

A pilot study of the effect of creating animated stories in visual programming environments for elementary students

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Abstract: Computer programming involves a high degree of problem-solving activity and is perceived as an essential skill for today's digital world. Recent studies have mostly focused on how to make programming accessible and engaging for children through computer game. The general goal of our research is to develop an understanding of how children learn to create projects in technologically rich situations and to develop ways to support children in visual programming situations. It builds on the knowledge that elementary school students can learn to program, through work with Scratch. They can use basic programming skills to design their own projects. We present evidence that describes the relationship between animated stories along with a series of factors that can potentially affect success with type of goal specificity and individual differences during Self-regulated learning environment.

Keywords: visual programming, goal specificity, individual difference, Self-regulated learning.

Introduction

Since the 1970s, attempts to build programming environments for children started with Logo and Smalltalk; these a substantial amount of research on children's and students' use and learning of programming languages has been conducted [1]. Computer programming involves a high degree of problem-solving activity and is perceived as an essential skill for today's digital world. More recent game programming toolkits tend to have a stronger visual aspect than Logo, either in the sense that they enable designers to easily create graphical games or because they have a visual programming language, or both. This shifts the emphasis away from low level programming, enabling learners to focus on the other roles as designers or writers [4]. Making games is a rich task, in that it offers opportunities for children exercise a wide spectrum of skills (such as devising game rules, creating characters and dialogue, visual design, and computer programming) to create a complex artifact [5]. Therefore, game making has the potential to be a powerful learning environment. Scratch is designed to facilitate this process by providing a way to avoid debugging processes and syntax errors. The computer can be a tool for personal expression through the design and execution of creative coding projects. Students can design simple games or animated stories in groups or individually.

Programming is a method to solve the problem using the program syntax complex process. Effects of goal specificity on problem solving have been found in a number of recent studies [2, 6]. Solving problems without a specifically defined goal leads to higher learning

outcomes (schema acquisition) than solving problems with a specifically defined goal, usually stated as a specific problem state that has to be reached [7].

In order to understand the effect of students' performance, self-regulation and flow experience of created projects during self-regulated learning, The subjects, in this study, were sixth-grade learners participate in a 12-week Scratch programming courses to design animated stories through self-regulated learning cycle, and they were provided with different goals according to an experimental design with goal specificity (nonspecific goals versus specific goals) and individual differences (prior programming knowledge, self-efficacy, and computer game experiences) as factors.

1. Research Design and Implementation

This study was intended to examine the effects of type of goal specificity and individual differences factors on learners' programming performance, self-regulation and flow experience for created projects. The dependent variables included programming performance, self-regulation and flow experience. The independent variables were types of goal specificity (nonspecific goals versus specific goals; NSG versus SG) and individual differences (prior programming knowledge, self-efficacy and computer game experiences). The students who are self-regulated learners believe that opportunities to take on challenging tasks, practice their learning, develop a deep understanding of subject matter, and exert effort will give rise to academic success [3]. A self-regulated learning process was implemented to enables learners to act more effectively when the design tasks of created animated stories in computer programming (fig.1). Therefore, the research question to be answered was whether the type of goal specificity approach in crated animated stories projects helped to enhance programming performance, self-regulation and flow experience by students, and learners' individual differences factors whether affect programming performance, self-regulation and flow experience for created animated stories with scratch.

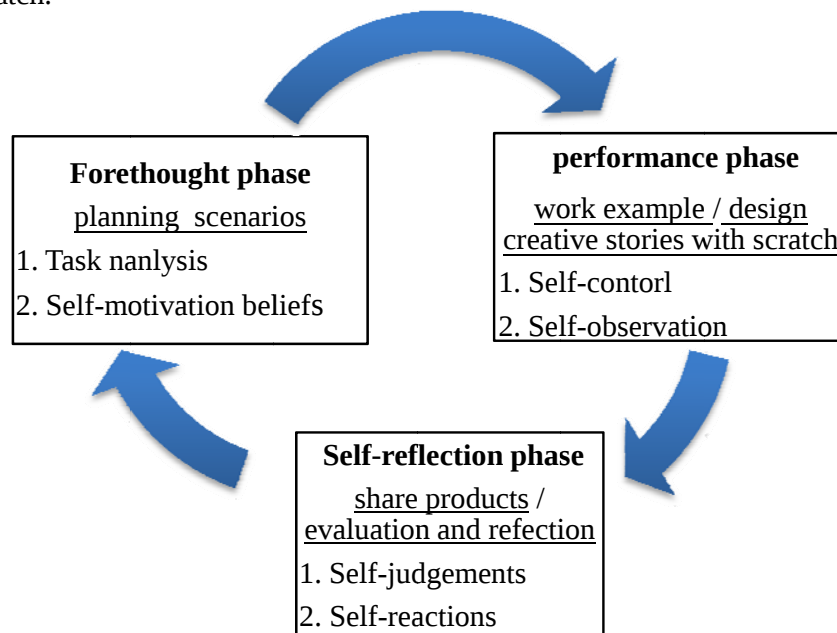


Fig.1 A cyclical model of self-regulated learning (modify from [8])

2. Data Analysis and Results

The effects of goal specificity and individual differences on programming performance, self-regulation and flow experience were examined by means of a 2×2 Multivariate Analysis of Variance (MANOVA). The significance level was set to 0.05 for the study. The analysis is described below.

2.1 *Analysis of goal specificity and individual differences on programming performance for creating animated stories*

All of the two-way interactions were not significant for main effect of understanding of programming concepts was not significant on all dependent measures. Moreover, the main effect of type of goal specificity was significant on the performance of program application ($F_{(1,50)} = .38$, $p = .246$, $\eta^2 = .027$) and was not significant on the other dependent measures. As the programming performance mean scores show in Table 1, the specific goal group outperformed the group on the performance of program application for mean scores. The result indicating that the learner receiving the specific goal strategy was better than the nonspecific goal strategy and specific goal strategy can arousing participants' the performance of program application.

2.2 *Analysis of goal specificity and individual differences on self regulation for creating animated stories*

Box's test of equality of covariance matrices revealed that the observed covariance matrices of the dependent variables were equal across groups (Box's $M = 7.23$, $F = 0.74$, $p = .670$). All of the two-way interactions were not significant. Moreover, the main effect of scratch self-efficacy was significant on self regulation ($F_{(1,50)} = 5.55$, $p = .02$, $\eta^2 = .100$) and was not significant on the others dependent measures. In other words, learners' self-efficacy can affect their self-regulated ability significantly; the high scratch self-efficacy group outperformed the low scratch self efficacy on self regulation. The result indicating that high scratch self-efficacy group during the process of a cyclical model of self-regulated learning was better than low scratch self efficacy group for promoted participants' self regulation.

2.3 *Analysis of goal specificity and individual differences on flow experience for creating animated stories*

Box's test of equality of covariance matrices revealed that the observed covariance matrices of the dependent variables were equal across groups (Box's $M = 2.21$, $F = 0.28$, $p = .991$). All of the two-way interactions were not significant. The main effect of type of goal specificity was significant on animation flow antecedent ($F_{(1,50)} = 6.82$, $p = .01$, $\eta^2 = .116$) and animation flow experience ($F_{(1,50)} = 5.22$, $p = .026$, $\eta^2 = .091$). Moreover, the main effect of prior programming knowledge was significant on animation flow antecedent ($F_{(1,50)} = 12.76$, $p < .01$, $\eta^2 = .197$). According the animation flow experience mean scores, nonspecific goals group outperformed specific goals group on animation flow antecedent and animation flow experience. The result indicating that nonspecific goals strategy promoted to participants' animation flow experience.

3. Discuss and Conclusion

The study described in this paper has investigated the effects of type the goal specificity and individual differences on learners' programming performance, self regulation and flow experience to creating animation. Firstly, for programming performance, it is concluded that: (1) The specific goal strategy enhances learners' the performance of program application; and (2) All of the factors of individual differences did not affect learners' programming performance during self-regulated learning. That is to say, the performances of the specific goals group not only better than nospecific group also exceeds its original performance. Secondly, for self regulation, the results showed that: (1) high self-efficacy for Scratch enhanced learners' self regulation; and (2) the type of goal specificity did not enhance their self regulation. That is to say, as learners have the more confident learning Scratch, the higher their self-efficacy. Therefore, their self regulation is better during the process of self-regulated learning. Finally, for flow experiences, the results showed that: (1) nonspecific goals strategy enhanced learners' animation flow antecedent and animation flow experience; and (2) prior programming knowledge that contribute to animation flow antecedent.

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