UNIVERSITI TEKNOLOGI MARA

Public Interest Centre of Excellence

# International Teaching Aid Competition 2023

Reconnoitering Innovative Ideas in Postnormal Times

# iTAC 2023

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## INTERNATIONAL TEACHING AID COMPETITION
# E-PROCEEDINGS

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**PREFACE**

iTAC or International Teaching Aid Competition 2023 was a venue for academicians, researchers, industries, junior and young inventors to showcase their innovative ideas not only in the teaching and learning sphere but also in other numerous disciplines of study. This competition was organised by the Special Interest Group, Public Interest Centre of Excellence (SIG PICE) UiTM Kedah Branch, Malaysia. Its main aim was to promote the production of innovative ideas among academicians, students and also the public at large.

In accordance with the theme "Reconnoitering Innovative Ideas in Post-normal Times", the development of novel ideas from the perspectives of interdisciplinary innovations is more compelling today, especially in the post-covid 19 times. Post-pandemic initiatives are the most relevant in the current world to adapt to new ways of doing things and all these surely require networking and collaboration. Rising to the occasion, iTAC 2023 has managed to attract more than 267 participations for all categories. The staggering number of submissions has proven the relevance of this competition to the academic world and beyond in urging the culture of innovating ideas.

iTAC 2023 committee would like to thank all creative participants for showcasing their innovative ideas with us. As expected in any competition, there will be those who win and those who lose. Congratulations to all the award recipients (Diamond, Gold, Silver and Bronze) for their winning entries. Those who did not make the cut this year can always improve and join us again later.

It is hoped that iTAC 2023 has been a worthy platform for all participating innovators who have shown ingenious efforts in their products and ideas. This compilation of extended abstracts published as iTAC 2023 E-Proceedings contains insights into what current researchers, both experienced and novice, find important and relevant in the post-normal times.

Best regards,

**iTAC 2023 Committee**
**Special Interest Group, Public Interest Centre of Excellence (SIG PICE)**
**UiTM Kedah Branch**
**Malaysia**

# TELANGCATOR 2.0 – A NATURAL ACID-BASE INDICATOR FROM BUTTERFLY PEA FLOWER

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## ABSTRACT

*Telang* or Butterfly pea flower (*Clitoria ternatae*) is abundantly found in Malaysia. Its petals have vibrant violet-blue colour; hence it is most commonly used as food colouring. *Telangcator* is an innovation that is able to become an alternative acid-base indicator from *Telang* flowers. Extract of *Telang* flowers is prepared from maceration of dried *Telang* flowers. The extract is used to produce two (2) types of acid-base indicators; natural *Telangcator* pH paper and natural *Telangcator* pH liquid indicator. For *Telangcator* pH paper, *Whatman* filter paper was soaked in the *Telang* extract for 10 minutes and left to dry at room temperature. The dried filter paper was cut into 10 mm wide strips and used as pH papers. For *Telangcator* pH liquid indicator, the leftover *Telang* extract was used directly as pH liquid indicator. When tested on various household substances to determine their reliability as acid-base indicators, both the *Telangcator* pH paper and the *Telangcator* liquid indicator changed colour from violet-blue to red in acidic substances and violet-blue to green in basic substances. When conducted with Kolej Matrikulasi Negeri Sembilan (KMNS) students, the *Telangcator* activity has been successful in gaining their interests in pursuing Science subjects at university. Furthermore, the activity has been found to be interesting to the public when displayed and demonstrated during Open Day KMNS. Both the natural *Telangcator* pH paper and *Telangcator* liquid pH indicator are suitable to be used as alternative acid-base indicators in schools and other education institutions as their productions are cost-effective and not harmful to the environment.

**Keywords:** *Telang* flower, butterfly pea flower, acid base, indicator.

## BACKGROUND

In a news article in Berita Harian (2019), Hazami Habib stated that there was a noticeable reduction in the number of students taking up STEM subjects, from 203,391 in 2012 to 167,962 in 2018. He stated that students' not being exposed to the daily applications of Science and

Mathematics in real life as one of the contributing factors to the reduction. According to Maszlee Malik as reported in Berita Harian (2019), the number of students taking Science, Technology, Engineering and Mathematics (STEM) subjects in the year 2018 was only 44% compared to 49% in the year 2012. The decrease was estimated to be 6000 students per year.

In 2017, a research was done on 59 students in Matriculation, 223 students in Form 2 and 211 students in Form 4. It was found that Matriculation students had lower motivation in studying Science subjects compared to Form 2 students, with min score of 2.67 from 4.00. (Osman, Iksan, & Halim, 2007).

Based on Ministry of Education Annual Report 2020 (Ministry of Education, 2020), there was only 47.18% students' enrolment in STEM packages in upper secondary school level. The percentage was made up of 74,882 students enrolling in Pure Science package with Physics, Chemistry, Biology and Additional Mathematics, while 97,302 students enrolling in non-Pure Science package with any two from either Physics, Chemistry or Biology, and Additional Mathematics.

## PROBLEM STATEMENTS

From observations on Kolej Matrikulasi Negeri Sembilan (KMNS) Science stream students from 2018 to 2022, students' motivation and interests toward Science subjects are moderate. From random interviews with the students, majority of them have admitted to being a Science stream student not because they were interested in it, but only because they were asked by their parents to take Science subjects during school. The students also described not being able to relate the content they were taught in Science classes with their daily life applications, thus not able to understand the relevance in studying STEM subjects.

In order to encourage students' participation in STEM subjects throughout their education, teachers and lecturers alike need to design various teaching and learning approaches to attract students' interests in studying the subjects. Simple experiment activities that demonstrate the application of Science in daily life, for example, will help improve students' understanding and thus, their tendency to choose STEM subjects in their tertiary education levels. (Gendjova, 2007).

Therefore, there is a need for educators to conduct Science classes in various approaches, as recommended by YB. Dr. Maszlee Malik during *Majlis Amanat Pendidikan* 2019;
*"Teachers need to change their teaching and learning methods to suit the current technological advances, as an enabler to demonstrate the best approach. Education is not just what is*

*delivered, but also how it is delivered"* (Ministry of Education, 2019).

In experiments to determine the acid-base properties of substances, the common reagents used both in schools and Matriculation are litmus papers, pH papers and indicators such as phenolphthalein and universal indicator. At the beginning of a school or Matriculation year, the papers and indicators are purchased in large quantities and thus the cost is expensive. Phenolphthalein indicator, moreover, is flammable, could cause irritation and carcinogenic. (Safety Data Sheet, 2014). Therefore, there is a need for alternative pH paper and pH indicator that are not only cheaper and safer, but that could also encourage students' participation during the experiment.

## OBJECTIVES

1. To encourage students' participation in preparing materials for simple Science experiment.
2. To increase students' interests in Science subject.
3. To prepare an alternative acid-base indicator that is cheaper and safe to use.

## MATERIALS AND METHODS OF INNOVATION

Materials Used for Innovation

1. Dried *Telang* flowers (15 g) (**Figure 1**)
2. *Whatman* filter papers (5 sheets) (**Figure 2**)
3. Distilled water (120 mL)

How Innovation was Made

**(A) Preparation of *Telang* flowers extract**

1. Petals from 15 g of dried *Telang* flowers are cut up into small pieces.
2. The *Telang* flowers are mixed with 120 mL of distilled water (ratio 1:8) at room temperature.
3. The *Telang* flower solution is boiled for 60 seconds and stirred occasionally.
4. The *Telang* flower solution is left to cool at room temperature.
5. The cooled *Telang* flower solution is filtered to obtain a violet-blue *Telang* flower extract (**Figure 3**).

**Figure 1.** Dried *Telang*


**Figure 2.** *Whatman* filter


**Figure 3.** *Telang* flower

**(B) Preparation of natural *Telangcator* pH papers**

1. 15 mL of *Telang* flower extract from **(A)** is poured into a container.
2. 5 sheets of *Whatman* filter papers are put into the container and left for 10 minutes at room temperature (**Figure 4**).
3. After 10 minutes, the *Whatman* filter papers changed colour from white to violet-blue.
4. The *Whatman* filter papers are left to dry at room temperature (**Figure 5**).
5. Once dried, each *Whatman* filter papers is cut into 7 strips (1 mm width) to be used as *Telangcator* pH papers (**Figure 6**).

**Figure 4.**

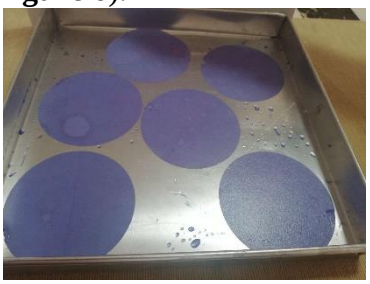

**Figure 5.**

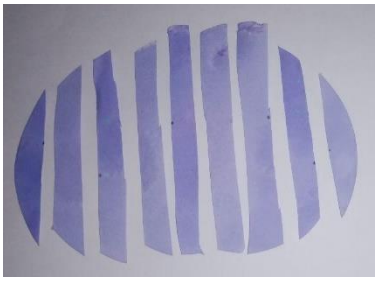

**Figure 6.**

**(C) Preparation of natural *Telangcator* pH indicator**

1. Leftover *Telang* flower extract from **(A)** is used directly as *Telangcator* pH indicator.

## PRACTICALITY AND USEFULNESS OF INNOVATION

The natural *Telangcator* pH papers were used to determine the acid-base properties of various household substances and they showed different colour changes for acids and bases (**Table 1** and **Figure 7**).

**Table 1.** Colour Changes of *Telangcator* pH Papers

| Substance | Colour of *Telangcator* pH paper | Acid-Base |
|---|---|---|

| | Before dipping | After dipping | Properties |
|---|---|---|---|
| Lemon juice | Violet-blue | Red | Acid |
| Lime juice | Violet-blue | Red | Acid |
| Cream of tartar powder | Violet-blue | Violet-red | Acid |
| Baby shower cream | Violet-blue | Violet-blue | Neutral |
| Toothpaste | Violet-blue | Blue | Base |
| Soda bicarbonate powder | Violet-blue | Green | Base |
| Liquid detergent | Violet-blue | Green | Base |

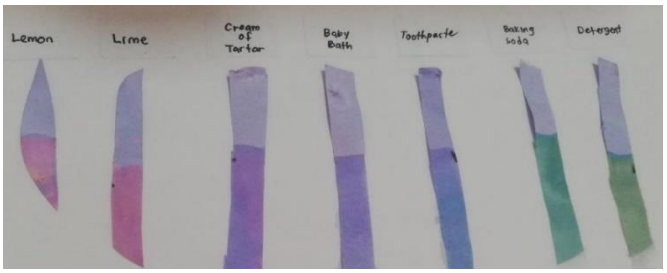


**Figure 7.** Colour Changes of *Telangcator* pH Paper

The natural *Telangcator* pH indicator was used to determine the acid-base properties of the same household substances and it showed different colour changes for acids and bases. (**Table 2** and **Figure 8**)

**Table 2.** Colour Changes of *Telangcator* pH Indicator

| Substance | Colour of *Telangcator* pH indicator | | Acid-Base Properties |
|---|---|---|---|
| | Before addition | After addition | |
| Lemon juice | Violet-blue | Red | Acid |
| Lime juice | Violet-blue | Pink | Acid |
| Cream of tartar powder | Violet-blue | Purple | Acid |
| Baby shower cream | Violet-blue | Violet-blue | Neutral |
| Toothpaste | Violet-blue | Blue-green | Base |
| Soda bicarbonate powder | Violet-blue | Green | Base |
| Liquid detergent | Violet-blue | Green | Base |


**Figure 8.** Colour Changes of *Telangcator* pH Indicator

## IMPACT OF INNOVATION

A group of 24 students in Science stream class from Kolej Matrikulasi Negeri Sembilan (KMNS) has conducted the *Telangcator* activity on 23rd November 2022 (**Figure 9**). A survey was conducted to assess the impact of the innovation on their interests in pursuing Science subjects (**Table 3**).

**Table 3.** Survey on *Telangcator* Activity

| No. | Items | Strongly Disagree | Disagree | Agree | Strongly Agree |
|---|---|---|---|---|---|
| | | Percentage (%) | | | |
| 1 | I like to conduct Science experiments hands-on in the laboratory. | 0.0 | 0.0 | 8.3 | 91.7 |
| 2 | I am interested in conducting *Telangcator* hands-on activity with friends and family outside of classroom. | 0.0 | 0.0 | 25.0 | 75.0 |
| 3 | *Telangcator* hands-on activity has increased my interests in pursuing Science subjects at university. | 0.0 | 0.0 | 20.8 | 79.2 |

On 17th and 18th March 2023, the *Telangcator* activity has been displayed and demonstrated to public during Open Day KMNS 2023 (**Figure 10**). Random interviews with the visitors have been conducted and all of them have stated that the activity was interesting and successful in gaining their children's interests in pursuing Science in schools.

**Figure 9.** *Telangcator* Activity with KMNS Students

**Figure 10.** *Telangcator* Activity during Open Day KMNS

## COST OF INNOVATION

The total cost of making both natural *Telangcator* pH papers and natural *Telangcator* indicator was RM 6.60 (**Table 4**). For the *Telangcator* pH papers, 35 strips were made and for the *Telangcator* pH indicator, 105 mL was made. The cost of distilled water and heat were free as they are both readily accessible at schools, Matriculation colleges or even at home.

**Table 4.** Cost of Production for *Telangcator* pH Papers and Indicator

| Material | Price | Quantity | Cost |
|---|---|---|---|
| Dried *Telang* flowers (1 jar × 15 g) | RM 4.60 | 1 jar | RM 4.60 × 1 jar **= RM 4.60** |
| *Whatman* filter papers (1 box × 100 sheets) | RM 40.00 | 5 sheets | RM 40.00 / 100 × 5 sheets **= RM 2.00** |
| | | **TOTAL** | **RM 6.60** |

## COMMERCIALISATION POTENTIAL OF INNOVATION

Innovation of *Telangcator* pH papers and *Telangcator* pH indicator are suitable to be used in experiment to determine acid-base properties of substances, whether in schools or Matriculation. The *Telang* flowers is a natural ingredient that is easily accessible and safe to be handled by students with minimal supervision. The preparation of both *Telangcator* pH papers and indicator is simple with easy-to-follow steps. Therefore, *Telangcator* is highly suitable to be used during Science lessons and will allow students to conduct their own hands-on experiments, thus increasing their interests in the subject.

As stated above, the cost to produce both *Telangcator* is cheap (RM 6.60), therefore students will be able to participate in the experiment without having to share chemical reagents, which will also cut the waiting time during the experiment. The *Telangcator* innovation is also suitable to be used at home as hands-on activity between parents and children, which will also help improve students' motivation in studying Science subjects throughout their school years.

The innovation of natural *Telangcator* pH papers and natural *Telangcator* pH indicator has been registered at MyIPO as Intellectual Property of both authors with registration number LY 2020003893.

## SUMMARY

The *Telangcator* pH paper and *Telangcator* pH indicator innovation is made using natural ingredient that is easily accessible and cost-effective. The *Telangcator* pH paper has the potential as an alternative to the expensive litmus papers that schools and Matriculation have to purchase each year. The *Telangcator* pH indicator can be used as a natural alternative to phenolphthalein, which is not only expensive but also poses health and hazard risks if handled without teachers' supervision. The *Telangcator* is safe and easy to be prepared by students on their own. Students' participation in making the *Telangcator* during experiment will be able to improve their interests in Science subjects, thus producing highly competent and motivated individuals in the STEM subjects.

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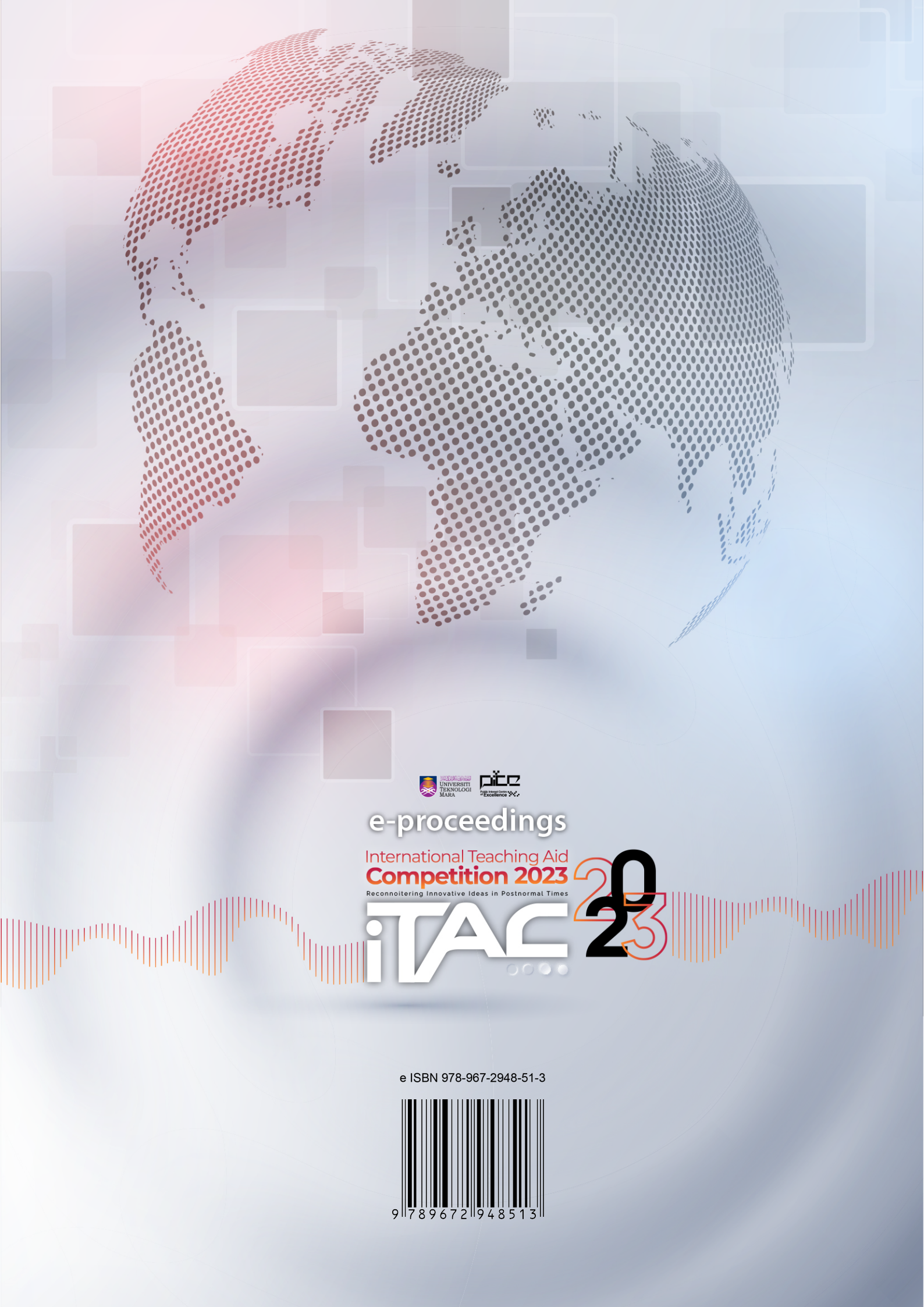


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