Multimedia Motivational Agent: The Impact on the Middle School Students' Science Learning and Motivation

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Abstract: This study examined the effects of motivational agent (present and absent) and different formats of instructional content (text narrative and animated narrative) on student learning and motivation. The provision of motivational agent was found to significantly interact with the format of instructional content on student performance. The provision of motivational agent affected student performance when reading animated narrative content. However, the provision of motivational agent did not affect student motivation when reading either text or animated narrative contents. The implications of current study extends what we know about the benefits of motivational agent in learning and offers important insights on how to better design or integrate motivational agent in the instructional content to enhance performance and motivation to learn.

Keywords: Motivational agent; formats of instructional content; performance; motivation; physics learning

1. Introduction

The pressure of credentializationism in Taiwan has caused many school teachers placing heavily attention on the aspect of keeping up with course schedule than students' motivation to learn. With the purpose of promoting students' science literacy and sustaining their interest and motivation in science learning or science-related activities, the design of web-based science learning environments have emphasized on how to enhance and complement students' deficiencies in motivation. This study proposes the use of learning agent as motivational mechanism that can provide direction for students to use appropriate learning strategy, sustain their motivation in learning, and facilitate their learning outcomes. Content delivered in the web-based learning environments generally through different formats or representations such as text, animation, narrative, audio, video, etc. Several researchers have found that certain instructional content delivered through computer can enhance the relation between abstract and concrete concepts, in which learners can explore the underlying principles by using different presentation modes [1, 2, 3, 4]. As new technologies emerge, the availability of teachers can be alternated by virtual humans [5]. Implementing virtual humans such that the assistance given to students is tailored to their individual needs is a new and promising direction of research. Accordingly, virtual humans are as pedagogical agents, and they not only serve to delivery knowledge, but play as communicative and interactive bridge with students [6]. Since many researchers have explored the roles (i.e., appearance, facial expression) of agents on student's learning. Moreno et al. [7] found that students had more positive attitudes and better achievement when the lesson was taught by an agent rather than by on-screen text.

Atkinson [8] also found that narrative embodied agent was more effective at fostering learning than a text-based learning environment. Currently, there are a number of pedagogical agents used in a variety of computer-based multimedia learning environments. For instance, Herman the Bug, a talkative agent, provides students real time advice intended to focus on botanical anatomy [9]. Peedy the Parrot, an animated agent, would fly across the screen and use gesture or gaze to help the learners associate verbal information with visual information [8].

2. Methods

2.1 Participants and design

A total of 139 7th grade students from four classes were recruited to participate in this study, and the average age of the participants was 14. The participants had not learned what the instruction would be covered in this study. Students were randomly assigned to four groups. A 2 (text narrative and animated narrative) x 2 (with and without motivational agent) factorial design was used to study the effects of different formats of instructional content and motivational agent.

2.2 Instruments

The instruments used in this experiment were: an assessment for learning and instructional materials motivation survey. An assessment for learning was used prior to the study and after the completion of the study. The assessment consisted of 21 multiple-choice items with four response options each, which is the regular type of assessment for the course in which the assessment was administered. The instructional materials motivation survey assesses the motivational effects of instructional situations. The survey was constructed according to the ARCS model with four respective subscales, namely Attention, Relevance, Confidence, and Satisfaction. Reliabilities of the measures for each subscale were Cronbach's alpha .89, .76, .88, and .82 respectively.

2.3 Procedure

Four web-based learning modules were created. Data were collected twice with one week apart. Each session lasted 45 minutes. Participants were first randomly assigned to one of the four conditions (as shown in Table 1) and given a code to use throughout the study to login to the website. The website started with an overall description of the site, the purpose, and the tasks for the participants. Then the participants were asked to fill out a demographic questionnaire and a pre-test. After the pre-test, the website instructed participants to read a series of instructional passages about force and motion. One week later, participants returned for the second session of the study. In the second session, participants went back to the website and the website directed them to read the instructional passages as shown and to complete a post-test.

Table 1. Experimental groups

Motivational agent	Formats of instructional content	
	Text narrative	Animated narrative
Present	Group A	Group B
Absent	Group C	Group D

2.4 Data analysis

A multivariate analysis of variance (MANOVA) was employed to analyze whether there was a main effect on students' post-tests and motivation. The treatment groups were independent variables. Dependent variables were students' post-tests and motivation. The effect size was calculated using the eta squared statistic and interpretation was based on the thresholds of .01 for a small effect, .06 for a moderate effect, and .14 for a large effect (Cohen, 1977). The assumption of equal variance was met at the .05 alpha level as shown by the results from the Leven's Test.

3. Results and Conclusions

The results showed that the provision of motivational agent was found to significantly interact with the format of instructional content on student post-test. The provision of motivational agent affected student performance when reading animation narrative content. However, the provision of motivational agent did not affect student motivation when reading either text or animated narrative contents. Differed from previous studies, this study did not find positive effects of present or absence of the agent [10, 11]. One reason might be the design of the motivational agent appearance or its purpose did not meet the needs of the students. Another reason is that the instructional contents were new to these students, therefore much cognitive capacity was focused on the understanding of the content itself, fewer attention can be split to other tasks. In digital age, emerging technologies have changed the formats of instructional content can be presented; however the design of instruction is still perceived as an important component in determining the effectiveness of digitized learning methodology on student learning. This study found the provision of motivational agent embedded with different formats of instructional content (text or animation) seemed to have an impact on learners' processing different formats of instructional content.

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