Open and Distance Learning for Limited Internet Access in Technology and Engineering Course

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Abstract: The 2019 Coronavirus outbreak, or Covid-19 pandemic, has accelerated the deployment of internet technology across various sectors, including education. During the early stages of the Covid-19 pandemic, internet platforms and access services were unsatisfactory, particularly in some areas of Malaysia. However, the internet's platform providers are constantly improving their systems. Today (after two years of the outbreak), there are many reliable instruments available for teaching and learning (T&L). Among the initiatives taken by the Internet service providers (ISPs) are continuous expansion of their coverage area. However, this expansion takes time and huge amount of costs are involved. As a result, we took the idea of manipulating multi-featured Telegram as an alternative for students who do not have good access to the internet. We discuss the features available on Telegram in this article. We adapted the discussion on the application based on the mode of delivery, such as computation, description, activities, and others. Additionally, a survey was undertaken to elicit feedback on Open and Distance Learning (ODL)'s usage of Telegram in the T&L process. It has been demonstrated that the use of Telegram enables them to easily and rapidly acquire educational resources.
Keywords: Engineering education, IM Application, Instant Messenger, Telegram Channel, Telegram Messenger

INTRODUCTION

At the beginning of 2019, the coronavirus outbreak or covid-19 pandemic, caused most countries to take drastic measures, such as curfews, to prevent the development of more significant outbreaks. As a result, different sectors, including education, made the move to conduct their businesses and operations online. However, the situation is less favourable in Malaysia, where not all segments of society can afford or are able to use the internet due to a lack of coverage. Numerous strategies are utilised to ensure that no group is left behind, particularly in the education sector. The instant messenger (IM) applications are the best medium to cater to this drawback such as Whatsapp, Telegram, and others.

In one of the related studies, the author investigated the quality of ODL experience for students who enrolled in the Computer Organization and Programming Paradigm course (Abd Aziz et al., 2021). They evaluated three significant factors: the learning materials utilised in ODL, the platforms employed, and the delivery techniques used in ODL. Microsoft PowerPoint notes, lecture videos generated by lecturers, online worksheets for tutorial sessions, and discussion boards to facilitate interaction between students and lecturers are used as instructional resources in these courses. Google Classroom, Google Meet, UiTM Learning Management System (LMS), uFuture and UiTM MOOC, Whatsapp, Telegram, Youtube, and a few web-based programming software were used in this study to implement ODL. According to the findings of this study, 84.08%, 84.46%, and 83.71% of responses are favourable toward the learning materials, platforms, and delivery mechanism employed in ODL, respectively.

Though there are many online and social media tools available- Telegram in particular, has become the focus of some researches including (Aladsani, 2021). The authors focused on enhancement of online educational interaction for ensuring engagement in online learning due to lack of physical communication. By employing a qualitative approach, 77 university students were selected as respondents. The respondents pointed out some instructional activities that could improve learner and instructor interactions, as well as interactions with fellow learners. The respondents' perceptions and feelings towards Telegram were also obtained and analyzed. Some of the identified attractive features of Telegram are: easy to download, ability

to store messages in resource repositories, synchronous communication with instructor, notifications and alert messages, allowing users to edit and improve answers, and security provisioning by hiding mobile phone numbers. Telegram was also perceived as easy to facilitate technically and its cloud-based structure contributes to faster process of uploading and downloading files.

Some of the above-mentioned Telegram features were also acknowledged by (Ardimansyah & Widianto, 2021) especially the ability to withstand limited internet quota, space and time. Instead of conducting surveys to study the effectiveness of Telegram as an online learning tool, (Ardimansyah & Widianto, 2021) proposed and developed Telegram Chatbot to enable a learning process without accompaniment of educator or instructor. Chatbot utilizes artificial intelligence technology where a designed program can interact with humans. The development method was based on the Prototype Method which comprised three phases: (1) system requirements analysis, (2) system design and development, and (3) evaluation. Without the need for attachment to educators, students that have problems focusing during online learning can revisit the learning materials in synchronous mode.

Meanwhile (Owusu-Mensah et al., 2020) conducted a study which involved 100 Post Graduate Diploma in Education (PGDE) Distance Learning Students of the Winneba Study Centre as participants. The study aimed to investigate participants' views on Telegram's capability in learning modules delivery and convenience in using the application. With respect to delivery and convenience criteria, the findings verified that Telegram is indeed a very efficient application and suitable for busy scheduled remote students. The reviewed works highlight about Telegram effectiveness in terms of teaching methods and activities as well as addressing engagement between learner and instructor, while this paper emphasizes Telegram's capability in handling limited internet access.

This paper discussed ODL implementation using Telegram Channel for easy access and those with limited internet connectivity. The advantages of using Telegram compared to Whatsapp, including Telegram Desktop, is that it does not need to synchronize with the connection in a smartphone. It means that Telegram Desktop can still be accessed, even when a smartphone is out of battery. Besides that, Telegram offers more capacity or size of a file, video,

and audio to be shared directly. A new member can view the previous post before joining the channel. In a Telegram channel, members cannot post anything unless they can reply to the admin post. This is suitable to build a full content of the course which is similar to a Massive Open Online Course (MOOC) but there is a limitation of Learning Management System (LMS). For two-way communication, it is recommended to use Telegram Group Messenger. Telegram also supports more features such as gif animation, poll/quiz, message scheduling, editing and others. The usage of Telegram is simple, faster and user friendly, especially for those who do not have a PC or laptop- it also provides low data usage.

The research was conducted during the semester session of March-July 2020 in the Computer Organisation course for Computer Science students. This method was also implemented in a Computer Programming course for Electrical Engineering students during the semester session of September 2020-February 2021. Both courses consist of theoretical, computations, and programming. Telegram is used only for the delivery of the contents for these courses. It does not support the programming and simulation platform. However, this paper recommends the Telegram Channel as an ODL platform for delivering the course contents for those with limited internet connectivity, or it is beneficial as a second alternative. Due to its advantages, it is also suggested to be implemented in schools for the online home-based learning. The homework submission looks more organized.

For the first time of ODL implementation during the semester session of March-July 2020, due to the Covid-19 pandemic, the survey to students who took the Computer Organisation course had been carried out in the beginning of the semester. The result reveals that the coverage and the internet price were the biggest challenges for ODL implementation. A total of 18 students out of 61 registered in this course, which is 29.5%, stated problems of internet access. Referring to the data released by the Center for Innovative Delivery and Learning Development (CIDL), Academic Affairs Division, Universiti Teknologi MARA Malaysia, a total of 27.02% students subscribe to unlimited internet data plan while the majority of the students (28.11%) subscribes to less than 5GB internet plan (Center for Innovative Delivery and Learning Development (CIDL), Academic Affairs Division, 2020). This shows that a large number of students are unable to use the internet more efficiently.

In this paper, the development of ODL content is discussed in section 2.1. The survey for students who took the course after the implementation of ODL is elaborated in section 2.2 and its result is discussed in section 3. In the section 2.3, the network monitor software is used to measure data of Telegram usage for specific tasks.

RESEARCH METHODOLOGY

This section presents how the function of the Telegram Channel is manipulated to deliver lessons through ODL. The Telegram Channel can be built during the T&L process or constructed early before starting T&L and built according to the MOOC procedure. The Telegram channel can be reused for multiple semesters; group members can be removed and replaced. In this paper as well, a survey on students' perceptions of Telegram Messenger's usage as the ODL platform was conducted. A total of 55 respondents have answered this survey question.

2.1 The Development of ODL Content

The content of ODL using the Telegram Channel can be divided into 11 approaches. The methodologies consist of video lectures, notes, calculations, voices, images, graphical explanations, gif animation, survey, simple quiz, attendance and submission elaborated in the following subsections.

2.1.1 Lectures video

The short video can be uploaded directly to the Telegram Channel, as shown in Figure 1(a). If the file size is bigger, the file needs to be downloaded by the viewer, as depicted in Figure 1(b). Besides, the video can also be shared using the link as Figure 1(c).

2.1.2 Notes

The compression files for lecture notes are usually using pdf

format. The notes can also be uploaded directly to the Telegram Channel or by sharing its link.

2.1.3 Calculations

Even though lecture videos can cover the calculation part, calculation steps can easily be understood by sharing the handwritten images. Figures 2(a) and 2(b) demonstrate two different examples of handwritten images for calculation and storytelling.

2.1.4 Audio

The explanation can be delivered using voice recording along with the note's image, as illustrated in Figure 3(a).

2.1.5 Image and Text

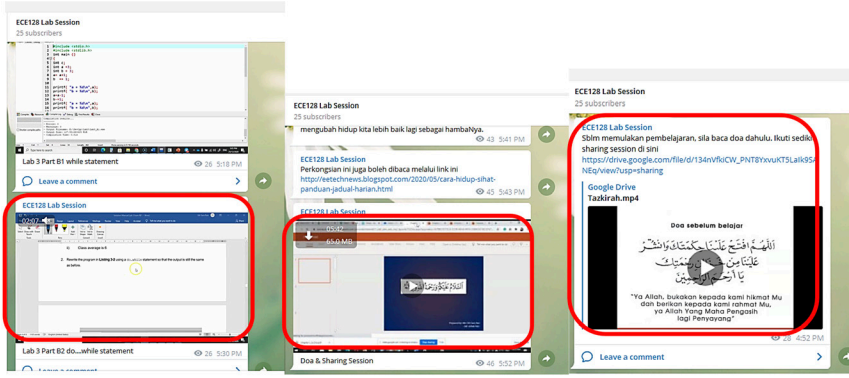
The simplest way to deliver the content of syllabus is by providing the image with text. A description of a particular topic can be done through text accompanied by relevant images. Figure 3(b) presents an example of delivery of the subtopic using image and text.

2.1.6 Graphical Illustration

Some subtopics/topics require a graphical explanation. Figure 3(c) exhibits an example of a graphical explanation with text.

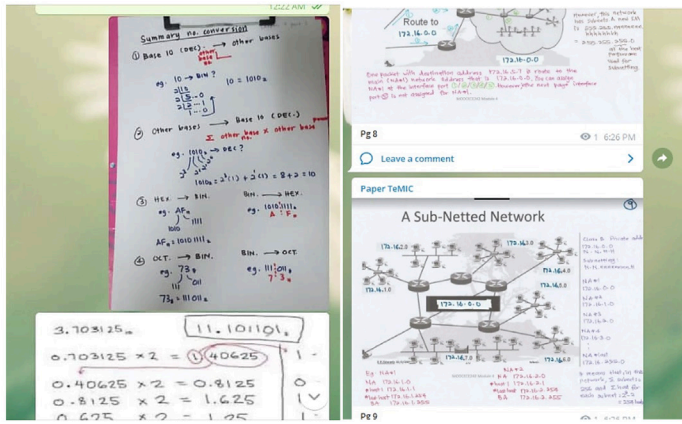
2.1.7 Simple survey

Features such as polls are provided in the Telegram, and this feature can be applied as a simple survey. Figure 3(d) indicates an example survey had been conducted. The purpose of the survey is to get the number of students who had made the laboratory report submissions.



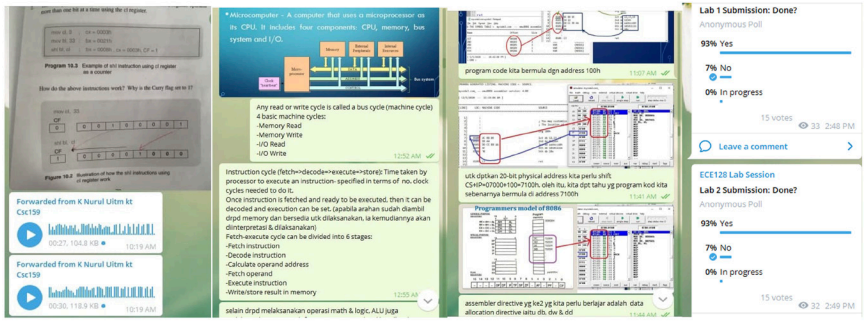
(a) (b) (c)

Fig. 1 Methods for uploading videos in Telegram Channel



(a) (b)

Fig. 2 Handwritten notes for (a) calculation steps and (b) storytelling.

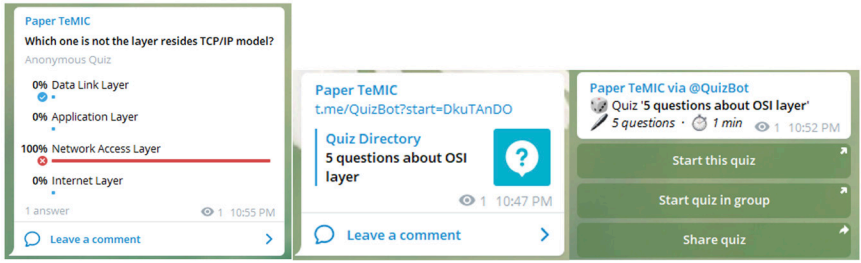


(a) (b) (c) (d)

Fig. 3 Content delivery using Telegram Channel: (a)Audio+Image, (b) Image+Text (c)Graphical Illustration, and (d) Survey

2.1.8 Multiple Choice Quiz

Using the same features as the survey in section 2.1.7; polls in Telegram can also be used for multiple-choice quizzes. Once it has been answered, the result appears, as shown in Figure 4(a). Multiple choice quiz with a large number of questions can also be built on Telegram using QuizBot. QuizBot provides questions that need to be answered within a certain period set by the creator. QuizBot can be shared in the way shown in Figures 4(b) and 4(c). This quiz is utilized as exercise, not the assessment.



(a) (b) (c)

Fig. 4 Multiple choice quiz methods in Telegram can be done through (a) polls, (b) QuizBot with sharing its link and (c) QuizBot embed in a Telegram Channel.

2.1.9 Gif animation

Gif animation is an alternative approach to deliver course content like storytelling. Gif animation can be built using free online software such as makeagif.com, gif-animator.com, Wondershare Filmora and others.

2.1.10 Attendance

Attendance can be taken through poll or Attendance Group Bot. Each student is advised to use his/her real name or full name in the Telegram. The attendance will be uploaded to Ms Excel sheet using Attendance Group Bot.

2.1.11 Submissions

The submissions can be done through Google Form, and it is organized in a specific folder in a Google Drive. However, for those who have internet access problems, the submissions can be done by replying to the specific chat made by the lecturer.

2.2 Survey

The survey assesses students' perceptions of Telegram's usage as the ODL platform, especially for students with limited internet access. Email ID of respondents is required to identify duplicate respondents. The background of respondents such as respondents' familiarity with Telegram and the usage of Telegram in a particular course code are taken into considerations in the survey. The survey also takes into account internet problems if any. The perceptions of the use of Telegram as an ODL platform are shown in Figure 5.

Telegram as ODL Platform *

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Telegram is a user-friendly ODL platform	○	○	○	○	○
The data usage in Telegram is much lower compared to other ODL platform	○	○	○	○	○
It is convenient to use Telegram as ODL platform	○	○	○	○	○
The delivery of course's content by Telegram is effective	○	○	○	○	○
Your understanding of the course has increased after your lecturer shared his/her lecture materials through Telegram	○	○	○	○	○

Fig. 5 Some of the questions in the survey that was conducted.

2.3 Simple Network Tester

Network Usage Monitor is used to collect data regarding the use of Telegram Desktop on any PC running Windows 10. The evaluation takes into account background software such as Kaspersky Internet Protection, OneDrive, and others. As a result, this data represents the entire amount of data used by Telegram Desktop and any background applications running. This testing is used to compare the usage of three different approaches in delivering video via Telegram

RESULTS AND DISCUSSIONS

3.1 Students' Responses Result

98.2% of students are familiar with the Telegram application, and they all use it as an ODL platform for a variety of courses, including mathematics, Islamic studies, and the third language. As many as 44% of students, or 24 students, experience difficulties with their internet connection. 14, 24, 12 and 15 students, respectively, stated that their internet connectivity issues were restricted coverage, slow speed, limited data, and pricey data.

Figure 6 shows the response for student perspective of ODL implementation via Telegram. Overall, most students responded positively, indicating that Telegram aided them in the T&L by ODL. They agree, as illustrated in Figure 6, that Telegram is a convenient tool and a user-friendly ODL platform. They also agree that Telegram consumes far less data than other ODL platforms, that the course content is delivered adequately, and that their understanding of the course has improved as a result of utilising Telegram.

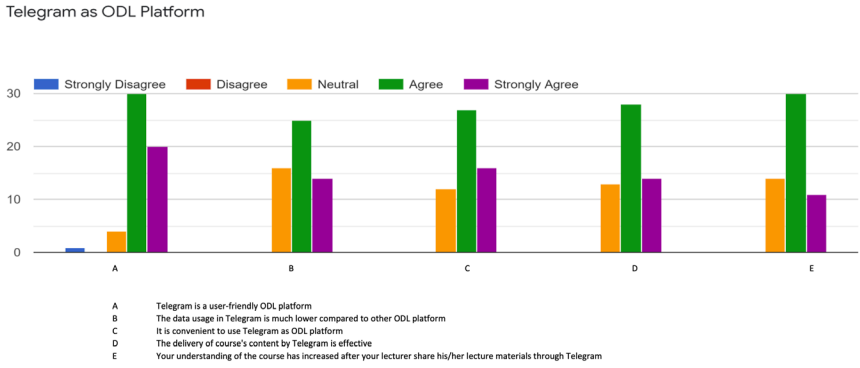


Fig. 6 Result of the students' perspective on Telegram usage in ODL implementation

3.2 Network Testing Result

The Network Usage Monitor is a software to measure total data usage, including background software running in Windows 10. The internet is accessed using a LAN cable Cat7 with connection by ISP's package: Unifi 100Mbps package with the router provided by ISP. Figure 7 shows one of the measurement results.

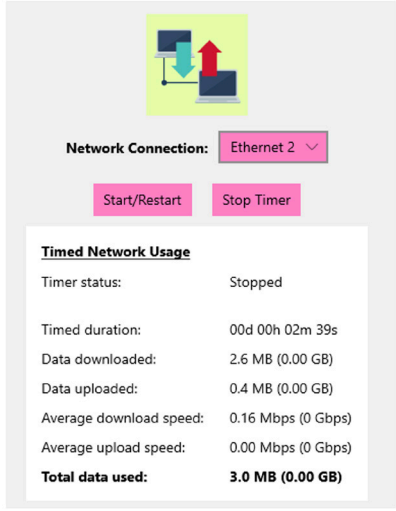


Fig. 7 Data measurement by Network Usage Monitor software

In Table 1, the software measured the total data usage with three different techniques in delivering the video using Telegram with the same duration; 2 minutes 39 seconds. The methods include, first, ensuring that the video is in the Telegram or the link is shared in the Telegram. Then, the video has to be opened outside of Telegram (Google Drive) using 360 pixels and 720 pixels. From the table, we can conclude that the video uploaded directly to Telegram uses the least data.

Table 1. Data usage measurement with three different approaches in delivering the video using Telegram

	Techniques	Duration	Total data usage (MB)
1.	Direct upload in Telegram	2 minutes 39 second	0.2
2.	GD Link with 360 pixels	2 minutes 39 second	3
3.	GD Link with 720 pixels	2 minutes 39 second	3.6

CONCLUSION

The Covid-19 pandemic has affected the educational delivery system. Although numerous ways and platforms have been adopted to support online learning, it cannot be maximised for use if students face internet access issues such as limited coverage, slow connection speeds, limited data, or inability to purchase data.

Instant messengers such as Whatsapp, Telegram, and others make communication more accessible. However, because Telegram's functionalities outweigh that of Whatsapp's, Telegram was chosen as the ODL platform in this study. Numerous strategies are utilised in the T&L process depending on the features accessible on Telegram, which contributes to the platform's attractiveness and minimal data usage.

The results acquired utilising the Network Usage Monitor software indicated that videos published directly to Telegram had the lowest data usage readings compared to those uploaded to Google Drive. The outcomes of the survey among students also showed positive feedback on the use of Telegram as an ODL platform

For future study, we intend to do more precise data measurements utilising GlassWire, which allows separation of the background and application software. Additionally, we intend to incorporate other data usage series depending on various T&L process activities.

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