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Increasing social presence of social actors in e-learning environments: Effects of dynamic and static emoticons on children

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Abstract

The present research aimed to employ dynamic and static emotions as social cues in e-learning environments for computers to be able to convey social presence and increase children's motivation with learning. To understand how children of different gender react to the two types of emoticon in e-learning environment, a math problem-solving practice program was designed to test their reactions. The program features two treatments, dynamic emoticons and static emoticons. A 2×2 (emoticon style $\times$ gender) between-subjects factorial design was adopted for this study. One hundred seventy-three sixth graders participated in this study. Data were collected via questionnaire regarding the perceived social presence and children's intrinsic motivation, and then analyzed by means of two-way ANOVA. The results show that the children in dynamic-emoticon condition perceived a higher degree of social presence and reported greater intrinsic motivation than those in static-emoticon condition. The feelings of social presence created by the computer itself can mediate children's intrinsic motivation. Besides, no gender differences in children's attitudes toward computers were observed. It suggests that the use of dynamic emoticons as social cues incorporating in e-learning environments can enable children to perceive computers on social dimension and lead to increase their motivation with learning.

Keywords: Emoticon; Dynamics; Social presence; Children; e-Learning environment

1. Introduction

Computers are now widely used to assist school children in learning and provide students with practices of particular skills. The focus in the design of computers for children's learning is different from those for adults. In addition to issues of usability, the former needs to improve engagement and motivation for younger users [1,2]. Studies have suggested that the enhancing social presence in an e-learning environment can instill the learner with an impression of a quality learning experience. One benefit is to induce and sustain the learners' motivation [3,4]. This research has mostly focused on the enhancement of social presence to create a successful learning experience in situations involving learners and instructors in online environments. According to Aragon [5], the social connection is important in an online environment due to the isolated nature of the instructional settings. However, little research has been done on the possibility that a learner could perceive social presence from the computer itself via suitable computer interface design. Such a perception may reduce a learner's feeling of isolation while interacting with a non-human computer-mediated learning environment and lead to the attainment of the instructional goal.

Social presence is defined as "the degree of awareness of another person in an interaction and the consequent appreciation of an interpersonal relationship" [6]. Social presence in a computer-mediated communication environment refers to the user's degree of feeling, perception, or reaction being connected to another intellectual entity, which involves a subjective quality of the communication

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medium related to the concepts of intimacy and immediacy [7,8]. In other words, a medium which provides people with intimate or immediate responses may evoke their social emotional reactions. Such experiences could allow an individual to perceive that another social being exists and is interacting with them. The possibility that social presence can also be created through the computer itself has theoretical and practical implications[9]. Computers could be perceived as a social actor to improve involvement and motivation while a single learner participates in computer learning activity with no instructor involved. This paper focuses on the social presence and specifically the dimension of presence in which people perceive media technology as social actors. The most studies type of social presence is represented by CASA (Computers Are Social Actors) research [10].

CASA is identified by Lombard and Ditton [11] as a conceptualization of presence. It involves social responses of people not to other entities within a medium, but to cues provided by the medium itself. CASA studies have shown that if computers exhibit social cues, people will treat the computers as social actors rather than as inanimate tools. Several empirical studies have demonstrated that people do not respond to a computer merely as a tool; instead, individuals bring to bear a wide range of social rules and behaviors that change their interactions with and attitudes towards computers [12]. Findings from those studies show that people tend to feel that computers are friendlier, more attractive, and more helpful if they exhibit social cues such as teammate label, praise, and active help in controlled interaction [13–15]. These examples have revealed that people's attitudes can be influenced by social attributes of computers and their social response can facilitate a more intimate human-to-computer interaction. This in turn improves the users' attitudes towards computers and motivates them to interact with computers.

The CASA paradigm shows a potential strategy for interface design to improve motivation in a computer-mediated learning environment [16,17]. The paradigm seeks to introduce social cues in user interface design by replicating human-to-human interaction in the context of human-to-computer interaction. Thus, this study attempted to extend the concept of CASA by employing emoticons as social cues in an e-learning environment for children. Emoticons were defined as symbols composed of punctuation marks designed to express some forms of emotion in the form of a human face [18]. With increasing frequency of emoticon usage, recent developments in computer mediated communication make emoticons graphic based, going far beyond the composition of punctuation marks. Indeed, the face, the most important channel of emotional expression, plays a significant role in social communication [19]. Ekman [20] stated that people have the perceptive ability to recognize emotion from facial expression, thus, visual cues involving faces are considered to be the most influential [21].

The symbols of facial expressions have been applied in human–computer interface as the way of communication. The earlier versions of mackintosh operating system had used facial icons of happy Mac and sad Mac, representing the computer to alter the use of its state. The icons prompt computers to be user-friendly and accessible. According to Takeuchi and Nagao [22], presenting human faces in a system helps increase a successful human–computer communication. Thompson and Foulger [23] suggest that emoticons can reduce perceptions of flaming in electronic mail by leading a receiver to view the message as less threatening. As indicated by Rezabek and Cochenour [24], CMC (computer-mediated communication) users often use emoticons as visual cues to expand the meaning of textual electronic messages. Concluded from those studies, emoticons can provide additional social cues beyond what is found in text, which may enhance the exchange of social information and create pleasant interactive experiences for people.

Most research on people's attitudes to emoticons is conducted by using static facial icons as stimuli; however, the facial expression of emotion is a dynamic phenomenon while a static emotion is an unnatural representation. Ekman and Friesen [25] have pointed out that emotion messages are transmitted by rapid signals, instead of static ones, which cause changes in facial expressions. Rapid signals mean contraction of facial muscles and the visible changes in the appearance of the face when these feelings occur. The dynamic display of facial expressions provides unique temporal information about the expressions that is not available in static displays [26]. Although dynamic characteristics of facial expression are mostly overlooked, a few studies examine its effect on the intensity of emotional expressions and suggest that dynamic characteristics of facial of emotion are necessary for full extraction of emotional information from faces [27–29]. In the light of that, the dynamics is important in facilitating the perception of facial expressions. The present paper argued that the use of dynamic emoticons in e-learning environments can enrich the sense of sociability more effectively than the use of static emoticons. This area deserve to be explored further, as the authors hope to employ emoticons as social cues in e-learning environments for children to have better computer experiences and motivation. Accordingly, an experiment was conducted to test the effects of dynamics of emoticon in e-learning environments on children's attitude towards computers, especially in investigating the following questions: (1) if there is a significant difference in the social presence perceived by children between employing dynamic and static emoticons in e-learning environment; (2) if the dynamic display of emoticons has an impact on increasing children's intrinsic motivation with computerized learning, (3) and if there is a correlation between children's intrinsic motivation and the perceived social presence.

2. Hypotheses

H1: Children in the dynamic-emoticon condition perceive stronger social presence than those in the static-emoticon condition.
H2: Children participating in the e-learning environment with dynamic emoticons are more intrinsically motivated than those in the e-learning environment of static emoticons.
H3: There is a correlation between the distinguished social presence and children's intrinsic motivation toward learning.
RQ1: Does gender influence subjects' reaction to emoticons as predicted in H1–H3?

3. Method

A 2×2 (emoticon style $\times$ gender) between-subjects design was used in the research. The dependent variables were the perceived social presence and intrinsic motivation.

3.1. Subjects

One hundred seventy-three sixth graders (82 girls and 91 boys) from six classes of two elementary schools in the north-western region of Taiwan participated. The average age was 11.6 years. All subjects have experienced using computers and have received computer instruction at least once a week since third grade. A total of 82% of the subjects reported that they often used computers at home for playing games and web browsing. These figures suggest that the subjects are familiar with computers.

3.2. Materials

The instructional material was prepared as a math problem-solving practice program designed in Macromedia Flash. The instructional program had ten math problems that were equivalent to 6th grader's level of ability. The degree of difficulty of the questions was discussed with teachers of the selected schools. The instructional program was controlled by using a mouse and the answer was inputted by the numeric buttons of the keyboard. The feedbacks provided by the program included a text-based greeting at the beginning, a symbol "right" as feedback when a subject's answers was correct, or a symbol "wrong" and a message which suggested the subject to press "again" or "next" icon for proceeding when he or she failed to answer correctly, and the final counts of correct answers and positive comments. Two different program versions were developed to present either dynamic or static emoticons by providing two kinds of emoticon sets in the above-mentioned feedbacks.

There were two processes in choosing emoticons. First, two elementary teachers and two sixth graders formed a focus group. They discussed the suitable emotional facial expressions for those feedbacks provided by the instructional program. According to the results of focus group discussions several emoticons were designed to show the states of emotion in those feedbacks and four different emoticons were developed for each feedback. Next, a class of sixth graders was given questionnaires. The instructional program was demonstrated to them. They were subsequently asked to complete a questionnaire in which they chose an emoticon from options that best suited each feedback of the program. The emoticons with the highest frequency in feedbacks of the instructional program are illustrated in Table 1.

The difference between the two versions of the instructional program was that the static-emoticon version presented still emoticons during the whole feedback time while the dynamic-emoticon version presented a dynamic display of emoticons starting with a neutral facial symbol (the first emoticon in Fig. 1) developing into the static emoticon of the corresponding feedback (the rightmost emoticon in Fig. 1). Fig. 1 illustrates the visible change of eyes, eyebrows, and mouth during the transition from a neutral emoticon to a happy emoticon. The motion speed of the dynamic display is 12 frames per second.

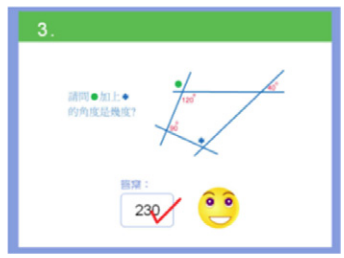
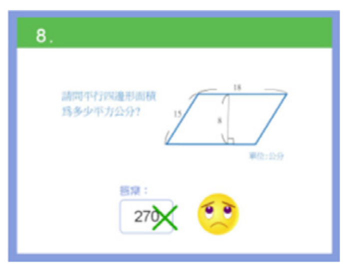
3.3. Measurement tool

The dependent variables of social presence and intrinsic motivation were measured using a set of paper-and-pencil questionnaires. The wording used in questionnaires had been discussed with teachers and the children to prevent any misunderstanding. In addition, the experimenter explained these words in detail and clarified any points children did not understand. As for the semantic differential technique used in the first questionnaire, the researcher demonstrated how to complete the first set questions by giving three examples including a well-known character, toy, and computer game.

The first set questions adopted the four items proposed by Short, Williams, and Christie [30] to measure social presence, sociable/unsociable, personal/impersonal, sensitive/insensitive, and warm/cold, and applied a semantic differential technique. The semantic differential technique was used with bipolar five-point scales. The index was reliable (Cronbach's $\alpha = 0.85$).

The second set questions used an adapted version of the activity-feeling scales (AFS) developed by Reeve and Sickeniuns [31] to measure the subjects' intrinsic motivation. The index developed was a 12-item measure to evaluate a child self-determination, competence, relatedness, and tension. The name and individual items are as follows: self-determination – offered choice what to do, I want to do this, and my participation is voluntary; competence – capable, competent, and achieving; relatedness – involved with friends, part of a team, and brotherly/sisterly; tension – pressured, stressed, and uptight. The scale was assessed on a 9-point Likert scale ranging from 1 (very strongly disagree) to 9 (very strongly agree). The index was reliable (Cronbach's $\alpha = 0.80$).

Table 1
Emoticons in feedbacks of the instructional program

Feedback	Display of screen	Emoticons
Greeting at the beginning		
Feedback for a correct answer		
Feedback for a wrong answer		
Prompt for the next step		
Feedback at the end		

3.4. Procedure

The study took place in the computer labs of the two selected schools during one of their computer class sessions. Each computer was separated by some distance from one another to prevent mutual interference. Each student was assigned to one numbered computer in the lab. The labeled numbers matched their school numbers and the

Fig. 1. Five sequential emoticons captured from a dynamic display.

order started with boys then followed by girls. The two versions of programs were randomly and equally installed on those computers for boys and girls. Therefore, all subjects were randomly assigned to one of the two conditions, with gender balanced across the conditions. The outcome of the assignment was that 86 children (40 girls/46 boys) were assigned to the static-emoticon condition while 87 children (42 girls/45 boys) were assigned to the dynamic-emoticon condition. All subjects were informed through the opening introduction which encouraged them to participate in the math practice game and they were requested to fill out the questionnaires according to their experience after finishing the practice. Upon completing the experiment, the subjects were debriefed and thanked with toys.

4. Results

On average, the subjects made 6.5 (SD = 2.8) correct answers in 30 min out of 10 math questions. The average wrong answer was 8.7 (SD = 4.9) while re-test wrong answers were 5.3 (SD = 3.1). This shows that the subjects had generally already experienced the various designed feedback from the learning materials in the educational activity. Results of the study are explained as follows.

4.1. Social presence

The mean of perceived social presence for subjects in a dynamic-emoticon condition ($M = 7.70$, $SD = 2.01$) was higher than those in static-emoticon condition ($M = 6.98$, $SD = 2.31$). And girls graded social presence ($M = 7.59$, $SD = 2.00$) higher than boys did ($M = 7.11$, $SD = 2.33$). A two-way between-subjects ANOVA reveals there was a statistically significant main effect for emoticon style, $F_{(1,169)} = 4.58$, $p < 0.05$, while no statistically significant main effect for gender, $F_{(1,169)} = 2.02$, $p = 0.001$. No significant interaction effect was found. The hypothesis H_1 is supported (see Table 2).

4.2. Intrinsic motivation

The mean of the subjects' intrinsic motivation in the dynamic-emoticon condition ($M = 6.41$; $SD = 1.09$) was higher than those in static-emoticon condition ($M = 5.82$; $SD = 1.38$). And girls reported slightly higher intrinsic motivation ($M = 6.22$; $SD = 1.13$) than boys did ($M = 6.02$; $SD = 1.39$). A two-way between-subjects ANOVA demonstrated that there was a statistically significant main effect for emoticon style, $F_{(1,169)} = 8.93$, $p < 0.01$, while no statistically significant main effect for gender, $F_{(1,169)} = 0.99$, $p = 0.001$. No significant interaction effect was found. The hypothesis H_2 is supported (see Table 3).

4.3. Relationship between social presence and intrinsic motivation

A correlation analysis with the Pearson's correlation coefficient (r) was employed to establish relationships between social presence and intrinsic motivation. A statistically significant positive correlation between the two variables was observed in girl subjects (Pearson $r = 0.68$, $N = 82$, $p < 0.001$) and in boy subjects (Pearson $r = 0.72$, $N = 91$, $p < 0.001$). The results indicate that the correlation between the two variables is high, that is, the feelings of social presence even from a computer itself can mediate children's intrinsic motivation. The relationship between the two dependent variables for boy and girl subjects is depicted in Figs. 2 and 3, respectively.

5. Discussion

The study aimed to explore the possibility of employing emoticons as social cues in e-learning environment and further compare the effects of dynamic and static emoticons on children's attitudes towards computers and motivation with learning. The experiment revealed that dynamic emoticons were perceived to have higher social presence than static emoticons. The results suggest that children can feel

Table 2
Summarized results of the analysis of variance_social presence

Source	SS	df	MS	F value
Emoticon style	21.51	1	21.51	4.58*
Gender	9.48	1	9.48	2.02
Emotion style × gender	0.15	1	0.15	0.03

* $p < 0.05$.

Table 3
Summarized results of the analysis of variance_intrinsic motivation

Source	SS	df	MS	F value
Emoticon style	13.65	1	13.65	8.93**
Gender	1.52	1	1.52	0.99
Emoticon style × gender	3.84	1	3.84	2.51

** $p < 0.01$.

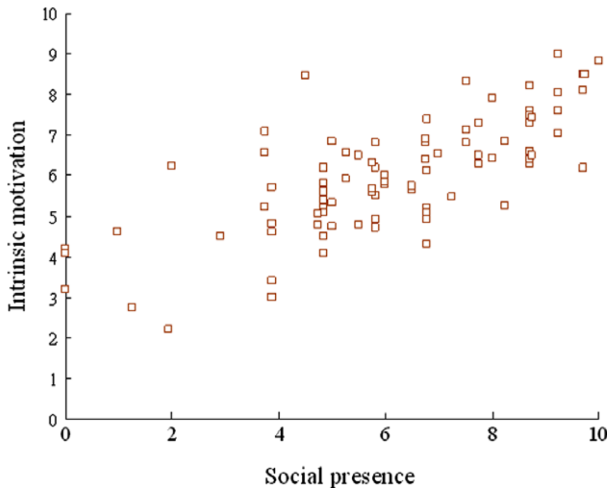


Fig. 2. Scatter plot of social presence and intrinsic motivation for boy subjects, $r = 0.71$.

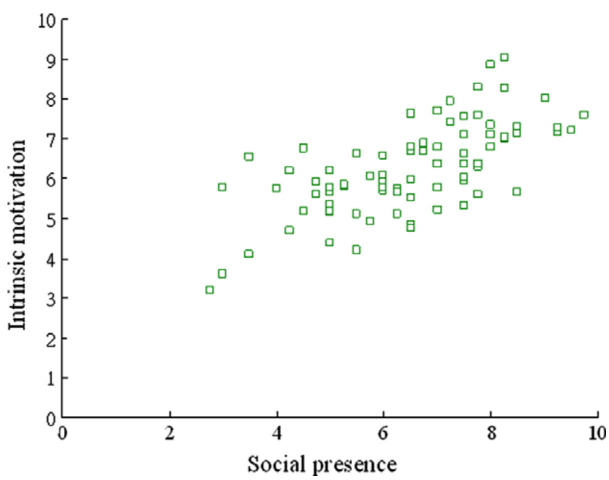


Fig. 3. Scatter plot of social presence and intrinsic motivation for girl subjects, $r = 0.68$.

social presence with a computer and such social awareness can be influenced greatly by the social cues rendered by the computer interface. The findings are consistent with the argument of this study that dynamic presentation improves perception of emotional facial expressions and it also plays an important role to enrich the communication of emoticons, hence having a better social presence. Besides, a plausible explanation for differences in children's social awareness of static and dynamic emoticons could be related to the naturalness of the latter. The static emoticons presented the visual cues of emotional faces, but these were not the emotions expressed normally by people when they interact. People express different emotions when they interact with other people. They smile, laugh, frown and get serious. In comparison, dynamic emoticons express emotions of the face by the rapid facial signals which are more similar to the actual way people react. People are likely to see a computer not as a tool but as a social actor when the computer itself present people with social cues normally reserved for human–human interaction[32]. Studies related to the CASA paradigm concerning human-to-human interaction is replicated in the context of human-to-computer interaction. Consequently, it should pay close attention to the characteristics of emotional facial expressions in the context of human-to-human interaction for utilizing emoticons as social cues in e-learning environments. Dynamic expressions are more natural, more realistic and thus are stronger signals of intentions and actions of others [33]. Leveraging the feature could enrich the social presence in e-learning environments and create a more sociable learning experience.

In addition, the findings of the present study, that there are no significant gender differences in computer attitudes, are in contrast to the results of previous studies [34,35], which suggested that boys are more positive in their attitudes toward computers than girls. It is more likely that the high rate of computers use at home and at school allow girls to interact with computers more often than before. The gender equity in access and use of computers may compensate for gender differences in computer attitude; however, this remains to be studied whether both genders use computers equally intensively to reduce the gender differences.

Finally, there was a high correlation between children's intrinsic motivation and the degree of perceived social presence in the present study. Research suggested that high levels of social presence create an environment that is perceived as warm and will produce positive results on student learning [36]. The social presence addressed in those studies involved the degree of interpersonal contact with the instructor and other participants in an online learning environment. The present study further suggests that the social presence created by a computer can function as a way to effectively enhance children's motivation with computerized learning with no instructor or other colleagues involved. Most research in educational technology has considered computers as being neutral cognitive tools and has emphasized the cognitive and information processing aspects of learning [37]. Turkle [38] indicates that the computational object is no longer effectively neutral. People perceive computers on a social dimension and attribute personality, intelligence, and emotion to them. Thus, the findings suggest that designers of educational technology may move beyond an emphasis on merely cognitive aspects of learning with computers and pay attention to the effects of social traits of computers.

6. Conclusion

Learning is a social activity that requires a close connection to achieve better quality. Thus, attention must be paid to the social demand of the pupil in the design of computerized learning. Creating a social interface for an e-learning environment can help counterbalance the negative effects that the lifeless computer environment may have on children. Incorporating social cues adopted from human-to-human interaction into human-to-computer interaction can intensify the sense of social presence and generate a strong connection. This study provides empirical support for the claim that children's attitudes towards a computer and computer-mediated learning can be affected by the social cues provided by a computer. The use of dynamic emoticons in the computer interface brings the human-to-computer interaction to a level more sociable. Such social interaction may in turn increase children's motivation with computer learning activities. This paper studied the potential of emoticons in e-learning environments. Future studies may further explore the impact of various cues and investigate other possibilities in creating sociable interfaces by identifying the features of interpersonal communication that can be applied to make a more sociable computer technology.

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