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More than just engaging? TikTok as an effective learning tool.

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More than just engaging? TikTok as an effective learning tool.

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Abstract

With the growing popularity of social media, educators have been adopting social media platforms, such as TikTok, for learning purposes. Whilst the effectiveness of TikTok to increase learner engagement has been demonstrated, there was little evidence indicating the effectiveness of TikTok on actual learner performance through formal graded assessments. This study is one of the first attempts to investigate the effects of TikTok as a learning tool on learner performance. The findings from a controlled experiment indicate that TikTok had a beneficial impact on the learner's performance as well as self-perceived engagement in an introductory statistics course.

Keywords: TikTok, Social Media, Statistics, Microsoft Excel, Learning

1.0 Introduction

The global pandemic has shifted the way of learning significantly. Although much of the initial shift to online learning was forced, rather than planned, many benefits of online learning have demonstrated a positive influence on learning and engagement. Online learning incorporates advanced information communication technology (ICT) such as electronic media in the learning process (Thomas & Graham, 2019). However, with online learning, students miss some features of classroom-based learning, such as social interactions and a specifically designed learning environment. Therefore, a blended approach to learning has been received positively by students (Shen et al, 2011). According to Gilmore et al (2021), blended learning is likely to be a positive way forward post the pandemic. The blended learning incorporates technology with a focus on active learning that is achieved by replacing face to face time with a percentage of intentionally designed online learning activities.

Gilmore et al (2021) conducted a three-year study including spanning a pre and pandemic timeframe finding that a blended course design was effective in facilitating student achievement. The new norm of blended learning contains both synchronous and asynchronous learning that can allow students to learn at a pace that suits them. The availability of mobile technologies also enforces the foundation of such an approach. For

asynchronous learning, students have the opportunity to choose when and to a certain degree what they learn. Therefore, it could be possible to apply bite-sized learning to asynchronous learning.

Statistics is a course about scientific thinking and science of uncertainty to which students have very little exposure prior to university. Students come into statistics classes with a lot of trepidation with a presumption of a mathematics-laden course and do not have a clear understanding of the purpose of learning statistics which hinders the learning environment. Internet technologies have been increasingly used for teaching statistics to supplement and/or enhance traditional face-to-face teaching (Tishkovskaya & Lancaster, 2012). During the pandemic, the use of internet technologies has become indispensable. Various types of internet technologies have been put into use given the disruptive scenario of the global pandemic. Like all other teachers, statistic teachers have adopted these technologies as learning aids. Publishers of statistical education materials have noticed this trend and incorporated technology into their platforms. For instance, Khan Academy and StatQuest have websites and YouTube channels demonstrating statistical concepts that are helpful learning aids. Khan Academy has over 70 million users with 15 billion practice questions completed in 190 countries (Khan Academy, 2021). Khan Academy has 6.47 million subscribers to its YouTube channel, and its videos have been viewed over 1.8 billion times as of March 2021 (Social Blade, 2021). StatQuest has over 443K subscribers, and the videos have been viewed over 21 million times as of March 2021 (Social Blade, 2021).

Social media applications have emerged as one of the taken-for-granted ways for people to interact. In addition to entertainment, social media has been adopted in the learning environment (Hayes, et al., 2020; Escamilla-Fajardo, et al., 2021). Microsoft Excel is one of the most popular spreadsheet applications, and many students have experience using it, even if it is not for statistical analysis. Prior experience of using Microsoft Excel could reduce the anxiety of learning a new discipline based on Microsoft Excel, such as statistics. In addition to using a more familiar tool, applying a reductionist approach might also reduce the challenges of learning statistics. Therefore, this project aims to investigate the effects of the reductionist approach to teaching statistics by using bite-size videos on TikTok to teach statistics.

2.0 Literature Review

2.1 Bite-Sized Learning

Bite-sized learning has emerged from cognitive learning theory research and practices. Cognitive learning theory considers learning as a process, in which learners process

information and develop certain actions as a result (Mayer, 2002). Such cognitive processes involve the reorganisation of mental processes that develop human intelligence (Piaget, 2000), which can be considered knowledge. Knowledge is the mental processing of information and the know-how of performing tasks (Wang and Noe, 2010), however, knowledge is subjective based on an individual's interpretation of information (Miller, 2002). Through the mental process, learners digest information and consequently construct and internalise knowledge.

However, there is strong evidence to suggest that attention and recall decline over time when students are subjected to long and uninterrupted sessions (Burns, 1985, Hattie and Yates, 2013). Burns' study found that the greatest impact on learning appeared within the first five minutes with a declining impact thereafter. Hattie and Yates's research suggest retaining information is more effective when learning is distributed across several short sessions than a single longer session. It is evident that restraining students in long and uninterrupted sessions and one-way communication are ineffective ways of teaching while young students are becoming avid users of online short video and chat apps.

2.2 Segmentation and Just-in-Time Learning

Mayer & Moreno (2003) investigated ways to reduce cognitive load in learning, which is the learner's capacity for cognitive processing. Their findings point at segmenting as one of seven methods for load reduction. Segmenting is the process of allowing time between successive bite-sized segments of instruction. This is also known as bite-sized learning which is linked to just-in-time learning, which facilitates informal, learner-initiated knowledge acquisition and use (Weintraub & Martineau, 2002). Just-in-time learning favours learning materials that are shorter and focus on specific outcomes. Bite-sized learning transforms a learning session with multiple learning objectives into several short sessions that can be consumed quickly and usually have one key learning objective for each session.

Bite-sized learning is found to have a positive impact on transferring knowledge via micro-content of learning and delivery methods (Job & Ogalo, 2012). The use of bite-sized learning can lead to more retention of information than learning a large amount of information in one setting (Stahl et al., 2010). According to Gray (2015), bite-sized learning also presents the advantages of increased participation.

The just-in-time and bite-sized learning approach has been widely applied to corporate training and work-based learning (Armstrong & Sadler-Smith, 2008). Furthermore, the use of bite-sized learning is also being applied in formal education with promising results. Bite-sized learning approaches have been found to have a high acceptance level amongst

students and lead to learning outcome improvement in the context of higher education via the use of WhatsApp (So, 2016). Furthermore, Manning et. al. (2021) stated that the use of bite-sized learning in medical education showed that residents taught through bite-sized learning scored significantly higher on immediate post-test compared to those taught by case-based teaching.

Bite-sized learning is both pedagogical and pragmatic. It provides the means for students to manage cognitive load effectively and at their own will. Fast-advancing mobile technologies enable effective and inexpensive vehicles to carry bite-sized learning (So, 2016). The use of mobile, web, and e-learning techniques for education permits knowledge-sharing through mobile devices such as smartphones, tablets, laptops in a timely and modern fashion (Hayes, 2020). Students tend to use mobile devices more than laptops for non-conventional classroom activities (Dahlstrom et al., 2015). Since the use and importance of smartphones amongst students have been increasing steadily over the years (Galanek et al., 2018),mobile delivery of bite-sized learning could be an effective means to reach students.

2.3 Multimedia Learning

Multimedia learning involves the delivery of an instructional message to students using a combination of words and pictures designed to foster meaningful learning (Mayer, 2002). Derived from Paivio studies, it is assumed that information processing in humans is separated into a dual-channel system i.e. visual and verbal channels.

The amount of processing that each information processing channel can handle is highly constrained (Baddeley et al., 1998). Mayer (2003) found that using different technologies can serve as powerful aids to human cognition. Multimedia learning is most effective when instructors automate some tasks and allow them to focus on learner motivation, interaction and assessment (Velleman and Moore, 1996). The use of social media as learning aids could support such an approach, as it delegates some of the instructional tasks to technologies.

Many social media applications have gained huge popularity in the last decade, such as Twitter, Instagram, and TikTok. TikTok was launched in China in September 2016 as an application that allows creators to create and share short-form mobile videos. Pivotal to their success in the US, TikTok then merged with Musical.ly in August 2018. Its success is powered by artificial intelligence as it enables creators to add music to their clips along with the ability to add effects, such as stickers, GIFs, picture filters, augmented reality, split screens for duets in response to other users' videos, and green screens. In 2019, there were 37.2m TikTok users in the US with a growth rate of 97.5% (Statista, 2019). In 2020, there

are 100m TikTok users in the US (Sherman, 2020). TikTok is particularly popular amongst young users in the US. According to Piper Sandler (2020), in the Fall of 2020, the percentage of US teens that are TikTok users is 69%, and 29% of them choose TikTok as their favourite social media platform. In addition to entertainment, TikTok has been incorporated in higher education (Escamilla-Fajardo, et al., 2021), as well as outreach and widening participation in chemical education (Hayes, et al., 2020). Such effort has resulted in increased participation of learners. However, there is little focus on the effectiveness of TikTok as a learning tool on learner performance.

2.4 Statistical Education

Many information systems curriculum will include machine learning and other analytics courses, which normally require the fundamental understanding of statistics. Therefore, statistics is essential for information systems practitioners and researchers. However, it is well known in statistical education research that students have anxiety over taking statistics courses (Sowey, 2020; Verhoeven, 2006). According to Garfield & Ben-Zvi (2007) the ideas of probability and statistics are very difficult for students to learn. Statistics is the foundation for analytics and making sense of data and is deeply applicable to many disciplines, including information systems. It is also known that instructors of introductory statistics struggle to motivate and engage students in their learning process (Jonsdottir et al., 2021). Solutions to combat this issue have included calls for revision of the statistics curriculum to integrate technology and real data while fostering active learning (Carver et al., 2016). Many researchers (Chu, 2007; Loomis and Cox, 2003; McEwen, 1994) have proposed the inclusion of statistical software or alternative technologies with real data and problems as a way to foster active learning. Furthermore, Ridgway (2016) suggested that statistics instructors should focus on tools appropriately designed for current data processing needs.

Mairing (2020) proposed the infusion of information and communication technologies to also be infused across the undergraduate program. Therefore, Mairing suggests the integration of technology into statistics courses is complimentary because statistics require complex computations using some formulas. Statistics also involves collecting, representing, summarising, analysing, and drawing conclusions from the data. Researchers and instructors use statistical software such as Minitab, SPSS, or JMP (Basturk, 2005; Stephens et al., 2014; Jatnika, 2015) which helps undergraduates analyse and comprehend the data immediately (Mairing, 2013). However, according to Mairing (2020) these tools may lack meaningful understanding of statistical formulas by students and proposes that Microsoft Excel may bridge this gap in learning. Microsoft Excel can be used to

demonstrate a step-by-step process unlike statistical software packages that are few clicks away from test results, therefore, Chaamwe & Shumba (2016) argue that Microsoft Excel can provide technology aspects without eliminating the meaning while being easy and less time consuming than traditional pen and calculator methods.

3.0 Methods

This study aims to assess the effectiveness of the intervention of TikTok as a learning tool via direct assessment and self-perceived assessment. This intervention research was designed to examine whether online bite-sized videos enhance the delivery of course materials for problem-solving in a statistics course. Seven TikTok tutorial videos were created to explain the AVERAGE, STDEV.P, STDEV.S, NORM.S.DIST, NORM.S.INV functions, and the data analysis toolpak. All the tutorial videos were about 60 seconds or shorter and contained a step-by-step guide on how to perform the specific statistical analysis with Microsoft Excel. A TikTok user profile (available on TikTok @bite_size_stats) was created specifically for the purpose of this research to maintain personal and professional boundaries. A screenshot of one of the TikTok videos is shown in Figure 1.

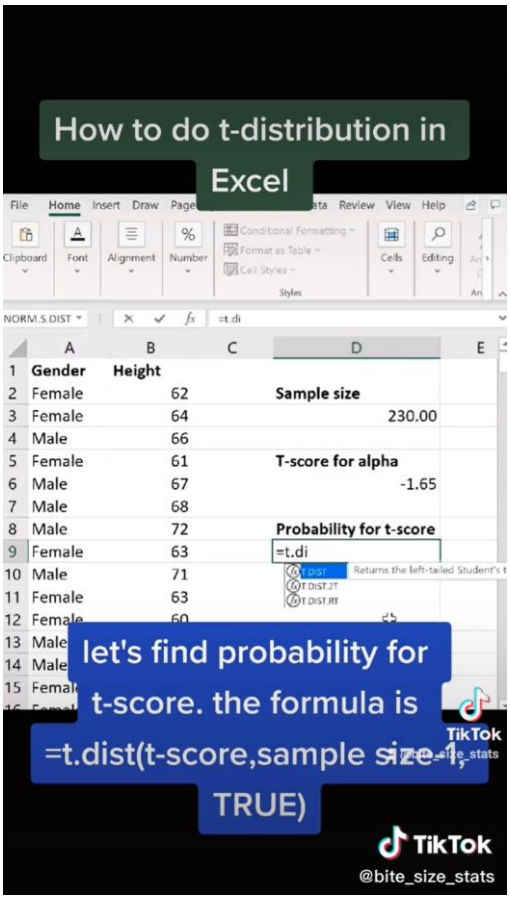

Figure 1. An Example of a TikTok Video.

The context of this research is appropriate because the topics in statistics courses are clearly defined, and students are familiar with the requirements of the task since they have taken other tests in the subject previously. The purpose of the study was explained to the students. The test instruments, the problem sets on specific study topics, are also readily available. The experiment proceeds in several stages over a period of four weeks from pre-intervention to post-intervention assessment. Because of the relatively long time span, students have sufficient time to study and rest and articulate the contents of videos.

The sample consisted of full-time undergraduate students enrolled in an introductory business statistics course at a university in the USA. There were a total of 83 students that participated in the direct assessment, and 57 out of the 83 students participated in the self-perceived assessment. The self-assessment respondents' level at university was proportioned as 71.93% junior, 14.04% senior, 8.77% sophomore, and 5.26% freshman. The gender of the respondents is close to even with 49.12% male, 47.37% female, and 3.51% prefer not to say. The university system is renowned for its inclusiveness, which improves the sample coverage to students with diverse backgrounds.

3.1 Direct Assessment

In the introductory sessions, the students were given a lecture on specific statistical topics followed by a pre-intervention test in order to evaluate their understanding of the learning objectives prior to direct assessment. All the students participated in the direct assessment to evaluate their knowledge of the specific topics (descriptive statistics, normal distribution, and t-distribution). This pre-intervention assessment ensures that the students are aware of the topics included in the experiment and the format of the test. The pre-intervention assessment may also initiate the self-learning process among some students.

The two groups were assigned randomly as the treatment group and the control group in this teaching experiment. The students were split into two groups: control and treatment groups. Both groups continued to receive the same instructor-led tutorials before the post-intervention assessment. However, the treatment group was sent links to the online bite-sized TikTok videos, in addition to the instructor-led tutorials, two weeks prior to the post-intervention assessment related to the specific topics covered

by the videos. The TikTok videos provide the same instruction as in the tutorials, but in a different format, e.g. short TikTok videos.

This allowed students sufficient time to watch and articulate the content at their free disposal. The control group was not provided with the links to the support videos at this stage. Next, both groups were assigned the post-intervention assessment to evaluate their understanding of the learning objectives. In an effort to provide equal opportunities, the control group received the support links to the bite-sized videos after the conclusion of the post-intervention assessment.

It is possible that some students in the control group were "contaminated" due to unintended information spillover during this period (i.e. student sharing the links), but the exposure is likely negligible since young students are far more likely to share entertainment content on social media rather than school works. Another limitation of the study may be that not all students have wide-band internet connections to access the videos. However, the merit of bite-sized video is the limited use of bandwidth for a relatively short period of time, which requires neither high specification technologies nor super-fast internet connectivity.

3.2 Self-Perceived Assessment

Additionally, an online survey was administered to solicit the students' perceptions of learning statistics with Microsoft Excel through TikTok. The survey questions measure the participants' self-evaluation of their ability, interest, and intentions in using Microsoft Excel for statistical analysis before and after watching the TikTok videos.

In order to assess familiarity with the topics, responders were asked their self-perceived level of expertise in Microsoft Excel and statistics and whether they had previously watched TikTok videos. The additional survey questions include whether the TikTok videos make them more interested in statistics, whether the TikTok videos make them more interested in Microsoft Excel, and whether they consider that they have learned something new from the TikTok videos.

4.0 Results and Analysis

4.1 Direct Assessment Results

A paired t-test was conducted to compare the differences between the pre-intervention and post-intervention assessments. Table 1 shows the means, differences, and between-sample t-tests for the pre-treatment and post-treatment performance. The analysis

revealed a statistically significant difference (p-value of <0.0001), highlighting an improvement in the direct assessment of their performance.

Efficacy Measurement	Pre-Intervention Mean	Post-Intervention Mean	Pre-Intervention vs. Post-Intervention Difference (Prob >|t|)
Direct Assessment	0.5920	0.8436	0.2516 (<.0001)

Table 1. Mean Differences of Direct Assessment Results.

A Oneway Analysis of Differences was conducted to test the differences between classes. The results show a statistically significant (*p*-value of <0.0113) difference between the treatment group and control group. This indicates a greater improvement for the treatment group over control group in the direct assessment of their performance.

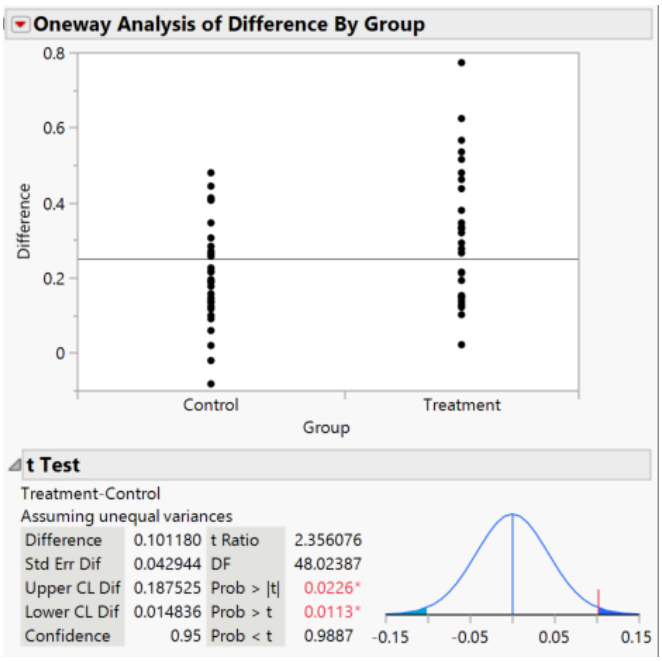

Figure 2. Oneway Analysis of Difference.

4.2 Self-Perceived Assessment Results

The results from the self-perceived efficacy surveys provide further insight into students' perceived effectiveness of bite-sized learning through TikTok. Prior to watching the videos, the students were asked to report their self-perceived understanding of Excel and statistics. The students reported their understanding of Excel to be Expert (5.26%), Advanced (31.58%), Competent (40.35%), Developing (22.81%), and Beginner (0.00%). Their self-perceived understanding of Statistics was as follows: Expert (3.51%), Advanced (17.54%), Competent (40.35%), Developing (35.09%), and Beginner (3.51%). Additionally, the majority of the students (96.49%)

reported that they had previously watched TikTok videos compared to those that had not (3.51%) students. The following tables highlight the self-perceived ability with concepts and application of statics and statistical software.

Level	**Understanding of Statistics**	**Understanding of Excel**
Expert	3.51%	5.26%
Advanced	17.54%	31.58%
Competent	40.35%	40.35%
Developing	35.09%	22.81%
Beginner	3.51%	0.00%
Total	**100%**	**100%**

Table 2. Self-Perceived Level of Understanding.

The majority of the respondents strongly agree (59.65%) or somewhat agree (33.33%) that they learned something new about using Excel for statistical analysis. The majority of students reported an increased interest in Microsoft Excel and statistics. The majority of students also strongly agreed (61.40%) or somewhat agreed (33.33%) or that they envision applying the skills shown in the videos.

	Learned something new about using Excel for statistical analysis.	**Increased interest in Microsoft Excel.**	**Increased interest in Statistics.**	**Envision applying what was shown.**
Strongly agree	59.65%	42.11%	17.54%	61.40%
Somewhat agree	33.33%	43.86%	42.11%	33.33%
Neither agree or disagree	3.51%	10.53%	31.58%	3.51%
Somewhat disagree	3.51%	3.51%	7.02%	0.00%
Strongly disagree	0.00%	0.00%	1.75%	1.75%
Total	**100%**	**100%**	**100%**	**100%**

Table 3. Self-Perceived Level of Learning.

It was also important to learn if TikTok was an accessible platform for learning compared to other platforms. Students reported that they strongly agreed (43.86%) or somewhat agreed (29.82%) that it was more accessible than other platforms.

	TikTok seems more accessible than other platforms to learn statistics.
Strongly agree	43.86%
Somewhat agree	29.82%

Neither agree or disagree	12.28%
Somewhat disagree	8.77%
Strongly disagree	2.56%
Total	**100%**

Table 4. Self-Perceived Level of Accessibility.

5.0 Discussion and Conclusion

Considering the popularity of social media amongst students, this could be an effective way to reach and engage students. The nature of bite-sized learning naturally binds well with the characteristics of social media. Therefore, this study deployed seven TikTok tutorial videos on applying statistical analysis using Microsoft Excel and their impacts on student learning. The findings from this study suggested that students responded positively to the use of TikTok as a platform for bite-sized learning of statistics, via self-perceived assessments. The students also reported that they learned something new about Microsoft Excel for statistical analysis. The students agreed that their interest in both statistics and Microsoft Excel had increased. The students also reported that TikTok videos are easily accessible for learning over other platforms.

One of the key contributions of this study is the identification of the effectiveness of TikTok as a bite-sized learning tool for statistics through formal graded assessments. Whilst the effectiveness of TikTok to increase learner engagement has been demonstrated, previously there was little evidence indicating the effectiveness of TikTok on actual learner performance through formal graded assessments. This study is one of the first to evaluate the impacts of TikTok as a learning tool on learner performance. The study results show that TikTok has positively influenced the learner's performance with a statistically significant difference between the treatment group and control group.

However, one of the limitations of this study was that it was conducted at one university using two separate groups of students in the same academic semester. The relatively small sample and the lack of repeated experiments mean that the results should not be overly generalised at this moment. Since this study was an initial step into the efficacy of TikTok as a learning tool, the researchers intend to extend the study in the upcoming academic year as well as in different institutions. The wider range of participants could enhance the validity of study results and better inform educators on the use of TikTok as a learning tool. In order to increase the scope of the study of bite-sized learning, the insights from the study could also be further applied to different short video-focused social media platforms, e.g. Snapchat, Instagram Reels, Byte, Clash, Triller and

Dubsmash, to suit the preference of learners. The efficiency, flexibility, and accessibility of bite-sized learning sessions may be a practical approach to other disciplines within higher education and further afield. Some of the potential areas are corporate training and adult education, as the nature of short video-focused social media could fulfil the 'on-demand' needs of certain corporate and adult learners.

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