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The integration of Mobile Instant Messaging to a Peer-Interaction Programming Learning System

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Abstract: Computer programming is essential knowledge in the digital age and becoming a critical subject during recent years. However, learn to program is not an easy topic, as supported by many researchers. During the development of information technology, many online learning systems have been developed and proven their positive effect on students learning. Many of them focused on helping students learn to program. However, few studies have geared toward supporting its use in programming courses with the support of instant messaging, which is extremely popular in the past few years. Therefore, this study aimed to upgrade an existed online learning system named Peer-Interaction Programming Learning System to enhance students' peer-interaction by integrating with a mobile instant messaging service. In this paper, we reported on the development of the integration and its user interface, discussed our motivation and future work.

Keywords: online learning system, programming learning, peer interaction, facebook messenger

1. Introduction

In recent years, Online Learning System has emerged as a popular innovative platform, offering equitable access to lifelong open learning opportunities (Raspopovic, Cvetanovic, Medan, & Ljubojevic, 2017). From past studies, the learning benefits of online learning systems have been well recognized (Gökçearslan & Alper, 2015). Allen and Seaman (2016) reported that 77.1% of academic leaders in America agreed that online learning is critical to their long-term strategy. Increasing numbers of institutions have offered online programming courses to accommodate students' needs and also to reduce their budget (El Said, 2017); however, among many courses, programming courses still are the most difficult courses for many students (Dolgopolovas, Jevsikova, & Dagiene, 2018). Jenkins (2002) pointed out that the teaching methods employed by the instructor are the primary factors on student achievement during programming courses, but Matthíasdóttir (2006) discuss that the problematic nature of computer programming is the actual cause of programming difficulty. Gomes and Mendes (2007) in another research argue that some of the issues contributed to programming activity are the study methods, abilities, and attitudes employed by the student, also the nature of the art of programming, the lack of prior knowledge of novice students, and the psychological influence that the student suffered from society (Jenkins, 2002). Students lack motivation and low self-efficacy for learning and may lead to lower completion rates than in face-to-face courses (Lai, Tho, & Liang, 2017). One of the possible reason is the lack of peer interaction and less immediate feedback from the instructor (Echeverría, Cobos, Machuca, & Claros, 2017; Lu, Huang, Huang, & Yang, 2017).

Little empirical research has been conducted in remedial online programming courses with regard to peer interaction. Law, Lee, and Yu (2010) suggest that social pressure and competition have a significant and positive relationship with efficacy during their research with an online programming learning system named Programming Assignment aSsessment System (PASS). For decades, researchers have been building online learning systems to lower the barrier to programming learning (Bergin & Reilly, 2005; Funabiki, Korenaga, Nakanishi, & Watanabe, 2013; Lai et al., 2017; Law et al., 2010; Matthíasdóttir, 2006; Thomas, Ratcliffe, Woodbury, & Jarman, 2002). For example, Peer-Interaction Programming Learning System (PIPLS) is an online learning system based on a Question Generated strategy created by Lai and Tho (2016). PIPLS have a significant effect in support students learn to program by using the Question Generated

strategy and allow students to have some peer-interactions features such as comment and voting (Lai et al., 2017). However, the web-based online learning system still has difficulty with engaging students to interact with each other. Although their research helps improve students' achievement in programming courses, more empirical research is necessary for peer-interaction settings due to the explosion of social networks nowadays.

On the other hand, the popularity of smartphones leads to the widespread use of text messaging and mobile instant messaging (Tang & Hew, 2017) in recent years. However, many researchers integrated messaging tools in higher education teaching and learning but limited only to the exchange of text-based messages or PC-based tools (So, 2016). Teachers may not be comfortable when integrating mobile technologies into their teaching (So, 2016) and may not realize the potential of mobile instant messaging in create alternative spaces for student peer-interaction engagement (Rambe & Bere, 2013).

2. Mobile Instant Messaging in education

In the past decade, Mobile Instant Messaging (MIM) has become extremely popular (So, 2016). Tang and Hew (2017) in their recent research revealed six applications in which MIM was used in education included journaling, dialogic, transmissive, constructionist with peer feedback, helpline, and assessment. Among them, the three most common are dialogic (Almekhlafy & Alzubi, 2016; A. Lai, 2016; Ng, Luk, & Lam, 2016; So, 2016; Willemse, 2015), transmissive (Chai & Fan, 2016; Gutierrez-Colon Plana, Gimeno, Appel, & Hopkins, 2015), and helpline purposes (Hazaea & Alzubi, 2016; Zhang & Xue, 2015). However, among various types of MIM applications, most of the previous researchers only using MIM as a forum with notification send to student's mobile phones, and have the group size depends on the number of students. Because of this, there are some negative effects of MIM were reported such as too much irrelevant information (Hazaea & Alzubi, 2016; Tang & Hew, 2017) or too much interference with learners' private lives (So, 2016; Tang & Hew, 2017). This way of use MIM in education also makes some instructors did not feel comfortable using their private phone number or private account because they felt that work and private life should be kept separate (Khatoon, Hill, & Walmsley, 2015; Tang & Hew, 2017).

One key reason for MIM's negative effects is the educator often use MIM to create a chatroom between students in their class; all the messages will be sent to all students without any filter. Students then can only accept the message or "mute" the conversation or even "leave" the group. There is no easy-use mechanism to help the educator to manage messages when they integrate normal MIM applications into their classes such as WhatsApp or WeChat.

Facebook announced chatbots for the Facebook Messenger Platform in April 2016. This brings up an idea to fix the afore-mentioned MIM negative effects in teaching and learning by using a chatbot to manage and redirect messages in MIM during educational activities.

Therefore, this study aimed to fulfill the gaps which remain in previous research by design a chatbot that can be integrated into an existed programming learning system named Peer-Interaction Programming Learning System (PIPLS).

3. Description of the PIPLS

PIPLS is an online programming learning system first developed in 2015 in National DongHwa University, Taiwan, with the primary aim to assisting beginners in learning programming with the Student Question Generation (SQG) strategy (Lai & Tho, 2016). It is now regularly used as an integrated part of many undergraduate courses related to computer programming.

PIPLS allows students to choose to use their real name, their nickname or anonymous in their posts included questions, comments, and all other activities. PIPLS supports student-generated multiple types of questions, included free-response, multiple-choices, fill in the blanks, and true-false questions. In this system, the students can discuss with each other by asking a question, answer, or comment on another's

questions. The teachers can set questions, share the resources of learning, and develop the effectiveness of class management.

After logging in, via the home page (Fig. 1), students can find some quick statistical information about their progress: courses they are following, contributed questions, answered questions, unanswered questions, and exercises with the grade.

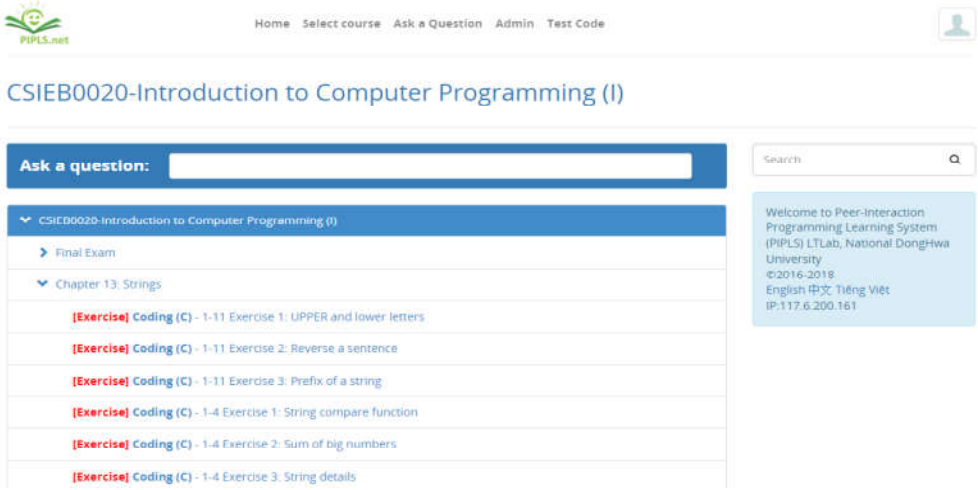

Figure 1. The main page of PIPLS

In PIPLS, answers are revealed according to the course setting. The teacher can allow the student to view others' answers by default, after the deadline or only after the student submitted the correct answer for automatically judged questions or the answer for an essay question.

According to peer-interaction features, students also have the opportunity to write formative feedback to the question author, thanks to the comment feature of original Question2Answer which is visible to all users and can agree or disagree with other feedback provided by their peers by voting feature. When the others' answer is visible, students can comment and also vote in others' answer.

PIPLS automatically generate feedback for students who answer multiple-choice, true/false, fill in the blanks, and coding questions, by reporting whether the answer is correct (by percentage) or not. In the PIPLS, we have two types of free-response questions: essay questions and coding questions. Essay questions need an author or teacher to examine, but other types of questions are automatically judged. PIPLS is now supporting C, C++, Java, Pascal, Python, JavaScript, and PHP in the auto-judge function. For coding questions, all feedback returned by the compiler will be converted as a comment from "The Judge" user, so students can feel more comfortable while interacting with the system.

Coding questions are not only judged automatically, but the teacher also can re-judge the answer in case the compiler cannot or if the teacher wants to give some bonus points for the excellent solution.

4. The integration of Mobile Instant Messaging

To avoid the previous problems of MIM negative effects, we did not create any group chat but create a Facebook Page named PIPLS with its bot. All the notifications in PIPLS will be sent to students by Facebook Messenger, students also able to post a question to a discussion board or reply to another's comment or send a private message by communicating with Facebook Messenger Bot. This solution also can solve many of MIM's negative effects such as students can control by themselves which topic they want to subscribe to or not, and more critical, both their identity and their private life is fully protected.

4.1 Register and subscribe

Firstly, the student needs to register with the bot their identity as shown in Fig. 2. This mechanism can help the bot identity the student, then used this information to redirect the notification to the student.

4.2 MIM enhanced features

By implementing a chatbot to PIPLS, we can use all possible applications of MIM in education such as journaling, dialogic, transmissive, constructionist with peer feedback, helpline, and assessment. Due to the limit of this paper, only the use of the Discussion board is described next.

Whenever one student or teacher posts a question to the Discussion board, all students in the class can receive the question and the detailed link (Figure. 3). The student can have three options: Reply, Follow, or Unfollow the discussion. The unfollow option will be selected automatically to prevent students to receive too much un-necessary notification.

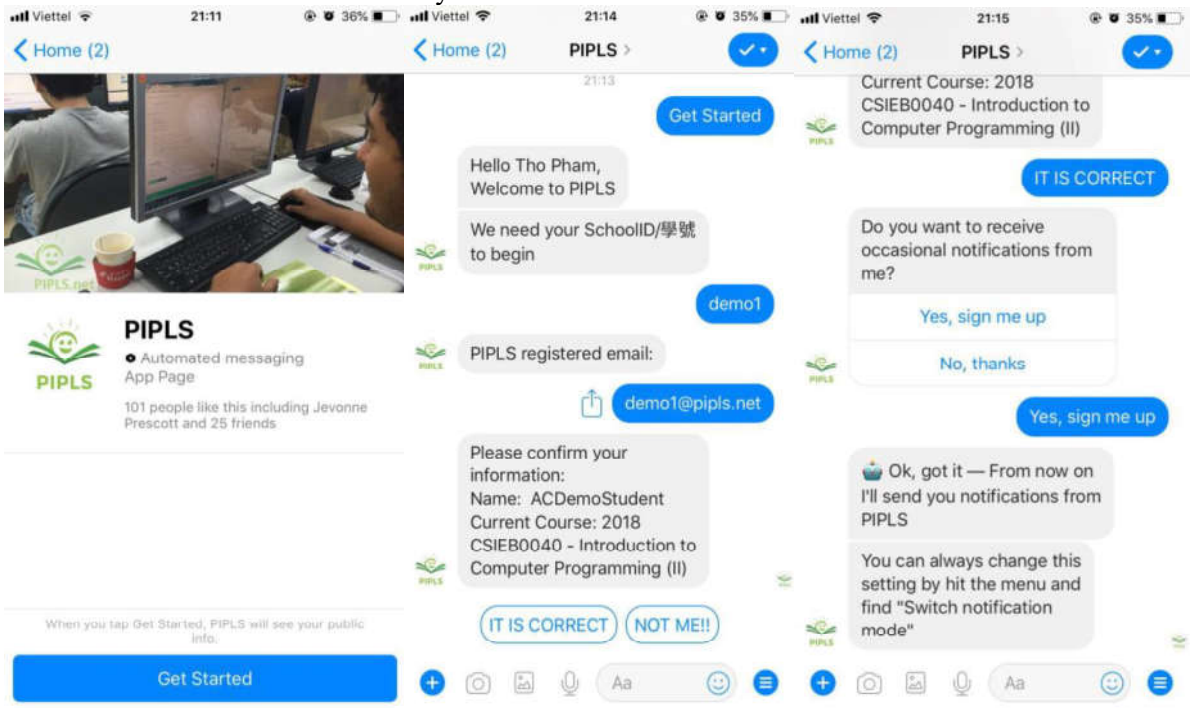

Figure 6. Register and subscribe to PIPLS

Figure 7. Students receive notification and can comment to a question

Not only text can be posted during the conversation but also multimedia content. Students also can use the web interface to interact with the system as shown in Figure. 4.

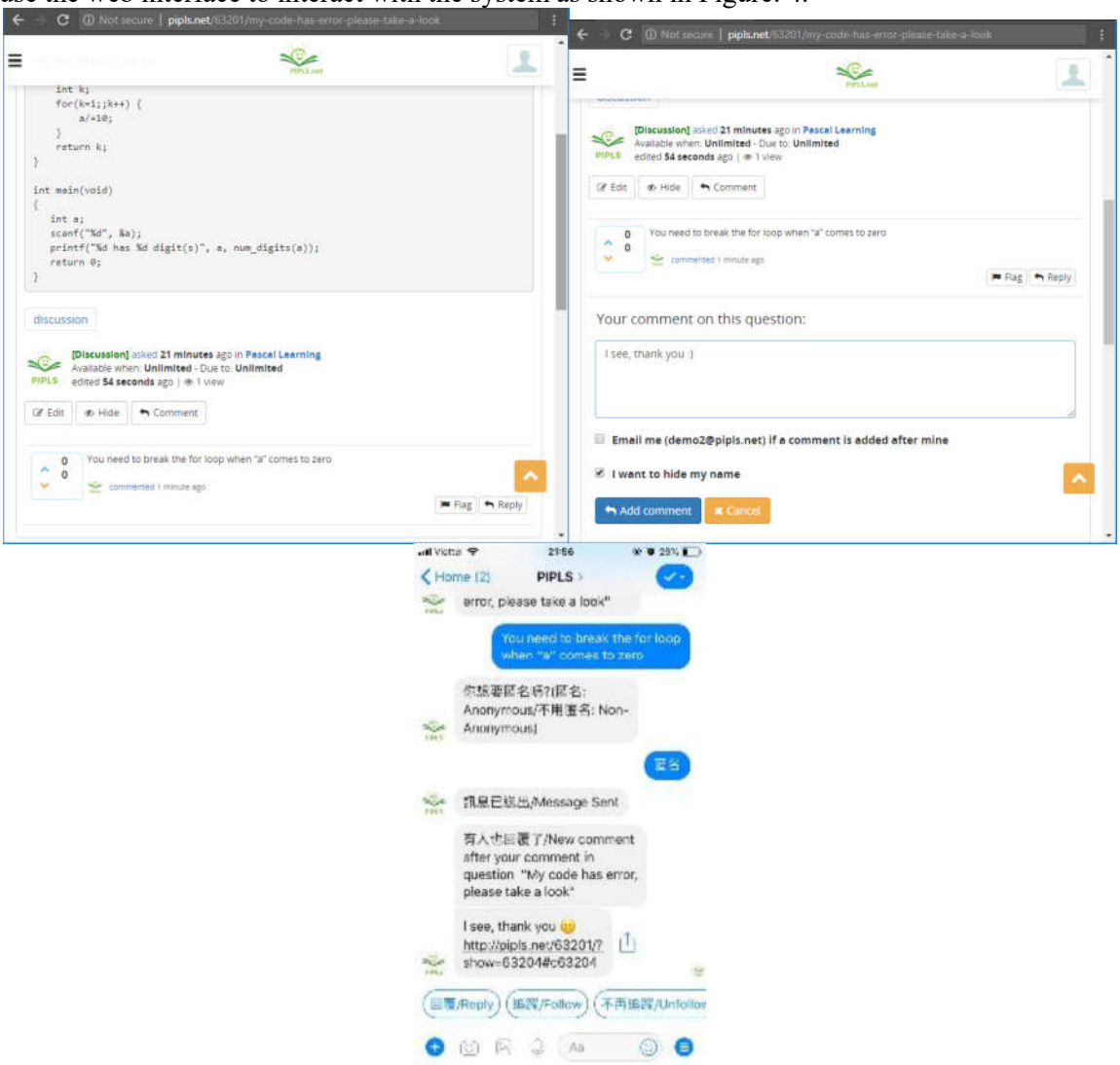

Figure 8. The web interface of commenting to a discussion

5. Conclusion and future work

We developed a new approach to MIM integration to a system based on previous research and focused on supporting students to learn Programming. We also extended the ability of MIM using in the education environment and erased some of the MIM negative effects which happen during the previous studies. We hope to give more support to students when compared with other systems which also support programming learning and/or integrated with MIM.

In the future, we will plan to enhance the existed systems' functions and evaluate the impact of the tool on students' performance. We also intend to study the nature and quality of the contents produced by students.

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