lectures?

Results show 97.6 % of students claimed that the technique was not applied during their classes as shown in Figure 3. The awareness of i-Chemtorials among the students become a significant benchmark for the rest of this survey. It is important to align with the main objective of the study which to break the concepts into their most conventional memorizing methods that can be systematically repeated in customized intervals of time [5].

Results show 80.6 % of respondents agreed that applying the technique of i-Chemtorials as their learning platform, more efficient compared to traditional learning method. This developed study might be more effective due to additional features such

as audio, immediate feedback, a seamless and user-friendly interface, and their high accessibility through a range of platforms [6]. By using this i-Chemtorials's medium, the students are capable of processing larger amounts of information, resulting in increased retention [7]. Only 19.4% of respondents did not agree and they preferred textbook-based learning because of perception that this format enabled an authentic, 'real' and enjoyable reading experience.

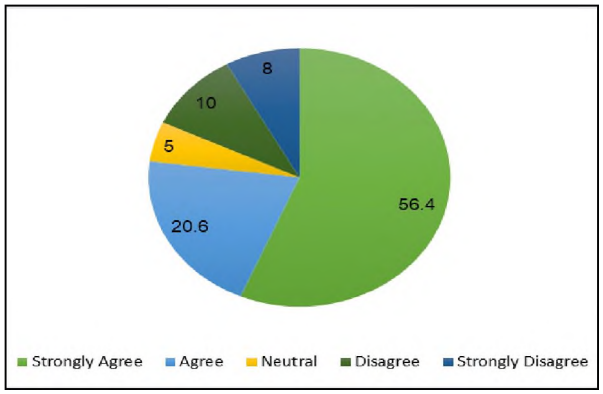

Fig. 4. Due to the outbreak of the COVID-19 pandemic, many schools, colleges, and other educational institutions have embraced online education platforms for lecture but the students' lacking in performing the tutorials after the online class due to not enough time and not effectively to guide the students during online lecture.

As can be seen in Figure 4, most of the respondents strongly agreed that due to the outbreak of the COVID-19 pandemic, many schools, colleges, and other educational institutions have embraced online education platforms for lecture but the students' lacking in performing the tutorials after the online class due to not enough time and not effectively to guide the students during online lecture. As introducing a new tool such as i-Chemtorials will provided an interactive digital tutorial platform such as a greater variety of activities, high level of immediate feedback, increased sense of control and learner autonomy, and the non-linearity of the application and it make i-Chemtorials was better than classical tutorial method.

V. CONCLUSIONS

From this gamification learning factors will motivate the students to engage with teaching and learning processes by implementing interactive multimedia content in instructional content. The findings showed that interactive multimedia content may influence students to stay motivated and interested with the learning process that directed to both intrinsic and extrinsic motivation. Furthermore, by incorporating interactive multimedia content in chemistry tutorials, students can be more fun, proactive and at the same time learning effectiveness can be achieved. Lastly, further research of this application i-Chemtorials should be done in the future for potential commercialization to get expand this area of study.

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