UNIVERSITI TEKNOLOGI MARA

Public Interest Centre of Excellence

International Teaching Aid Competition 2023

Reconnoitering Innovative Ideas in Postnormal Times

iTAC 2023

iTAC 2023
INTERNATIONAL TEACHING AID COMPETITION
E-PROCEEDINGS

Copy Editors*: Syazliyati Ibrahim, Azni Syafena Andin Salamat, Berlian Nur Morat (Dr.), Najah Mokhtar, Noor 'Izzati Ahmad Shafiai, Muhamad Khairul Anuar Bin Zulkepli (Dr.)*
Cover Design : *Asrol Hasan*
Layout : *Nurina Anis Mohd Zamri*
eISBN : 978-967-2948-51-3

Published by : Universiti Teknologi MARA Cawangan Kedah,
08400 Merbok,
Kedah,
Malaysia.

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

ELECTROCHEMISTRY TOOLKIT

Dani Asmadi Ibrahim
Negeri Sembilan Matriculation College
daniasmadi@outlook.com

Amal Hayati Jamali,
Negeri Sembilan Matriculation College
amal hayati@kmns.matrik.edu.my

Noor Fatihah Zulkeply
Negeri Sembilan Matriculation College
bm-0095@moe-dl.edu.my

Mohd Muazzin Mohd Yasin
Negeri Sembilan Matriculation College
mohd.muazzin@kmns.matrik.edu.my

ABSTRACT
Electrochemistry Toolkit is an application to help students learn chemistry. The toolkit is a mobile-friendly file format with links to web applications, simulators, interactive learning resources related to Chapter 3 Electrochemistry of the matriculation chemistry course. The toolkit allows users to make quick references, engage interactive tools and simulations related to the study of the topic by using their mobile devices. The study involved students of the Matriculation Program discusses how learning of Electrochemistry is enhanced by engaging the sub-microscopic elements of the topic and making the learning experience more interactive. Using a Likert scale questionnaire, the study finds all 106 students agree that the toolkit has a positive impact on their learning of the topic. Similarly, the open-ended question finds that out of 106 students, 65 gave positive comments, 46 gave neutral or no feedback at all. In conclusion, the use of the application has successfully incorporated interactivity and sub-microscopic learning of the topic and help improve students' learning and attitude toward chemistry.

Keywords: Science education, chemistry, electrochemistry, educational applications and twenty-first-century learning.

INTRODUCTION

The modern mobile device is essentially a computer with access to a vast digital ecosystem of chemistry and science resources. Our toolkit will help students tap into these resources to learn chemistry and better prepare them for the connected world. The guiding theme of this project is to empower students with access to powerful simulators and interactive learning tools to help them master fundamental concepts in chemistry at a meagre cost. Electrochemistry Toolkit is an application to be used for learning Electrochemistry. The toolkit is a mobile-friendly file format with links up to eight interactive self-study applications and supporting resources. The toolkit allows users to make quicks references, use interactive tools and simulations related to

the study of Chapter 3 Electrochemistry by using their mobile devices. Use of simulators in chemistry is helpful as they are visual, interactive and promete inquiry (Correia,2018)

BACKGROUND OF PROBLEM

The Electrochemistry topic is found to be difficult to learn due to its abstract concepts involving macroscopic, submicroscopic, and symbolic representation levels (Schwedler , 2021) as shown in Figure 1.

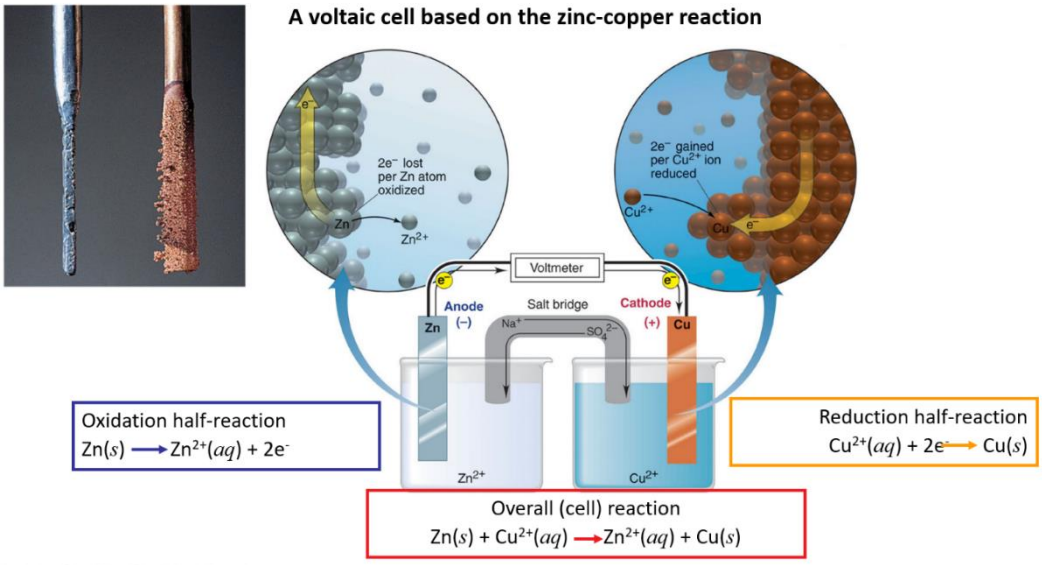
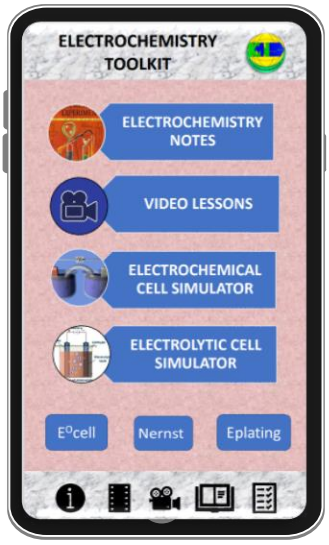


Figure 1. Macroscopic, submicroscopic, and symbolic representation levels in electrochemistry

- Macroscopically, students need to study the concepts of electrolytes and non-electrolytes, the electrolysis process, and voltaic cells.
- Submicroscopically, they need to understand the movement of ions and electrons during the electrolysis process.
- Symbolically, they also need to transform the process into chemical formulae and equations.
- Students face difficulties in understanding the abstract chemical processes, especially at the submicroscopic and symbolic levels.



DESCRIPTION DAN FUNCTION OF THE ELECTROCHEMISTRY TOOLKIT

Electrochemistry Toolkit (MGT) shown in Figure 2,is an application used to learn Electrochemistry. The toolkit is a mobile-friendly file format with links to several self-study applications. Among the applications are:

1. Electroplating Simulator
2. Electrochemical Cell Simulator
3. Electrolytic Cell Simulator
4. Nernst Equation Calculator
5. E^{o}_{cell} Calculator
6. Electrochemistry Notes
7. Video Lessons

Figure 2. Electrochemistry Toolkit

The toolkit allows users to make quicks references, engage interactive tools and simulations related to the study of electrochemistry by using their mobile devices. This innovation presents a cost-effective and practical solution to a problem related to learning Electrochemistry, a topic taught in the matriculation chemistry course.

The use of simulation and interactive learning tools allows students to visualise the submicroscopic level of chemistry, gives student deeper understanding and prevent misconception.

Two the key components of the Electrochemistry Toolkit is the Electrolyitc Cell Simulator and the Electrochemical Cell Simulator. The Electrolytic Cell Simulator demonstrate the operation of electrolytic cells. The goal of this simulation is to help student understand electrolysis at both macroscopic and submicroscopic levels, and help students relate the quantitative and qualitative aspects of electrolysis. Students can manipulate the type of electrodes, amount and time of current applied and observe how the variable determines the product of electrolysis. The screenshot is shown in Figure 3

.

Figure 3. Electrolytic cell simulator

The Electrochemical Cell Simulator allow students to create a variety of galvanic/voltaic cell from different electrodes. They can record the cell voltage and determine the reduction potential of each half reaction. Students learn to, identify anodes and cathodes, write half and full reaction equations and view what is happening in the cell at a molecular/submicroscopic level. The screenshot is shown in figure 4

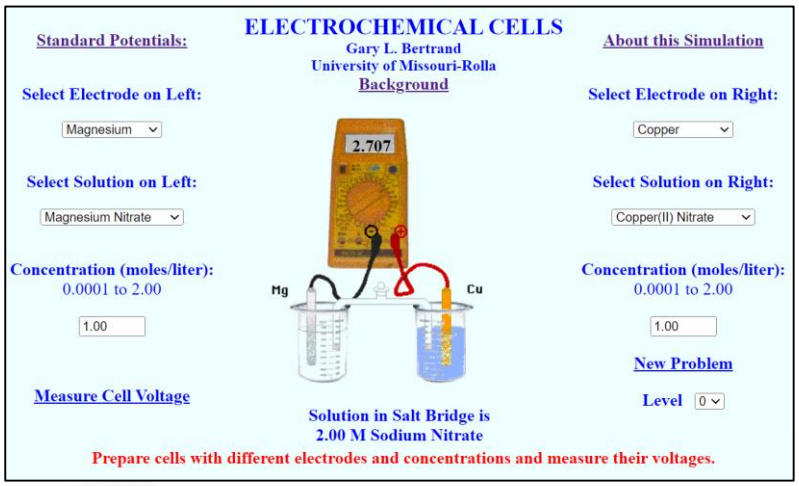


Figure 4. Electrochemical cell simulator

METHOD

A usage study involving 106 students was conducted. The Electrochemistry Toolkit Usage Questionnaire is used to gauge students' view on the usage of the application. The questionnaire comprises ten four-point Likert scale questions and an open-ended question on students' experience using the application.

RESULTS

Results presented in table 1 shows that the students liked the Molecular Geometry Toolkit. In addition, almost all the students agree that the use of the application brings numerous positive effects.

Table 1. Summary of Electrochemistry Toolkit(ET) Usage Questionnaire

Statement	1	2	3	4	% agree
1. I enjoy using ET to learn Electrochemistry	0	0	14.5	85.5	100
2. ET makes understanding the concept of the topic is easier.	0	1.8	12.7	85.5	100
3. ET is easy to use.	0	1.8	9.1	89.1	100
4. ET helps me visualise the submicroscopic aspect of electrochemistry.	0	0	18.2	81.8	100
5. ET increases my interest in chemistry.	0	0	16.4	83.6	100
6. The use of an interactive application like ET help me understand the topic.	0	0	12.7	87.3	100
7. The use of interactive learning tools like ET should be expanded to other topics.	0	0	18.2	81.8	100
8. ET makes learning chemistry more interesting.	0	0	16.4	83.6	100
9. ET is suitable as a self-study tool outside normal classes.	0	0	10.9	89.1	100
10. ET helps me improve my chemistry scores.	0	0	18.2	81.8	100

1=strongly disagree; 2=disagree; 3=agree; 4; strongly agree

The open-ended question finds that out of 106 students, 65 gave positive comments, 46 gave neutral or no feedback at all. Among the positive comments are:

"Interesting and help me understand the concepts better."
"Help me understand the difficult topic. The visuals make lessons more interesting."
"Very helpful and easy to understand. Hopefully, there are similar toolkit for other chemistry topics."
"The Toolkit is gives me deeper understanding of the topic and underlying concepts."

CONCLUSION

The Electrochemistry Toolkit is found to be an effective learning tool. Various interactive applications and simulators have helped students visualize the electrochemical processes and made learning more interactive. Since the components are sourced from various open education

and non-profit websites, the application is free. It can easily be shared and should be made available to pre-university level students. Electrochemistry Toolkit is developed based on one of 17 Global Goals for Sustainable Development outlined by the United Nations. Access to quality education is a global ideal. May this application be a small step in the right direction.

ACKNOWLEDGEMENT

Source links and contributors

1. Chapter 3 Electrochemistry. Kolej Matrikulasi Negeri Sembilan
2. Classroom Resources | Galvanic/Voltaic Cells | AACT (teachchemistry.org)
3. https://media.pearsoncmg.com/bc/bc_0media_chem/chem_sim/html5/Electro/Electro.php
4. https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_(Analytical_Chemistry)/Electrochemistry
5. Copper Electroplating Experiment. https://youtu.be/gTjWkeSp
6. Chapter 3 Electrochemistry. https://forms.gle/DvVvEmg8Wc5L6N6q9
7. Electroplating. http://billvining.com/mmlib_sims/#gen_19_0
8. Standard Cell Potential. http://billvining.com/mmlib_sims/#gen_19_2
9. Nernst Equation Calculator. http://calistry.org/calculate/nernstEquation

REFERENCES

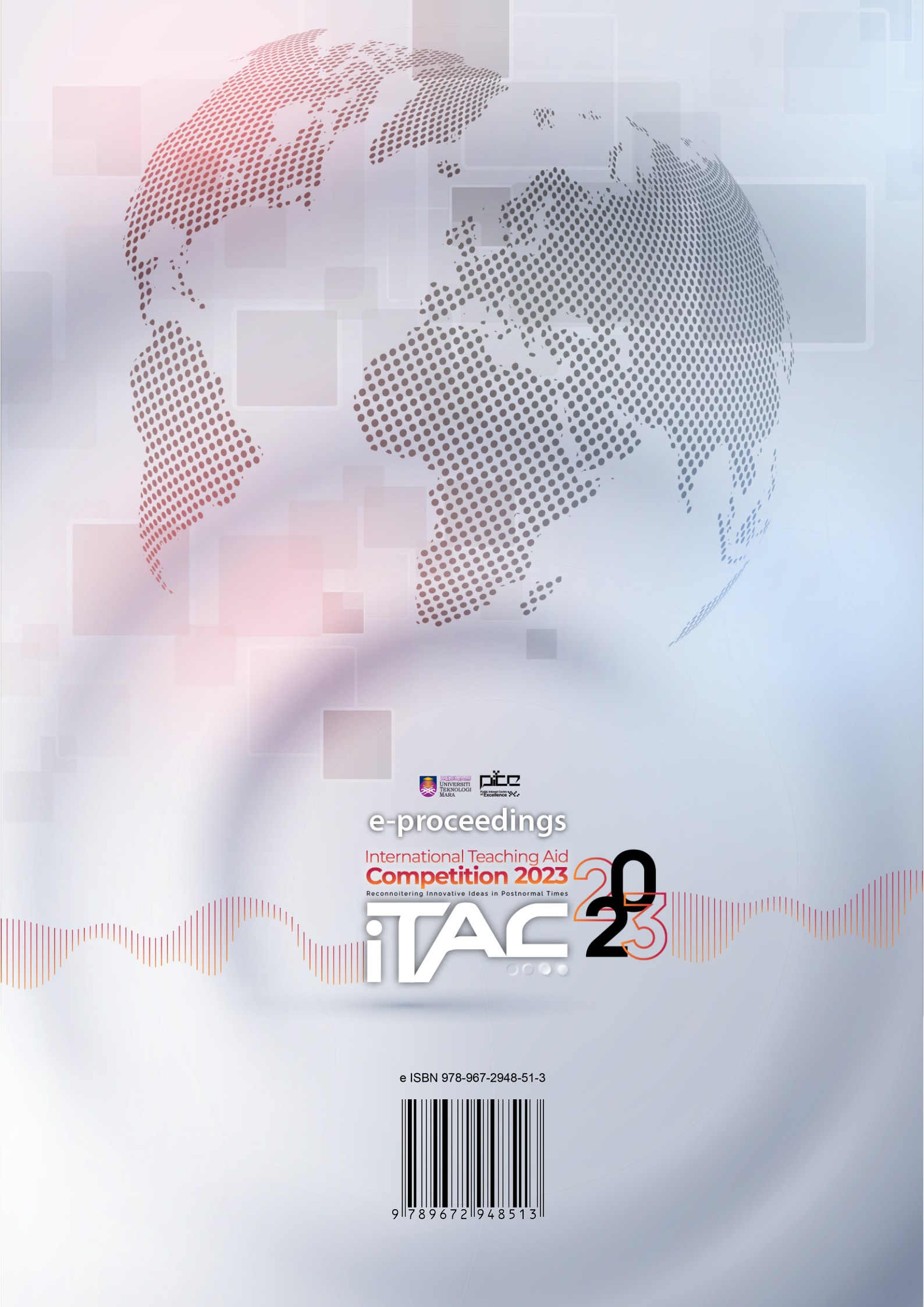
Correia, A. P., Koehler, N., Thompson, A. & Phye, G. (2018). The application of PhET simulation to teach gas behaviour on the submicroscopic level: secondary school students' perceptions, Research in Science & Technological Education. https://doi.org/10.1080/02635143.2018.1487834

Kamisah Osman & Tien Tien Lee (2013). Impact of Interactive Multimedia Module with Pedagogical Agents on Students' Understanding and Motivation in the Learning of Electrochemistry. *International Journal of Science and Mathematics Education* 12(2) DOI: 10.1007/s10763-013-9407-y

N. J. Ahmad, N. Yakob, M. A. H. Bunyamin, N.Winarno & W. H. Akmal (2021).The Effect Of Interactive Computer Animation And Simulation on Students' Achievement And Motivation In Learning Electrochemistry. *Jurnal Pendidikan IPA Indonesia.* DOI: 10.15294/jpii.v10i3.26013

Schwedler, Stefanie; Kaldewey, Marvin (2020). Linking the submicroscopic and symbolic level in physical chemistry: how voluntary simulation-based learning activities foster first-year university students conceptual understanding. Chemistry Education Research and Practice,

.



e ISBN 978-967-2948-51-3