The Design of Questionnaire of Student's Perceived Gender and Role of Humanoid Robots in Education

Mojibola Abioye[1], Maiga Chang[1], Shi-Jer Lou[2], Ru-Chu Shih[2], Tzu-Chien Liu[3], Fuhua Lin[1]

[1]School of Computing and Information Systems Athabasca University, Athabasca, Canada

[2]National Pingtung University of Science and Technology, Pingtung, Taiwan

[3]National Taiwan Normal University, Taipei, Taiwan

maiga.chang@gmail.com

Abstract—**Humanoid robots were introduced into the education sector as tools, tutors and companions for students to make learning more effective. This research does reliability and validity test for a proposed questionnaire which looks at various perceptions issues such as how students perceive gender and the role that humanoid robots have. Such a valid and reliable questionnaire could help the research team get the whole picture of students' preference, attitude, and level of interaction with humanoid robots for educational purpose. The research could help to determine what and how these issues will affect the acceptance and integration of humanoid robots into the education system.**

Keywords-Gender; Humanoid Robot; Education; Questionnaire

INTRODUCTION

Education is the most important weapon to change the world[1]. Within the first few minutes of a class, the students are either captivated or they have lost interest [2]. The teachers must find ways to keep students interested and focused in order to have an understanding of what is being taught. Humanoid robots are machines that have the form or functions of humans. They come in different sizes and gender and they can imitate human behavior and expressions [3]. According to Shin and Kim [4], robotics technology is being integrated into the field of education to improve it. This is possible because within the first few minutes of interaction with a humanoid robot, its visual appearance and human-likeness can trigger powerful social behaviors towards it [5]. Therefore, a thorough study of learners' psychology such as the gender factors is essential for a proper and effective integration of humanoid robots into educational programs [6]. This will assist in designing educational humanoid robots that are more user-friendly and adaptable. It will also yield better strategies of introducing students to robotic technologies so that young people can be properly engaged [7]. There are various factors that can hinder the integration of humanoid robots to the educational system such as cultural issues, the age and gender of the students. This research aims to design a valid and reliable questionnaire which can be used by researchers to capture students' perceived gender and roles of humanoid robots for educational purpose.

I. QUESTIONNAIRE AND PILOT

The questionnaire is designed based on an existing questionnaire [1]. There are forty one items in the questionnaire. This includes six five-point Likert-scale items

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[1] https://www.brainyquote.com/quotes/quotes/n/nelsonmand157855.html

(1 for "Strongly Agree" to 5 "Strongly Disagree") to measure the Attitude factor, four five-point Likert-scale items for the Role factor and six items (with options 1 for "Male", 2 for "Female", 3 for "Both Male & Female" and 4 for "No Gender") for the Gender as listed in Tables 1 and 2. The remaining items capture the students' demographics information and personal opinions and preferences for humanoid robots.

TABLE 1: FIVE-POINT LIKERT-SCALE ITEMS OF PERCEIVED HUMANIOD ROBOT'S ROLE AND ATTITUDE TOWARD HUMANIOD ROBOTS

Factor	Items
Role	Q14. Humanoid robots will be good teaching assistants.
	Q15. I wish to have a humanoid robot as a teaching assistant
	Q16. Humanoid robots will be good tutors.
	Q17. I wish schools will have a class teaching robot knowledge.
Attitude	Q12. Humanoid robots are amazing creatures.
	Q13. I am interested in the humanoid robot stuffs.
	Q18. I will enjoy interacting as a friend with humanoid robots.
	Q19. I have some doubts about humanoid robots.
	Q20. I don't like humanoid robots.
	Q21. I like humanoid robots.

TABLE 2: ITEMS OF PERCEIVED HUMANOID ROBOT'S GENDER

Factor	Items
Gender	Q6. I believe humanoid robot should be [choose one].
	Q7. Which humanoid robot will be more cheerful?
	Q8. Which humanoid robot do you think will be friendlier?
	Q9. Which humanoid robot will you interact with?
	Q10. Which humanoid robot will you prefer?
	Q11. If you were to have humanoid robot as a teaching assistant in class, which one would you prefer to learn from?

The survey plan and the questionnaire has been reviewed and approved by Athabasca University's Research Ethics Board. The pilot survey was conducted in Taiwan in collaboration with two professors who assisted in getting permission for the survey to be conducted. One hundred and six responses were received in which there are fifty grade 7 students and fifty-six grade 8 students.

II. VALIDITY AND RELIABILITY TEST

Cronbach's alpha analysis was first done for the Likert-scale and Gender items to test their reliability. The results are listed in Table 3. The Gender factor is reliable with a Cronbach's alpha value of 0.872. The Role and Attitude factors have questionable reliability with values of 0.567 and

0.658 respectively. As the data in Table 4 shows, these values changed when items Q12, Q14 & Q19 were removed.

TABLE 3: CRONBACH'S ALPHA VALUES OF THE QUESTIONNAIRE

Factors	Item amount	Cronbach	Items – alpha value changed if the item is removed
Gender	6	0.872	Q6 – 0.858
			Q7 – 0.874
			Q8 – 0.830
			Q9 – 0.827
			Q10 – 0.858
			Q11 – 0.847
Role	4	0.567	**Q14 – 0.624**
			Q15 – 0.442
			Q16 – 0.469
			Q17 – 0.500
Attitude	6	0.658	**Q12 – 0.633**
			Q13 – 0.619
			Q18 – 0.573
			Q19 – 0.707
			Q20 – 0.559
			Q21 – 0.578

Principal Component Analysis was then conducted to assess the items' validity. Item with low factor loadings (< 0.5) shows it doesn't relate well within its group and does not measure the same thing as the other items [8]. Table 4 shows all the items of the Role factor have high factor loading value but items Q12 & Q19 in the Attitude factor have low factor loadings. The result suggests that the two items are not substantially related to the other items and may not be grouped with them. These low factor loadings may be due to unclear questions or misunderstanding.

TABLE 4: FACTOR LOADINGS FOR ROLE & ATTITUDE ITEMS

Role	Components		Attitude	Components	
	A			A	B
Q15	0.770		Q21	**0.826**	-0.086
Q16	0.734		Q20	**0.809**	0.073
Q17	0.657		Q18	**0.736**	0.142
Q14	0.608		Q13	**0.539**	0.236
			Q19	-0.079	*0.828*
			Q12	**0.289**	*0.691*

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization

The research team reviewed students' responses and found that some students treat humanoids as aliens or advanced technology – the latter thought might have been influenced by the movie "Transformers." This finding might be responsible for the result of Q12 since not everyone treat humanoids as creatures. We also found that the students may not quite understand what "doubts" means. These two items need to be either removed or revised to fit the factors in future studies and experiments. For the Role factor, we found that the term "Teaching Assistant" may not be familiar to secondary school students since their classes do not have teaching assistants yet. Also the students do not have clear criteria to measure how good a teaching assistant is. Therefore, the research team suggests that item Q14 should be removed.

Table 4 shows the Cronbach's alpha value for the Attitude factor is increased to acceptable value 0.719 and the

Role factor is increased to 0.624 after the suggested items were removed.

TABLE 5: CRONBACH'S ALPHA VALUES CHANGED AFTER ITEM REMOVAL

Factors	Item amount	Cronbach	Items
Gender	6	0.872	Q6, Q7, Q8, Q9, Q10, Q11
Role	3	0.624	Q15, Q16, Q17
Attitude	4	0.719	Q13, Q18, Q20, Q21

III. CONCLUSION

Humanoid Robots are thought to be able to interact independently with humans in a socially meaningful way. Therefore humanoid robots should be designed in a way that their form, behavior and personality conform to that of humans [9]. This will allow students to interact more effectively with them. The aim of this research is to design a valid and reliable questionnaire that can be used to collect and analyze students' gender, attitude and role perceptions and preferences toward humanoid robots for the futuristic design of robots that will be easily adopted by both male and female students as well as by teachers into the educational settings and programs. This will make teaching and learning more effective and productive.

REFERENCES

[1] Y.-C. Lin, T.-C. Liu, M. Chang, and S.-P. Yeh, "Exploring Children's Perceptions of the Robots," Proceedings of the 4th International Conference on E-Learning and Games (Edutainment 2009), Springer, August 2009, pp. 512-517.

[2] D.M. Bunce, E.A. Flens, and K.Y. Neiles, "How long can Students pay attention in class? A study of Student attention decline using clickers." Chemical Education, vol. 87, no. 12, pp. 1438–1443, 2010.

[3] C. Kemp, P. Fitzpatrick, H. Hirukawa, K. Yokoi, K. Harada, and Y. Matsumoto, Springer Handbook of Robotics, Ch 56, 2010.

[4] [4] N. Shin, S. Kim, "Learning about, from, and with Robots: Students' perspectives." Proceedings of the 16th IEEE International Conference on Robot & Human Interactive Ccommunication, Jeju, Korea, August 26-29, 2007, pp. 1040-1045.

[5] M. Lapeyre, P. Rouanet, and P. -Y. Oudeyer, Physical Human-like Interaction with the Acroban and Poppy Humanoid Platforms, IROSWorkshop, Nov 2013, Tokyo, Japan. 2013. hal-00984312. Retrieved from https://hal.inria.fr/hal-00984312/document

[6] J. Dunlosky, K.A. Rawson, E.J. Marsh, M.J. Nathan, and D.T. Willingham, "Improving Students' learning with effective learning techniques: promising directions from cognitive and educational psychology." Psychological Science in the Public Interest, vol. 14, 1, pp. 4-58, 2013.

[7] N. Rusk, M. Resnick, R. Berg, and M. Pezalla-Granlund, "New pathways into robotics: strategies for broadening participation." Science Education and Technology, vol. 17, no. 1, pp. 59–69.

[8] J.F. Hair, R.L. Tatham, R.E. Anderson, and W. Black, Multivariate data analysis. 5th ed., Prentice-Hall: London, 1998, pp. 112.

[9] M. Joosse, M. Lohse, J.G. Pérez, and V. Evers, "What you do is who you are: the role of task context in perceived social Robot p ersonality," Proceedings of the IEEE International Conference on Robotics and Automation (ICRA), Karlsruhe, Germany, May 6-10, 2013, pp.16.