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WhatsApp as Part of a Blended Learning Model to Help Programming Novices

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Abstract**—**Programming is one of the challenging subjects in the field of computing. In the higher education sphere, some programming novices' performance, retention rate, and success rate are not improving. Most of the time, the problem is caused by the slow pace of learning, difficulty in grasping the syntax of the programming language and poor logical skills. More importantly, programming forms part of major subjects within the field of computing. As a result, specialized pedagogical methods and innovation are highly recommended. Little research has been done on the potential productivity of the WhatsApp platform as part of a blended learning model. In this article, the authors discuss the WhatsApp group as a part of blended learning model incorporated for a group of programming novices. We discuss possible administrative activities for productive utilisation of the WhatsApp group on the blended learning overview. The aim is to take advantage of the popularity of WhatsApp and the time students spend on it for their educational purpose. We believe that blended learning featuring a WhatsApp group may ease novices' cognitive load and strengthen their foundational programming knowledge and skills. This is a work in progress as the proposed blended learning model with WhatsApp incorporated is yet to be implemented.

Keywords**—**Blended learning, higher education, WhatsApp, programming, novices, lecturers.

I. Introduction

GENERALLY, the success rate of novice programmers has always been a common challenge in the higher education sector. Some students succeed, while others find programming difficult to master [1]. As a result, some students end up dropping out of the course of study [2]. In literature, there is enormous evidence of tools that aid programming novices [3]-[5]. However, some novice programmers still do not have adequate skills to use the tools [6]. Programming is a major subject in the field of computing and necessitates that appropriate modernized strategies be adopted to simplify the diversity of teaching and learning to program. The rise of social networks and the amount of time students spent on these networks presents a possible opportunity to rethink and restructure blended learning for programming novices. The key point in this paper is using the social media platform called WhatsApp and to see how it can be incorporated into blended learning to help programming novices.

Besides the WhatsApp platform as a reliable messenger, it is more like a therapy zone for millions of users to refresh their minds. In general, WhatsApp is of a social and informative nature and stands a chance to pose as an additional educational support platform. To this end, more than one billion people have downloaded WhatsApp messenger for the purposes of sharing information, receiving up to date information, staying informed, interacting and instantly communicating with friends, family, colleagues and the rest of the world [7]. Few of the major attractive features of WhatsApp include its convenient way of communicating, sharing, affordability, and quickness [8]. Because of these features, WhatsApp's capability of creating a group can be used for educational purposes.

As a result, we investigate and discuss the use of WhatsApp group to support programming novices' learning. Based on challenges of programming novices from literature, we also identify learning activities or concepts suitable for the WhatsApp group platform. We further recommend possible administrative activities for productive utilisation of a WhatsApp platform. We believe that the discussion will enlighten programming lecturers for new possibilities in the modernized blended learning architecture, and then, subsequently use it to enhance enthusiasm, skills and pace of learning. The strategy does not propose the exclusion of learning in the formal settings, hence the solution is a support-base and add-on to blended learning regarding programming education.

Our research objectives are formulated as follows: Firstly, to demonstrate the reality and practicality of WhatsApp group as a potential blended learning add-on through existing work from literature. We discuss the challenges of programming novices that can be alleviated through WhatsApp group and further recommend possible administrative activities for interacting in the WhatsApp group. The rest of the paper is structured as follows: Section III provides the methodology and Section IV shares the background. Section V discusses the results, while Section VI concludes this study.

II. Methodological Approach

Through literature, we demonstrate the reality, applicability and usage of WhatsApp group as a potential social educational platform in the blended learning environment. With many social media platforms available, WhatsApp is not expensive, is cross-platform, easy to use and convenient for instant messaging [8], [9]. In addition to using WhatsApp for text messages, sharing of images, video and voice messages, another attractive feature that stands out, is its ability to create a group facility where members with common interests participate [8]. From literature, we also demonstrate challenges faced by programming novices in higher education. Ultimately, we demonstrate possible administrative activities to be performed by programming

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lecturers in the WhatsApp group.

III. WhatsApp as a Potential Blended Learning Component

Blended learning is a dynamic approach of teaching and learning where varied traditional means and technologies are incorporated to present a revolutionised pedagogy in higher education [10]. Blended learning is basically restructuring face-to-face traditional teaching and learning styles with on-line methodologies [11]. Traditionally, online methods used in higher education mostly make use of a learning management system (LMS) platform like Blackboard. However, the use of a social media platform like WhatsApp group, as part of an emerging online blended learning component, has not been adequately analysed. Mobile devices (smart phones) which support these social media platforms are part of the equation for efficient communication between lecturers and students [12].

Social media as a major component of smartphones is evolving [13] and promises to disrupt and change the landscape of teaching and learning. Subsequently, Higher Education Institutions (HEIs) as Internet-conducive environments have resulted in providing all-time Internet connectivity for students [14]. The main purpose for HEIs in providing connectivity is to opportune students to access eLearning systems at any time and without limitations. There is an ongoing attempt by HEIs to tap into social media platforms in education to accelerate learning engagement and pedagogical adjustments [15]-[17]. The works of Junco and Loken [18], and Yang and Chang [19] show that students are more active and engaged when participating in collaborative online or peer learning platforms. However, teachers show little interest to cooperate in social media learning [20], [21], sometimes due to its informal settings, commercialisation and the negative perception around it [22]. Especially since some students expect an educator to be available online 24/7, which is improbable [23]. In a study by Mao [20], the author surveyed students' perceptions on their belief of using social media for educational purposes. The author found that 60% of the students agreed or strongly agreed that social media is very good for sharing, for attractive learning and generally for use as a global informative platform.

The most common social media platforms used by students in HEIs are Facebook, Twitter, Instagram, Blogs and WhatsApp [24], [25]. Even though students enjoy social media, Jamil, Zehra, Naqvi and Bhamani [26] show that excessive usage of social media impact negatively on the studies of the students. Nevertheless, it is possible to setup a learning environment in the social media setup, which can be properly administered by lecturers [27]. Social media platforms consist of many features, but WhatsApp specialises in messaging or information sharing [28]. The number of people using WhatsApp reached one billion in 2016 [7] and the numbers are unlikely to slowdown as the platform evolution continues. Another key feature of WhatsApp is its ability to create a group chat with a number of participants up to 256 per group. In a WhatsApp group, participants can share text, video, pictures, documents and audio. More importantly, WhatsApp is capable of a quick, reliable and instant sharing convenient for urgent communication [29].

Some educators have been using WhatsApp group only for the purposes of convenient communication [23]. The work by Kamel, Boulos, Giustini and Wheeler [8] assessed the productivity of using Instagram and WhatsApp in healthcare education. The authors found that WhatsApp can result in a modern quick dissemination platform in hospitals, among patients and healthcare teams. A similar study by Susilo [30] has made use of qualitative data to demonstrate how Facebook and WhatsApp can assist in English education. It was also found that programming students participate more on social media learning platforms than traditional eLearning blackboards [31]. A study by Wang, Woo, Quek, Yang and Liu [32], used students at the Teachers Education Institute in Singapore to share files, send announcements, tutorials and online discussions on the Facebook group. The authors found that the Facebook group could act as a LMS with minor limitations. The students' attraction to social media learning is also due to the unstructured and unrestrictive educational environment that gives the student an edge to learn openly and freely [33]. The attraction is more evident as only four out of 10 students make use of LMS adequately [34]. Another big contributing advantage of WhatsApp over LMS is quick response time between student and lecturer [35]. In order to pave a way to include the WhatsApp platform in the traditional blended learning model for programming novices, it is important to note their challenges as discussed in the next section.

IV. Common Challenges of Programming Novices

Programming challenges mostly experienced by novices include syntax, logic, misconceptions about syntax, tracing, recursions, parameters, initialisation, references and general logic issues [36]-[41]. Pillay and Jugoo [42] investigated and analysed errors made by programming novices. The authors found common errors like incorrect usage of variables, arithmetic expressions, logical operators, conditional structures and iterative structures. Syntax, semantics and typing errors committed by Java students have also been summarised by Brown and Altadmir [41]. Syntax is a serious barrier for students to advance in learning to program [43]. Errors like missing semi-colons and using an assignment instead of comparison operator are common across programming novices [44].

With reference to the issues mentioned above, a solution in the form of optimised blended learning featuring the WhatsApp platform is proposed to alleviate these issues. Addressing these kinds of errors and mistakes made by novices, teaching and learning can be supported significantly through WhatsApp group in order to advance, modernise, support and socialise programming education to better the introductory programming skills of novices. The following section presents a possible blueprint for using WhatsApp in the blended learning environment.

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V. Architectural Model

A typical blended learning setup consists of a lecturer, tutor, teaching, a learning with technology classroom and an LMS. Mostly, lecturers or tutors make use of online means through LMS to advance blended learning in the university. Course materials like tests, tutorials, past exam papers, educational videos, audios and study guides are mostly shared through LMS. Additionally, aspects like chats and announcements also feature in the LMS. WhatsApp group includes the same aspects as LMS, but is limited by storage size and file upload size. However, the biggest advantage of WhatsApp over LMS is its convenience, quickness and reliability. Without disregarding the usefulness of LMS in the blended learning environment, WhatsApp can act as a supporting and convenient platform for reducing cognitive load in teaching and learning programming. The following figure depicts WhatsApp on the blended learning architecture (see Fig. 1).

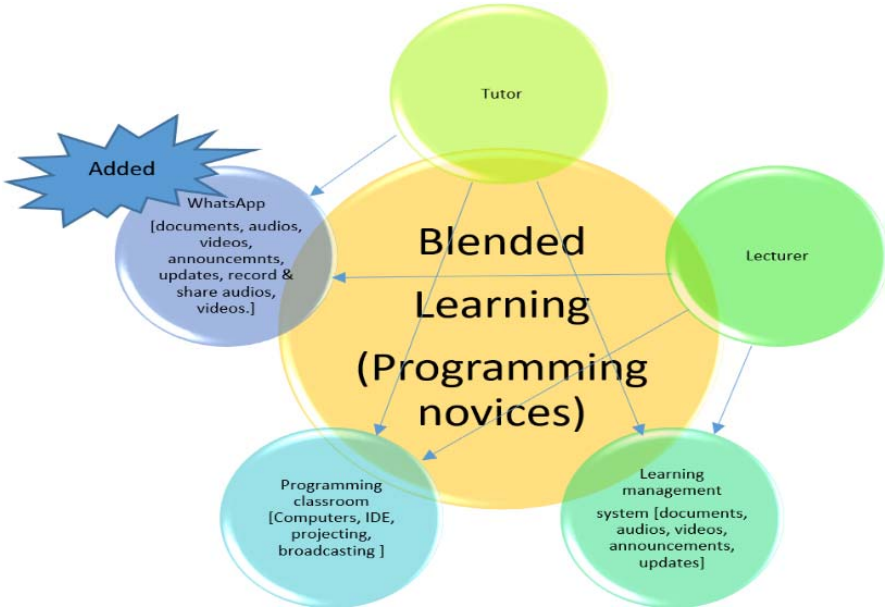


Fig. 1 Components of blended learning

Based on the challenges that programming novices experience (addressed in Section IV), an ideal solution would be to support the tutor, lecturer, LMS, and classroom teaching and learning by alleviating their syntax and logic problems through WhatsApp group. Having noted the WhatsApp platform to be a convenient supporting learning platform (see Section III) and the briefly discussed programming challenges (see Section IV), we believe that WhatsApp can play an important role in improving the language pattern (syntax) and logic of programming novices. To realise this, a lecturer or a tutor has to set up and share daily short quizzes through a WhatsApp group. A typical example of a syntax-related share could be error detection, for example, making novices aware by recognising a missing semicolon, bracket, using undeclared variables, assigning a value of a varied data type into a mismatched variable, mismatching function parameters, incorrect format for decision making, looping structures, and more. Typical logic errors should include incorrect use of arithmetic operations, displaying a wrong message, endless looping, misplaced syntax, and more. All these kinds of WhatsApp sharing are flexible to be posted as a picture, screenshot, audio recording through the WhatsApp audio recorder, various video clips, clips that captured computer screen activities and voiceover at the same time.

Through the social WhatsApp group and free Internet (free Wi-Fi) accessed in HEI, programming novices can participate anywhere without the boundaries of the classroom, university or LMS limitations. Because students participate more and better on social media learning than traditional LMS, short quizzes on WhatsApp could alleviate syntax and logic errors.

VI. Technical Guidelines for Effective Use of WhatsApp Platform

Based on our preliminary experience of using WhatsApp group and our plan to implement WhatsApp, the recommended activities include posting of Screen Recorded (SR) video clips, word documents, PDF documents, graphic pictures, screen shots, audios and texts. The SR video clip is made by recording activities on the computer screen and simultaneously capturing the voice through the computer microphone. The SR video clip, which is a combination of computer screen activities and audio, is converted to a smaller file size. This should be done precisely to avoid longer SR videos and to keep download duration as low as possible. Table I completes a summary of recommended guidelines and their benefits as compared to LMS. These recommended guidelines will be referenced during the next stage of this research, where lecturers will apply the guidelines in a real teaching and learning environment.

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TABLE I
ADMINISTRATIVE ACTIVITIES AND BENEFITS

	WhatsApp administrative activity	Benefits
a	Record short SR clips on the most challenging concepts	SR video clips are convenient and attractive
b	Convert the SR clip into a file size of two megabytes or less	This increases the distribution time, download time and consume less data
c	Limit the SR clips to a maximum length of 2.5 minutes	Long videos are boring, exhausting to watch and consume more data
d	The recommended resolution for SR clips should be 176p x 132p SR clip.	This helps to decrease the size of the video and is also sufficient for display on a mobile device screen.
e	Recommended video formats are windows media audio (wma) and third generation partnership (3gp)	wma and 3gp formats do not require many files which may lead to a big video size
f	Use WhatsApp voice recording for response on questions, comments and other types of announcements	Voice recording is quicker and more convenient as compared to text-based responses. Students can re-listen to the audio repeatedly
g	Display text questions or comments as graphic pictures using a large font	Like social media trends, an attractive picture should lead to increased enthusiasm and attract more viewers to read the content
h	Include teasers and quizzes within the scope of the curriculum as text-based posts	Develop bits of logical training exercises through text, graphic or SR video clips. Logical thinking is a major ingredient critical for programming understanding
i	Train novices on the common committed mistakes	It generates stimulation through text, graphic or SR video clips. The lecturer is expected to know common mistakes committed by novices
j	The lecturer stipulates rules and times for posting in the group	This ensure that the platform is not abused during specific periods (e.g. at midnight)

VII. CONCLUSION AND FUTURE WORK

Social media is growing at a rapid pace and more people get involved than ever before. Having noted and accepted that we cannot run away from the rise of social media, higher education is expected to take advantage of social media. In this paper, we demonstrated the potential of WhatsApp in education in the blended learning environment. We further emphasised how the challenges programming novices experience can be alleviated with the adoption of WhatsApp group. We also emphasised that WhatsApp group does not replace LMS but rather supports, modernises and socialises learning of programming. The reason why we identified WhatsApp group is that it covers the same aspects as LMS, except that it allows the sharing of small files only. However, small file sharing is not viewed as a limitation of WhatsApp, but could be more convenient for students when viewing shorter video clips at a time. In addition, we intend to implement a blended learning model with WhatsApp incorporated with programming novices at the university level. We will also share limitations that we may come across. During the implementation, the administrative activities in the WhatsApp group will follow the guidelines shared in Section VI.

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