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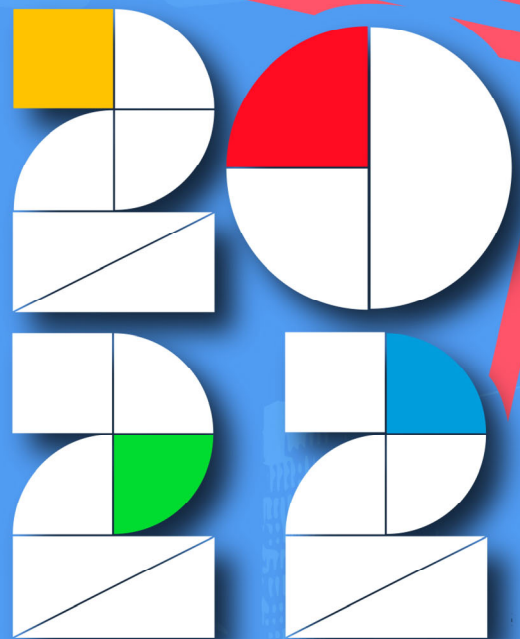
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Reengineering
Knowledge &
Creativity for
Global Excellence

30
June



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TECHNOLOGY, SCIENCE, SOCIAL SCIENCES AND
HUMANITIES INTERNATIONAL CONFERENCE
TeSSH 2022***

**Reengineering Knowledge and Creativity
for Global Excellence**

Copy Editors:

***Nor Azrina Mohd Yusof (Dr.)
Lee Chai Chuen
Juaini Jamaludin
Normaziana Hassan***

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30 June 2022
UiTM Cawangan Kedah, Merbok
Kedah, Malaysia**

UNIVERSITI TEKNOLOGI MARA CAWANGAN KEDAH

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Lee Chai Chuen
Juaini Jamaludin
Normaziana Hassan

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Foreword

The papers compiled in these e-proceedings are papers presented online at Technology, Science, Social Sciences and Humanities International Conference 2022 (TeSSH I 2022) held on 30 June 2022 at Universiti Teknologi MARA (UiTM) Cawangan Kedah, Kedah, Malaysia. With the theme, ***Reengineering Knowledge and Creativity for Global Excellence***, the conference has brought together presenters of diverse background who shared their conceptual and empirical papers in broad areas that are subsumed under the fields of Technology, Science, Social Sciences and Humanities. These e-proceedings comprise current researches that were undertaken with the rigorous endeavour of knowledge enhancement to ensure that the world of academia will continue to flourish. It is thus hoped that readers will significantly benefit from knowledge contained in these proceedings.

TeSSH I 2022 and these e-proceedings would not have been possible without the great efforts from the presenters, and the generous support from the TeSSH I 2022 committee members and the Rector of UiTM Cawangan Kedah, Prof. Dr. Mohamad Abdullah Hemdi. A heartfelt gratitude is extended to all involved. It is hoped that these e-proceedings will be an impetus to stimulate further studies and research that benefit the society at large.

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Investigating the usefulness of TikTok as an Educational Tool in Learning Chemistry

Nur Farha Shaafi

Faculty of Psychology and Education
Universiti Malaysia Sabah, 88400 Kota Kinabalu, Sabah
farhashaafi@yahoo.com

Mohammad Mubarrak Mohd Yusof

Faculty of Education
Universiti Teknologi MARA, 42300 Puncak Alam, Selangor
mubarrak@uitm.edu.my

Nurul Nabilla Mohammad Khalipah

Sekolah Menengah Integrasi Sains Tahfiz
56000 Cheras, Kuala Lumpur
g-20413824@moe-dl.edu.my

Norhazly Mohd Hanif

Sekolah Menengah Tinggi Sultan Salahuddin Abdul Aziz Shah
42500 Sabak Bernam, Selangor
g-25375276@moe-dl.edu.my

ABSTRACT

TikTok is a social media, video-based phone application, which enables creative and engaging videos that is rapidly growing in popularity. TikTok has been used to create fun, exciting, and engaging 15-60 second duration educational chemistry and science outreach videos. This study aims to investigate the usefulness of TikTok as an educational tool in learning chemistry among secondary school students in Malaysia. Non-random purposive sampling was used to select 40 participants from two different secondary schools, namely Sekolah Menengah Integrasi Sains Tahfiz, Cheras, Kuala Lumpur and Sekolah Menengah Tinggi Sultan Salahuddin Abdul Aziz Shah, Sabak Bernam, Selangor. The instruments used were document and interview sessions. The results showed that the overall response to the survey was promising as most of the respondents gave positive feedback on the use of the TikTok application in their chemistry learning process. In this respect, the potential of TikTok to be used as an educational tool should be further explored since it enables the designing and delivering of creative and high-quality e-learning content.

Key Words: TikTok, educational tool, chemistry, secondary school students

INTRODUCTION

TikTok is a social network launched in the Chinese market in 2016 (initially known as Douyin) and internationally in 2017, when it was rebranded as TikTok). The TikTok application has surpassed Facebook and WhatsApp as the most popular mobile phone app, with more than 45 million downloads globally during a three-month period (Adnan et al., 2021). In 2018, TikTok videos were the most downloaded mobile app in the United States and are nowadays available in more than 150 countries with 800 million monthly active users (Fiallos et al., 2021). TikTok allows users to create and share short videos (15 to 60 seconds duration) that are quick and uncomplicated to edit using various filters, effects, and sounds. In 2020, TikTok launched the 'LearnOnTikTok' program which consists of educational videos to assist learning during the COVID-19 pandemic (Hutchinson, 2020).

The educational videos were created by professionals from various disciplines, educators, and students who shared their knowledge to this social network's audience (Fiallos et al., 2021). A generally increasing trend on the number of publications in the field of education using TikTok could be observed from 2017 to the 2nd quarter of 2022 (Figure 1); which is speculated due to the new interest among the researchers towards educational videos.

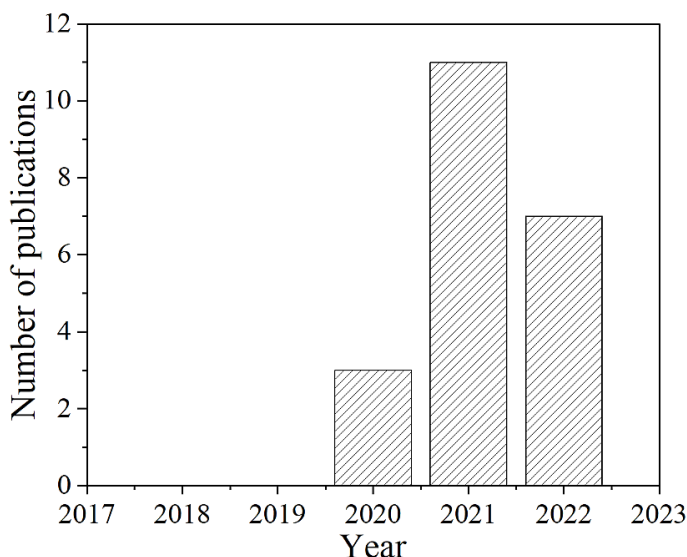


Figure 1. Number of Papers Published From 2017 to 2022; Generated from ISI Web of Science Keywords 'TikTok' and 'Education'

The educational videos were linked to the hashtag of #learnontiktok with various topics i.e., chemistry experiments, health tips, learning languages, cooking recipes, education tips, and others. TikTok has an ideal format and tools for creators to create short educational videos. The 'LearnOnTikTok' videos have achieved 72 billion views with hundreds of uploaded videos per day (Fiallos et al., 2021).

The educational system in Malaysia is moving towards implementing the latest technological innovations, in line with the Fourth Industrial Revolution (IR 4.0). Therefore, the education sector is currently adapting to new technologies to generate new types of teaching and learning media. This change is required to provide up to date knowledge, and inculcate students with all the essential skills needed for the machine age (Schwab, 2017). The teaching and learning methods are now being integrated with both face-to-face interaction and technology-facilitated instructional approaches in the form of online class sessions. In the 21st century, mobile phone technology with the integration of interactive Web 2.0 Internet, also known as the online social media (including TikTok – the world's most popular application) is becoming an important and integral part of our lifestyles (Azlan et al., 2019).

TikTok is mainly used by the younger audience and teenagers to create fun, visually engaging, creative, and humorous online videos. Educators and professionals can use this opportunity to create informative, fun, and visually engaging videos on the chemistry subject to attract the younger audience and inspire them to learn more about chemistry in a creative and innovative manner. Hence, the aim of this study is to investigate the usefulness of the TikTok application as an educational tool in learning chemistry among secondary school students.

LITERATURE REVIEW

Implementation of TikTok in Learning Chemistry

The existing TikTok accounts called “NileRed” was chosen for this study (Figure 2). As of 14th June 2022, these TikTok accounts have uploaded 117 educational videos. Generally, these videos demonstrate scientific experiments for the targeted audience who consists of secondary school and pre-university individuals with or without some background knowledge of chemistry, thus, the use of scientific jargon was limited. The explanations were kept simple and detailed procedure were provided using both text and visual aids. The TikTok educational videos could be used in conjunction with a system thinking approach to ensure the viewers could: (i) identify the steps required to reach the desired outcomes, (ii) explain the theory based on the observations, and (iii) demonstrate how the theoretical principles could be implemented to real life situations (Hayes et al., 2020).

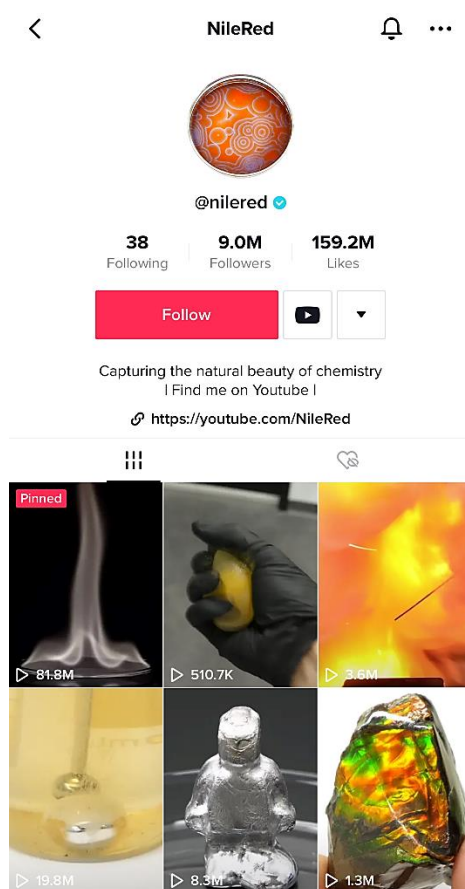


Figure 2. Screenshots of TikTok Accounts' Homepages for Learning Chemistry from “NileRed” (the photo has been screenshotted on 7th June 2022)

Theoretical Framework

The TikTok application could be a learning medium to facilitate learning spaces to be more conducive, creative, fun, and engaging which cater to the concept of Technology, Pedagogical and Content Knowledge (TPACK). In the 21st century, TPACK-based learning should be empowered by educators (Nevrita et al., 2020). The development of TPACK is highly significant among educators to promote an effective teaching and learning process using the technological approach (Rahayu, 2017). The concept of TPACK consists of seven domains: (i) material knowledge, (ii) pedagogical knowledge, (iii) technological knowledge, (iv) pedagogical knowledge and material, (v) knowledge of technology and materials, and (vi) knowledge of technology, pedagogy, and

materials. The framework concept of TPACK is depicted in Figure 3 (Mishra & Koehler, 2006).

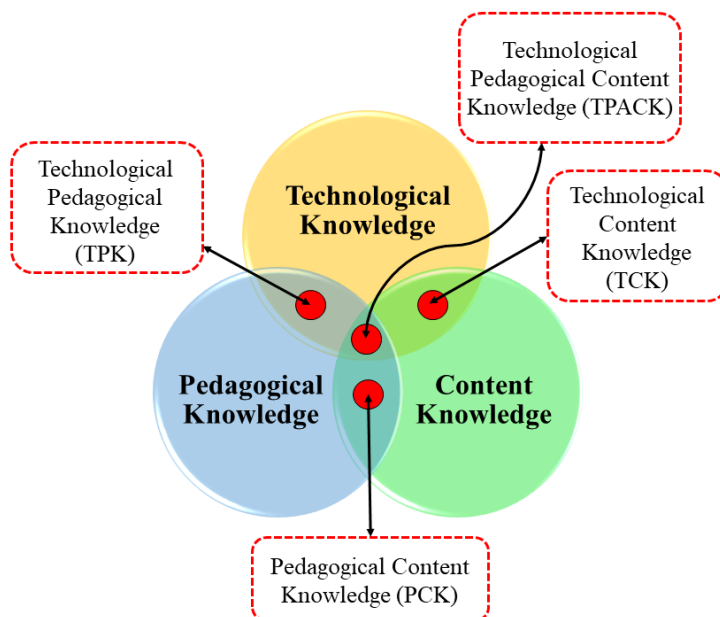


Figure 3. Framework concept of TPACK

The theoretical framework of Richard Mayer's 12 principles of using multimedia for learning could provide insights into the usefulness of the TikTok application in teaching and learning chemistry among secondary school students. The core of the 12 principles is that students learn the most from words and graphical images due to the meaningful connections between them, rather than from words only (Mayer, 2014). According to the 12 principles, the human information processing system has three memory stores, i.e., sensory memory, working memory, and long term memory (Mayer, 2002). The Mayer's principles are coherence, signalling, redundancy, spatial contiguity, temporal contiguity, segmenting, pre-training, modality, multimedia, personalization, voice, and image principles (Figure 4).

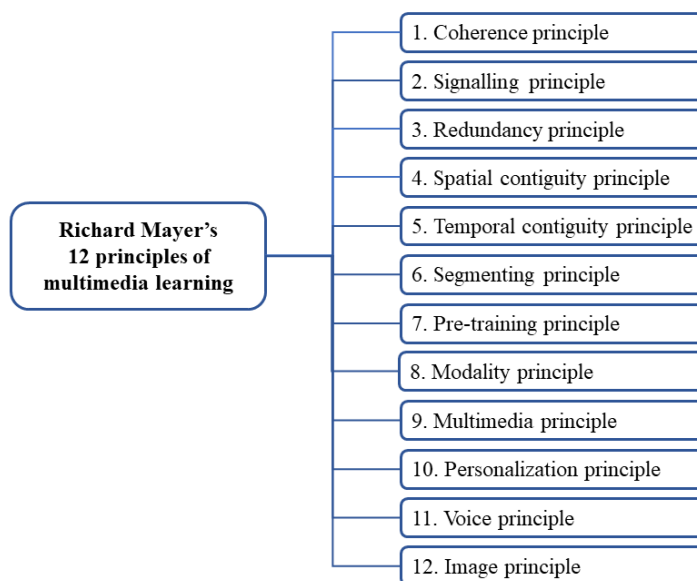


Figure 4. Richard Mayer's Principles of Multimedia Learning (Mayer, 2002)

Looking at the 12 principles, there are five principles that are applicable with the TikTok application, i.e., (i) spatial contiguity principle, (ii) temporal contiguity principle, (iii) pre-training principle, (iv) multimedia principle, and (v) image principle. The spatial contiguity principle refers to

the space in between the text and visuals on the screen, which states that users learn best due to the relevant text and visuals being physically near to one another (Mayer, 2005). The temporal contiguity principle states that individuals acquire new information at the highest level when corresponding words and visuals are presented simultaneously, instead of in consecutive order (Mayer, 2002). The pre-training principle states that individuals learn more efficiently when they have some prior background knowledge on certain things (Moreno & Mayer, 1999). The individuals could be more easily motivated when complex visuals and definitions are thrown in their way if they started a learning course on TikTok to gain some background knowledge. The multimedia principle states that individuals would learn better from both words and images, rather than using words only. Finally, the image principle states that relevant visuals on the screen would be more effective than only showing a video of an educator's or instructor's talking head (Adnan et al., 2021; Mayer, 2002).

METHODOLOGY

Participants

The participants of this study were 40 secondary school students who were non-randomly selected from science stream classes from two different schools, i.e., Sekolah Menengah Integrasi Sains Tahfiz in Cheras, Kuala Lumpur and Sekolah Agama Menengah Tinggi Sultan Salahuddin Abdul Aziz Shah in Sabak Bernam, Selangor. Purposive sampling was used by selecting 20 form 4 students who own a TikTok account from each of the two schools. The purposive sampling is an appropriate type of qualitative sampling due to adequate data collection and to avoid redundancy (Babbie, 2010; Creswell & Tashakkori, 2007; Merriam, 1998; Skulmoski, Hartman, & Krahn, 2007).

Instrumentation

The instruments used were document and interview sessions. The document consisted of videos that were used to support the interview data (Creswell & Tashakkori, 2007). The research procedures were carried out as follows: (i) The students were required to watch a TikTok video (url: <https://vt.tiktok.com/ZSdrf3vVR/>) from an account i.e., @NileRed (Figure 5b). This TikTok account has 117 educational videos (highest view: 81.7 million views), illustrating scientific experiments that could be easily understood by the target audience who are secondary school or pre-university individuals with little to no scientific knowledge.

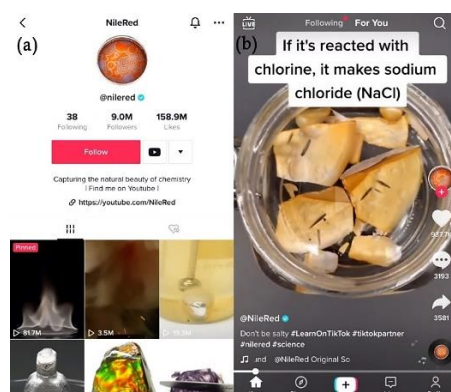


Figure 5. (a) View of Created Videos on the @NileRed TikTok Account Homepage, and (b) Screenshot from the @NileRed TikTok Video, titled “Don’t be salty” (the photos have been screenshotted on 7th June 2022)

The students were then asked to write down their observations based on the TikTok video to investigate their understanding in the learning process. (ii) The students were then required to watch a 5-minute video clip on a chemistry lesson on the topic of chemical bonds (url: <https://www.youtube.com/watch?v=q-tE6MN-wrE>) as shown in Figure 6. Chemical bonds is a

difficult topic for secondary school students to understand as it involves many abstract concepts (Abd. Halim, 2012).

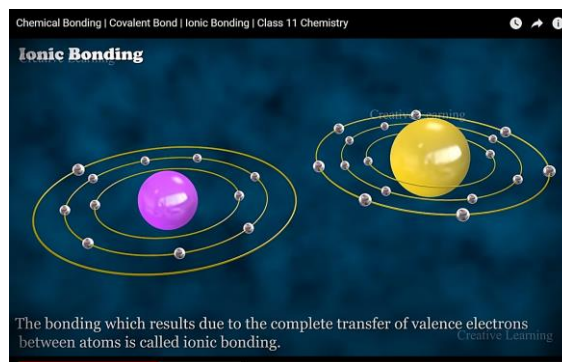


Figure 6. YouTube Video titled “Chemical Bonding | Covalent Bond | Ionic Bonding | Class 11 Chemistry” (url: <https://www.youtube.com/watch?v=g-tE6MN-wrE>)

They were then asked to transfer the information from the video clip to a graphic representation using the TikTok application. (iii) After watching the similar 5 minutes YouTube video clip on the chemical bond topic, they were required to proceed with the same task, though this time using the traditional mind-mapping technique. They were given one week to complete the tasks. Upon submission of the tasks, i.e., notes from the TikTok educational video, the recorded TikTok video made by the students, and the mind-map, the students were interviewed to give feedback on those two methods. Two questions were asked as follows:

- i. Can you share your experience using TikTok as a learning tool?
- ii. Which is better for you? TikTok or traditional mind-map technique? Why?

RESULTS AND DISCUSSION

4.1. Analysis of respondents' feedback

In this part, the demographic information was analysed which are gender and daily usage of TikTok application among the respondents. From figure 7(a), out of 40 respondents, there were 12 male students (30%) and 28 female students (70%) altogether. Figure 7(b) shows the percentage of daily usage of TikTok application among the respondents i.e., 35 respondents reported active participation (87.5%) while only 5 respondents reported inactive participation (12.5%).

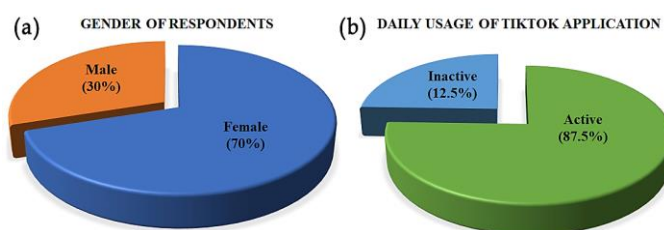


Figure 7. (a) Gender of respondents i.e., male (30%) and female (70%), and (b) daily usage of TikTok application among respondents i.e., active participation (87.5%) and inactive participation (12.5%)

The responses from the respondents were recorded and analysed to acquire an in-depth understanding of their opinions on this activity. The use of the TikTok application for knowledge and information transfer was analysed by employing Mayer's principles of multimedia learning as the analytical framework.

“...easy to understand, and TikTok application provides interactive and creative videos which grab students’ interest...”

(Respondent 2)

“...TikTok helps us as a learning tool, for instance, creating ideas for our additional notes...”

(Respondent 5)

“...I think it is difficult to get used to the TikTok application in the beginning, however, I could eventually catch up with the information given in TikTok videos...”

(Respondent 10)

“...I used to learn on how liquid could transform into ice, and why coco is insoluble in water at the first place and getting soluble in the end, from TikTok videos...”

(Respondent 11)

“...I like the music in TikTok while learning chemistry...”

(Respondent 12)

“...I think TikTok is more enjoyable to inspire the learning process...”

(Respondent 13)

“...TikTok application is a good learning tool which could attract us easily for the learning process because it is trendy with our generation...”

(Respondent 15)

“...I would choose both TikTok and traditional mind-map techniques. TikTok promotes fun-learning, meanwhile mind-mapping promotes simplified and good information...”

(Respondent 20)

“...TikTok is way better than mind-mapping because it consists of visual, audio, and physical movement which could help us to understand easily...”

(Respondent 21)

“...TikTok videos are way better than traditional mind-map because every procedure in chemistry experiments could be visually taught in videos rather than lame drawing skills...”

(Respondent 34)

“...I can challenge myself to be creative using TikTok...”

(Respondent 36)

“...I can remember better when learning using TikTok...”

(Respondent 37)

“...I would prefer the TikTok application because it is clear and direct information, it helps us to memorize better...”

(Respondent 40)

Based on the respondents’ feedback, it was found that, out of 40 respondents, 13 students preferred using TikTok as a learning tool to transfer the information from video to graphic representation. The respondents stated that TikTok was highly interesting due to the musical and entertainment elements compared to the traditional mind-mapping technique. One of the respondents mentioned that TikTok has challenged him to be more critical and creative by exploring new methods. In terms of content, most of the respondents agreed that TikTok could assist them to understand and memorize the content better due to the increased time spent in looking at the information to create their own TikTok video compared to that of the traditional mind-mapping

technique. Social media applications, especially TikTok could be used as effective learning tools in designing, scaffolding, and interacting between students during the learning process whenever necessary (Al-Naibi et al., 2018).

Whilst TikTok was mainly used by respondents (younger groups and teenagers) to create fun, visually engaging, creative, and humorous contents, we observe that TikTok could also be an opportunity for them to create informative, fun, and visually engaging chemistry videos, that could reach this audience. This would therefore encourage them to conduct their own study of chemistry i.e., taking notes, and conduct their own chemistry experiments at home in a creative and innovative manner.

Nevertheless, 4 out of 40 of the respondents pointed out that using TikTok was a challenge for them to keep up with the advancing technology and was time-consuming due to requirement of editing. As a result, they felt less motivated to use TikTok as an educational tool. Other than that, a lack of knowledge and familiarity using the creative video features in the TikTok application could be hypothesized as factors of interest inhibition. Thus, these 4 students seem to prefer to learn using the traditional mind-mapping technique rather than TikTok videos.

“...Using TikTok application is less preferable for my studies because it is hard to catch up with the technology...”

(Respondent 22)

“...TikTok is fun, but it is time consuming to edit the learning videos...”

(Respondent 3)

“...Mind-mapping technique is way better than learning from TikTok videos because I could permanently memorize all the information that I wrote...”

(Respondent 31)

“...Mind-mapping technique is preferable because it is easy to learn, more information, and time-efficient...”

(Respondent 32)

To effectively suit the target audience, a minimum background knowledge of chemistry and experimental technique were expected. Based on the respondents' feedback, the majority highlighted on the simple and understandable of information conveyed from the TikTok videos, which indicated that the use of scientific jargon was limited and avoided to ensure audience's engagement.

“...Learning chemistry using TikTok is very interesting and easy to understand...”

(Respondent 1)

“...Chemistry information in TikTok is very fun and engaging to students...”

(Respondent 4)

TikTok as an educational tool in learning chemistry

Referring to the Mayer's principles, five principles are in line with the use of TikTok as an educational tool for chemistry e-learning in this research, i.e., spatial contiguity, temporal contiguity, pre-training, multimedia, and image principles.

The spatial contiguity principle

The spatial contiguity principle refers to the space in between text and visuals on the screen. It states that the users would learn better when the relevant text and visuals are physically close to each other. In the context of the current research, the TikTok application would allow the students

to choose their own visuals and text. Therefore, the learning process in chemistry would be easier for the secondary school students.

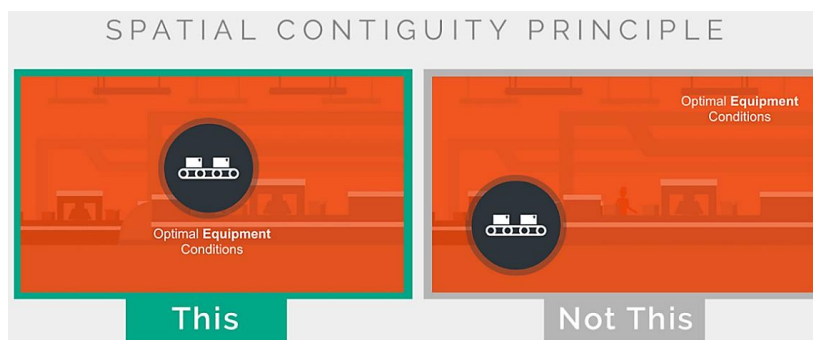


Figure 6. Spatial Contiguity Principle (Mayer, 2014)

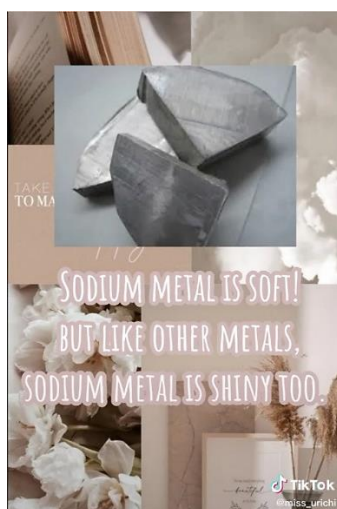


Figure 7. Spatial Contiguity Principle – A Sample of a respondent's TikTok video

The temporal contiguity principle

The temporal contiguity principle refers to the individuals acquiring new information at the highest level when corresponding visuals and text are presented at the same time, rather than in consecutive order. In the current research, the students were allowed to be creative in arranging their visuals and text. Most of the students preferred to present their visuals and text that are related to each other at the same time in TikTok to enhance the comprehension of viewers.

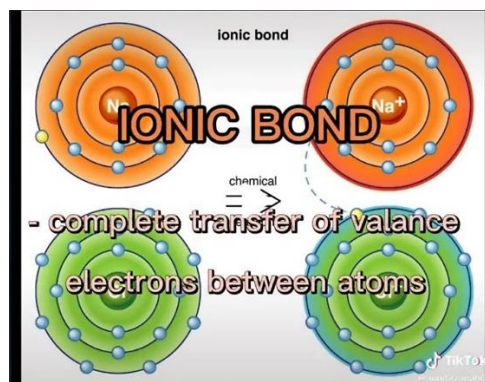


Figure 8: Temporal Contiguity Principle – A sample of a respondent's TikTok video

The pre-training principle

The pre-training principle states that the individuals would learn efficiently based on their prior knowledge on a particular matter. This means that their comprehension of basic definitions, terms, and concepts is highly significant for the pre-learning experience. The learners would be highly motivated to deal with complex visuals and definitions if the learning process begins with a background knowledge. In this research, 35 of the respondents have been actively using TikTok application for pleasure and entertainment before being introduced to using it as an educational platform. Therefore, the students possess some prior basic knowledge of TikTok, which results in an easier and more engaging learning experience.

The multimedia principle

The multimedia principle refers to individuals learning better from both visuals and text, rather than from text only. TikTok allows users to think out of the box due to the ability to insert images and words, and more engaging elements, such as animations, voiceovers, songs, sound effects, filters, and the users' own videos. These elements would ensure that the TikTok presentation becomes livelier, entertaining, engaging, fun, and informative.

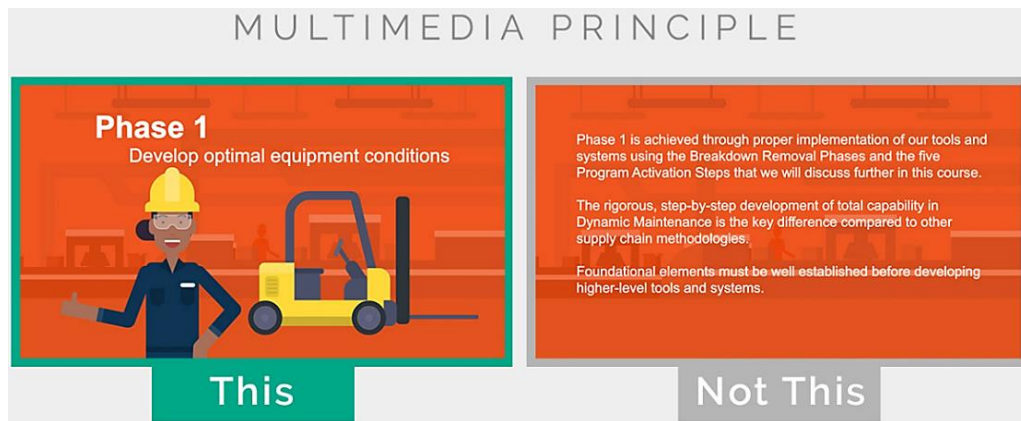


Figure 9: Multimedia Principle (Mayer, 2014)



Figure 10: Temporal Contiguity Principle (Mayer & Fiorella, 2014)



Figure 11: Multimedia Principle – A Sample of a respondent's TikTok video

The image principle

The image principle stated that the relevant visuals on the screen would be more effective for learning information compared to only showing a video of the instructor's talking head. The features element in the TikTok application allows users to be visible in the video. They could share their information with special effects without any spoken words.

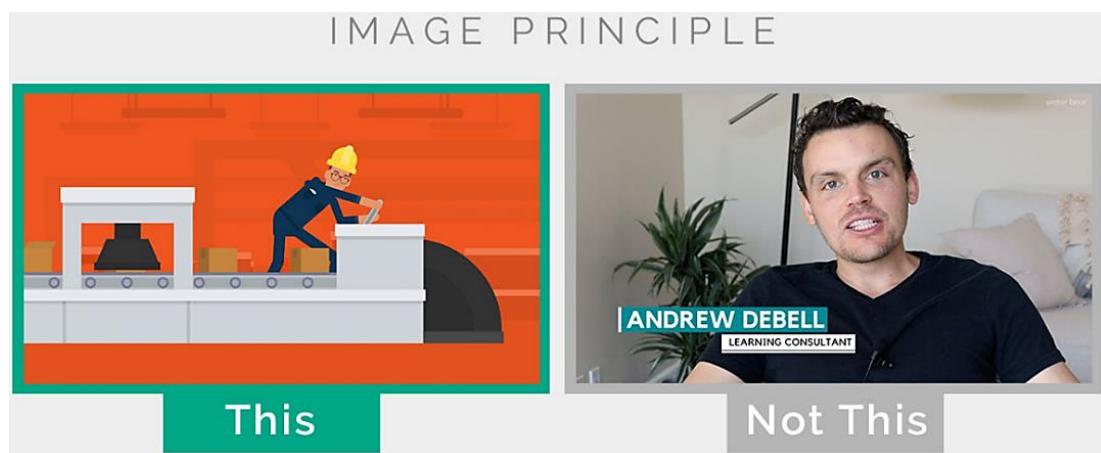


Figure 12: Image Principle (Mayer, 2011)



Figure 13: Image Principle – A sample of a respondent's TikTok video

CONCLUSION

TikTok could be used to effectively engage, educate, and stimulate the general public about chemistry. Chemistry could be contextualized in a fun and engaging manner using the creativity tools employed in TikTok. It enables students to act as partners in creating tools for chemistry education, which would be the biggest strengths of using TikTok in the classroom. The use of TikTok corresponds to five out of 12 of the of the Mayer's principles in multimedia learning. This demonstrates its effectiveness as a learning tool that is manifested as a better learning experience. However, there are positive and negative implications from the use of TikTok in educational environments. It is crucial to harness the positive aspects and adapt them for the modern approaches in teaching and learning. We suggest further work to assess the usefulness of the TikTok application as an educational tool for other subjects based on the components of critical thinking, problem solving, and experimental skills enrichment. Overall, we believe that provided it is correctly utilized, TikTok could provide educators with a valuable and useful new tool to improve chemistry knowledge.

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