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The Perception of Learning Agents' Behaviours by Students

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Abstract

This study aimed to examine students' perceptions towards the behaviours (i.e. facial expressions and gestures) of learning agents (LAs) in mathematics learning. In this study, students were exposed to LAs in the learning of mathematics. At the end of the study, questionnaires were distributed to collect their perceptions towards LAs' behaviours in learning. Most of the students in this study did not prefer having both the facial expressions and gestures in their learning. They preferred facial expressions more as compared to gestures.

Key words: Learning agents, mathematics

INTRODUCTION

Learning agent (LA) refers to an animated lifelike agent which is used to assist students' learning in a computer-based learning environment. It interacts with students either via speech (Baylor, 2005; Theodoidou, 2011; Veletsianos, 2010) or on-screen text (Baylor, 2005; Schroeder, Adesope, & Gilbert, 2013). The LA is knowledgeable and is a subject expert as it guides students in their learning process (Kizilkaya & Askar, 2008) as well as a motivator to motivate and inspire students in the learning process especially when students face difficulties (Kizilkaya & Askar, 2008). According to Unal-Colak and Ozan (2012), the LA is used to attract students' attention by transmitting nonverbal and verbal information. Kim and Baylor (2006a) and Kim and Baylor (2006b) stated that the LAs act as students' learning companion for learning together as well as encourage and inspire students to put more efforts in order to achieve success in academic.

Facial expressions such as eyes and mouth movements were important for LA for better learning outcomes (Atkinson, 2002). Baylor and Kim (2009) emphasized that most effective nonverbal behaviour i.e. facial expressions or gestures for the learning outcomes was still currently unanswered. Some researchers found that the LA providing both facial expressions and gestures caused students to be distracted in the learning (Mousavi, Low, & Sweller, 1995). In contrast, other researchers argued that both facial expressions and gestures by LAs increase students' learning outcomes (Cassell, Sullivan, Prevost, & Churchill, 2000). Yan and Agada's (2010) findings showed that students favoured LAs with both facial expressions and some head movements. Others found that expressions without gestures or vice versa by LAs decrease student's learning gains (Lee & Nass, 2003). Yet, these arguments had still currently did not have the best solutions.

However, Suraweera (1999) stated that students preferred gestures by LAs. This is because they found that when gestures were provided by LAs, they understand clearly the information that LAs deliver, make the learning interesting and increase their understanding. Baylor and Kim (2009) conducted a study to determine the effects of nonverbal behaviour towards the learning. They included variables such as type of instruction, i.e. either attitudinal or procedural, gestures, i.e. either presence or absence and facial expression, i.e. either presence or absence. The results showed that LA's nonverbal communication was important for ensuring higher learning outcomes. They too found that students preferred the presence of facial expressions when LAs did not have any gestures. Gestures also reduced the effectiveness of attitudinal instruction whereas the effectiveness in procedural instruction was improved. The presence of facial expressions had positive effects either in procedural or attitudinal instruction. Thus, researchers suggested that LAs having one nonverbal communication either facial expressions or gestures may be preferable. Horner, Plass, and Blake (2008) also agreed that gestures should be absence when facial expressions are present and vice versa as students' working memory processing may hindered when both nonverbal behaviours exist due to both facial expression and gestures were visual animations.

Therefore, this study aimed to examine the perception of students of different anxiety levels towards the presence of behaviours, i.e. facial expressions and gestures, of LAs in learning mathematics.

Methodology:

Sample:

A sample of 123 undergraduate students was involved in this study. Majority of the students were males, i.e. 81 (65.9%) students whereas there were 42 (34.1%) females in the sample. Their age range was 18-24 years-old.

Instrument:

There were 2 sets of online questionnaires given to students. The first set was given before the study and the second set was administered after the study. The first set consists of 2 sections, i.e. the first section is to collect the students' general information such as ages, gender, etc. and the second section is to collect the data for the grouping of students into 3 categories of anxiety levels, i.e. low, average and high anxiety levels. Questions in this section were adapted from McAllen (2010), Klinger (2006) and Wei (2010).

The second set consists a section that is to collect data on students' opinions about the characteristics of LA such as facial expression and gestures. It is an online questionnaire with 7 likert-scale ranged from 1 (Strongly Disagree) to 7 (Strongly Agree).

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Procedure:

This study started in the first week of the first semester before the lecturer started her teaching in class. Students were given some briefing from the researcher about the purpose of this study. Consent form was given to students online to obtain their consent to participate in this study. The first set of online questionnaire was given to students. Students were then started to learn mathematics with LAs online. The duration was one month.

At the end of the study, students were given the second set of online questionnaire. The data collected from both sets of questionnaires were then analysed using SPSS.

Results:

Students were grouped into different anxiety levels based on their responses in the first set of questionnaire. The anxiety levels can be determined using the mean and standard deviation. The low anxiety level was when the scores were below one standard deviation from the mean scores, the average anxiety level was the scores were within one standard deviation from the mean scores, whereas the scores that were above one standard deviation from the mean scores was categorized as high anxiety level. It was found that there were 27, 45 and 51 students in the categories of low, average, and high anxiety level, respectively (Table 1).

Data collected from the second set of online questionnaire was analysed for the frequency and percentage of students' opinion on the characteristics of LAs based on students of different anxiety levels. Table 2 shows the frequency and percentage of behaviours of LAs based on different anxiety levels.

There were three items to collect students' perceptions towards the behaviours of LAs (Table 2). As shown in table, 5 (4.07%) low anxiety level students, 8 (6.50%) average anxiety level students and 9 (7.32%) high anxiety level students had low preference towards facial expression shown by PAs in learning mathematics. 5 (4.07%), 13 (10.57%), 11 (8.94%) low, average and high anxiety levels students, respectively, unsure that whether facial expression of PAs help in reducing their anxiety levels. 17 (13.82%) low anxiety level students, 24 (19.51%) average anxiety level students and 31 (25.20%) high anxiety level students preferred most the facial expression as the characteristics of PAs in order to reduce their anxiety levels. In sum, there were 22 (17.89%) students had low preference towards facial expression to reduce their anxiety levels, 29 (23.58%) provided no opinion towards this view and 72 (58.54%) students preferred the facial expression of PAs in order to reduce their anxiety levels in learning mathematics.

Most students (52 or 42.28%), i.e. 12 (9.76%) low anxiety level students, 21 (17.07%) average anxiety level students, and 19 (15.45%) high anxiety level students, had low preference towards the gesture displayed by LAs in order to reduce their anxiety level in learning mathematics. 43 (34.96%) students provided neutral opinion where there were 11 (8.94%) low anxiety level students, 13 (10.57%) average anxiety level students and 19 (15.45%) high anxiety level students unsure whether they preferred the gesture given by PAs in reducing their anxiety levels. 28 (22.76%) students (4 or 3.25% low anxiety level students, 11 or 8.94% average anxiety level students, 13 or 10.57% high anxiety level students) preferred LAs' gesture as it can help in reducing their anxiety level in learning mathematics.

There were 15 (12.20%) low anxiety level students, 24 (19.51%) average anxiety level students and 24 (19.51%) high anxiety level students did not prefer both the facial expression and gesture by LAs to reduce their anxiety levels. 5 (4.07%) low anxiety level students, 9 (7.32%) average anxiety level students and 13 (10.57%) high anxiety level students unsure whether having both of the facial expression and gesture can help to reduce their anxiety levels. 7 (5.69%), 12 (9.76%), 14 (11.38%) low, average, high anxiety levels students, respectively, preferred both the facial expression and gesture by PAs as they think that both of them can reduce their anxiety levels in learning mathematics. In total, there were 63 (51.22%) students did not prefer both facial expression and gesture, 27 (21.95%) provided neutral opinion and 33 (26.83%) students preferred both the facial expression and gesture.

Discussion:

This study revealed that most of the students did not prefer to have gestures shown by LAs in their learning. They felt that having gestures by LAs will increase their stress in learning mathematics. Some of them also felt that gestures had not much effect on their learning; instead gestures confused them in understanding and answering the mathematical questions. Some did not think that gestures were important as they focused more on the LAs' facial expression and the way of teaching. However, there were some students preferred gestures as they can understand clearly the information that LAs deliver and increase their understanding in mathematics, which agreed with Suraweera (1999). Body language can also help in improving students' learning as students perceived that learning with LAs without gestures seemed to be dull and emotionless and thus they may lose their interests in learning. In additional, there were students found that gestures were important to them for reducing their anxious towards mathematics. They will not feel bored when learning with LAs that have interesting gestures. This view was supported by Suraweera (1999) that gestures made the learning more interesting as learning with LAs with gestures made students feel like learning with a real teacher which increased their attention on focusing on the lessons.

Table 1: Students of Different Anxiety Levels.

Anxiety Levels			
Low	Average	High	Total
27 (21.95%)	45 (36.59%)	51 (41.46%)	123 (100%)

Table 2: Frequency and Percentage of Behaviours of LAs Based on Different Anxiety Levels.

Statements		Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
I prefer the facial expression shown by LAs in order to reduce my anxiety level in learning mathematics.	Low Average High Total	2 (1.63%) 2 (1.63%) 4 (3.25%) 8 (6.50%)	2 (1.63%) 2 (1.63%) 1 (0.81%) 5 (4.07%)	1 (0.81%) 4 (3.25%) 4 (3.25%) 9 (7.32%)	5 (4.07%) 13 (10.57%) 11 (8.94%) 29 (23.58%)	6 (4.88%) 14 (11.38%) 18 (14.63%) 38 (30.89%)	10 (8.13%) 10 (8.13%) 10 (8.13%) 30 (24.39%)	1 (0.81%) 0 (0%) 3 (2.44%) 4 (3.25%)
I prefer the gesture displayed by LAs in order to reduce my anxiety level in learning mathematics.	Low Average High Total	3 (2.44%) 2 (1.63%) 5 (4.07%) 10 (8.13%)	3 (2.44%) 2 (1.63%) 2 (1.63%) 7 (5.69%)	6 (4.88%) 17 (13.82%) 12 (9.76%) 35 (28.46%)	11 (8.94%) 13 (10.57%) 19 (15.45%) 43 (34.96%)	1 (0.81%) 10 (8.13%) 7 (5.69%) 18 (14.63%)	2 (1.63%) 0 (0%) 2 (1.63%) 4 (3.25%)	1 (0.81%) 1 (0.81%) 4 (3.25%) 6 (4.88%)
I prefer BOTH the facial expression and gesture displayed by LAs in order to reduce my anxiety level in learning mathematics.	Low Average High Total	2 (1.63%) 2 (1.63%) 4 (3.25%) 8 (6.50%)	2 (1.63%) 2 (1.63%) 4 (3.25%) 8 (6.50%)	11 (8.94%) 20 (16.26%) 16 (13.01%) 47 (38.21%)	5 (4.07%) 9 (7.32%) 13 (10.57%) 27 (21.95%)	4 (3.25%) 7 (5.69%) 8 (6.50%) 19 (15.45%)	0 (0%) 2 (1.63%) 0 (0%) 2 (1.63%)	3 (2.44%) 3 (2.44%) 6 (4.88%) 12 (9.76%)

Research of which types of nonverbal behaviour, i.e. either facial expressions or gestures is the most effective for the learning outcomes, still did not produce an exact answer (Baylor & Kim, 2009). Most of the students did not prefer of having both the facial expression and gestures in learning. The reason that some students gave was that if both of the behaviours displayed simultaneously by LA, they may easily lose focus on the lessons being taught and focus more to the LAs' gestures instead. This was supported by Baylor and Kim (2009); Horner, Plass, and Blake (2008); Mousavi, Low, and Sweller (1995) that facial expressions

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and gestures should not be together as both of these behaviours were visual animations and could cause students to be distracted in their learning. In contrast, some of the students stated that facial expressions by LAs were an ideal way to reduce their anxiety level while gestures can be an option in learning. Hence, the results of this study showed that most of the students preferred facial expressions in learning compared to gestures. There were also students stated that both of facial expressions and gestures were equally important as they enabled learners to pay more attention to the lessons. Hence, increase their understandings. In conclusion, most of the students in this study did not prefer having both the facial expressions and gestures by LAs. They preferred facial expressions more as compared to gestures when learning mathematics.

Conclusion:

Educators who wish to use LAs in the teaching and learning process would be benefited from the findings of this study. They may consider to design the LA with more facial expressions than gestures.

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