Gender Differences in Engagement and Self-regulation in an Online Constructivist Learning Design and Learning Analytics Environment

Seyyed Kazem Banihashem
Wageningen University and Research, the Netherlands, https://orcid.org/0000-0002-9978-3783

Omid Noroozi
Wageningen University and Research, the Netherlands, https://orcid.org/0000-0002-0622-289X

Marzieh Parvaneh Akhteh Khaneh
Yeditepe University, Turkey

Abstract: There is a growing body of research on using learning analytics in an online constructivist learning environment to improve students' engagement and self-regulation. However, little is known to what extent female and male students differ in their engagement and self-regulation in an online Constructivist Learning Design and Learning Analytics (CLDLA) environment. This study was conducted to explore gender differences in engagement and self-regulation in a constructivist learning design and learning analytics environment. To do this, 50 female and male graduate students from Allameh Tabataba'i University participated in a Moodle course called "Teaching skills" and they were asked to fill out Agentic Engagement Scale and Self-Regulation Questionnaires in two phases as pre-test and post-test. The findings showed that female students received a higher score for engagement and self-regulation scale compared to male students from pre-test to post-test. These findings suggest that female students found the online CLDLA environment more engaging and self-regulative than male students. Based on the results, recommendations for future research and educational practice are presented.

Keywords: engagement, gender, learning analytics, learning design, self-regulation

Introduction

In 2011, learning analytics has been introduced as a promising field of study to improve learning and optimize learning environments (Siemens & Long, 2011). Learning analytics is considered as an interdisciplinary field of study where it has borrowed ideas and concepts from pedagogy, computer science, data science, statistic, and machine learning (Banihashem et al., 2018; Noroozi et al., 2019). A core concept in learning analytics is data in which usually are collected from the learners and the learning environment and then analytics methods are run

Banihashem, S. K., Noroozi, O., & Khaneh, M. P. A. (2021). Gender Differences in Engagement and Self-regulation in an Online Constructivist Learning Design and Learning Analytics Environment. In S. Jackowicz & O. T. Ozturk (Eds.), *Proceedings of ICSES 2021--International Conference on Studies in Education and Social Sciences* (pp. 171-176), Antalya, TURKEY. ISTES Organization.

on the data to provide information and insight into how the learners are doing (Banihashem, 2020; Banihashem et al., 2021). The prior studies have shown that although data play a key role in learning analytics, it is also important to consider what kind of learning theory, pedagogical beliefs, and learning conception underpin the teaching and learning process (e.g., Banihashem et al., 2019; Banihashem & Macfadyen, 2021; Gašević et al., 2016; Wong et al., 2021). Having this theoretical and pedagogical knowledge can help to better interpret reported data by learning analytics for the proper education and learning intervention (Banihashem et al., 2019).

Constructivism as a learning theory and pedagogical framework offers opportunities for active learning (Banihashem & Macfadyen, 2021; Banihashem & Aliabadi, 2017; Valero Haro et al., 2019; Zwart et al., 2020). Scientific evidence shows that constructivist learning environments and learning analytics can elevate students' learning, engagement, and self-regulation skills (e.g., Emamiyan et al., 2016; Noroozi et al., 2019; Shahali Zadeh et al., 2016; Rob & Rob, 2018; Verstege et al., 2019). However, little is known what is the difference between female and male students' engagement and self-regulation performance in such learning environments. Therefore, this study is aimed to explore gender differences in engagement and self-regulation in a constructivist learning environment with learning analytics support called CLDLA (Banihashem et al., 2021). To address this, the following research questions are formulated and addressed.

RQ1. To what extent gender affects students' engagement in the CLDLA environment?
RQ2. To what extent gender affects students' self-regulation in the CLDLA environment?

Method

Study design

This study took place in a Moodle platform at Allameh Tabataba'i University in the academic year of 2019-2020. A course called "Teaching Skills" with the CLDLA design was created and implemented in two weeks. In the first week, an introduction to the course was provided and students were asked to fill out the Agentic Engagement Scale and Self-Regulation Questionnaires as pre-test phase. Then, the first session of teaching skills was provided for students. The content of this session included (a) verbal communications in teaching and (b) non-verbal communication in teaching. In the second week, students learned about (a) speech principles in the class, (b) the body of the speech, and (c) the conclusion in the speech. In the end, students were asked to fill out the Agentic Engagement Scale and Self-Regulation Questionnaires as a post-test phase.

Participants

In this study, 50 graduate students from Allameh Tabataba'i University who were teachers enrolled for the "Teaching Skills" course. Almost 74% (N = 37) of the participants were female, and only 26% (N = 13) were male. To comply with the ethical aspects: (1) participants were notified that the study results would only be used for research purposes. (2) All participants were allowed to quit the research study; however, no participants

declined participation. (3) Researchers immediately omitted all identification data such as students' IDs after data collection to make sure that results could not be linked to any individual students.

Measurement

Students' engagement

Reeve and Tseng's (2011) Agent Engagement Scale was used to investigate students' engagement. This scale includes 22 items that assess four subscales: agentic, behavioral, emotional, and cognitive engagement. Participants were asked to demonstrate their agreement level on a 5-point Likert scale (from 1 = strongly disagree to 5 = strongly agree) to answer this scale. Reeve and Tseng (2011) confirmed the scale's validity and reported strong reliability (alpha = .94). In the present study, the scale's reliability was also measured by the alpha coefficient formula and showed to be strong (alpha = .91).

Students' self-regulation

Students' self-regulation was investigated by Brown et al. (1999) Self-Regulation Questionnaire. This questionnaire is made up of 63 items on a 5-point Likert scale (from 1 = strongly disagree to 5 = strongly agree). The questionnaire's reliability was measured in the present study using the alpha coefficient formula and showed to be high (alpha = .90).

Analysis

MANCOVA test was conducted to compare the gender differences in students' engagement and self-regulation in the CLDLA environment.

Results

RQ1. To what extent gender affects students' engagement in the CLDLA environment?

The results showed that female students received higher scores compared to male students for overall engagement and its subscales including agentic, behavioral, emotional, and cognitive engagement from pre-test to post-test (see Table 1).

Table 1. Engagement Differences between Female and Male Students in the CLDLA Environment

Variables	Test	Gender				Difference between engagement improvements of female and male students from pre-test to post-test
		Female		Male		
		Mean	SD	Mean	SD	
Agentic engagement	Pre-test	3.76	0.38	3.75	0.36	F (6.28), p < 0.01, η2 = 0.21**
	Post-test	4.09	0.56	3.79	0.39	
Behavioral engagement	Pre-test	3.65	0.34	3.64	0.32	F (7.89), p < 0.01, η2 = 0.29**
	Post-test	4.10	0.58	3.71	0.34	
Emotional engagement	Pre-test	3.35	0.28	3.39	0.28	F (8.97), p < 0.01, η2 = 0.34*
	Post-test	4.06	0.51	3.46	0.31	
Cognitive engagement	Pre-test	3.87	0.43	3.71	0.35	F (7.26), p < 0.01, η2 = 0.27**
	Post-test	4.23	0.64	3.77	0.37	
Overall engagement	Pre-test	3.65	0.33	3.62	0.32	F (7.99), p < 0.01, η2 = 0.30**
	Post-test	4.12	0.59	3.68	0.33	

RQ1. To what extent gender affects students' self-regulation in the CLDLA environment?

The results showed that female students received higher scores compared to male students for self-regulation from pre-test to post-test (see Table 2).

Table 2. Self-regulation Differences between Female and Male Students in the CLDLA Environment

Variables	Test	Gender				Difference between engagement improvements of female and male students from pre-test to post-test
		Female		Male		
		Mean	SD	Mean	SD	
Self-regulation	Pre-test	3.68	0.33	3.66	0.33	F (8.12), p < 0.01, η2 = 0.30**
	Post-test	4.12	0.59	3.73	0.35	

Discussion and Conclusion

This exploratory study provides insights into the gender influences in students' engagement and self-regulation in constructivist learning environments with learning analytics support. The results revealed that female students found the CLDLA environment more engaging and self-regulative than male students. Although this result indicates that male students might need more support for their engagement and self-regulative activities in

constructivist learning environments with learning analytics support, this also needs to be explored what were the reasons for such different performance. One reason to explain this finding can be female and male differences in their thinking and reflections (Noroozi et al., 2016, 2020; Tsemach & Zohar, 2021). Therefore, gender differences in engagement and self-regulation performance can be due to their different perceptions of the CLDLA environment. The results of this study can contribute to extending our knowledge on the role of gender in engagement and self-regulation performance in constructivist learning environments with learning analytics support.

References

Banihashem S. K., Aliabadi K., Pourroostaei Ardakani S., Delavar, A., & Nili Ahmadabadi, M. R. (2018). Learning analytics: A systematic literature review. *Interdisciplinary Journal of Virtual Learning in Medical Sciences*, 9(2). https://dx.doi.org/10.5812/ijvlms.63024

Banihashem, K., & Macfadyen, L. P. (2021). Pedagogical Design: Bridging Learning Theory and Learning Analytics. *Canadian Journal of Learning and Technology*, 47(1), 1-22. https://doi.org/10.21432/cjlt27959

Banihashem, S. K. (2020). Identifying components of learning analytics in education and providing a conceptual framework for optimizing learning. *Technology of Education Journal (TEJ)*, 14(4), 937-948. https://dx.doi.org/10.22061/tej.2020.6365.2387

Banihashem, S. K., & Aliabadi, K. (2017). Connectivism: Implications for distance education. Interdisciplinary Journal of Virtual Learning in Medical Sciences, 8(3). http://dx.doi.org/10.5812/IJVLMS.10030

Banihashem, S. K., Aliabadi, K., Pourroostaei Ardakani, S., Nili AhmadAbadi, M. R., & Delavar, A. (2019). Investigation on the role of learning theory in learning analytics. *Interdisciplinary Journal of Virtual Learning in Medical Sciences*, 10(4), 14-27. http://dx.doi.org/10.30476/IJVLMS.2019.84294.1001

Banihashem, S. K., Farrokhnia, M., Badali, M., & Noroozi, O. (2021). The impacts of constructivist learning design and learning analytics on student engagement and self-regulation. *Innovations in Education and Teaching International*, 1-11. https://doi.org/10.1080/14703297.2021.1890634

Brown, J. M., Miller, W. R., & Lawendowski, L. A. (1999). *The self-regulation questionnaire*. In L. Vande Creek & T. L. Jackson (Eds..), Innovations in clinical practice: A source book (Vol. 17, pp. 281–292). Professional Resource Press/Professional Resource Exchange. https://psycnet.apa.org/record/1999-02283-018

Emamiyan, K. M., Ghasemi, M., Mehraji, N., Banihashem, S. K., & Badali, M. (2016). The effect of integration of Merrill's first principles of instruction with team based learning on the achievement of recall and application of nursing students. *Journal of Nursing Education*, 5(1), 62-71. https://www.sid.ir/en/journal/ViewPaper.aspx?id=509900

Gašević, D., Dawson, S., Rogers, T., & Gasevic, D. (2016). Learning analytics should not promote one size fits all: The effects of instructional conditions in predicting academic success. *The Internet and Higher Education*, 28, 68-84. https://doi.org/10.1016/j.iheduc.2015.10.002

Noroozi, O., Alikhani, I., Järvelä, S., Kirschner, P. A., Juuso, I., & Seppänen, T. (2019). Multimodal data to design visual learning analytics for understanding regulation of learning. *Computers in Human Behavior*, 100, 298-304. https://doi.org/10.1016/j.chb.2018.12.019

Noroozi, O., Hatami, J., Bayat, A., van Ginkel, S., Biemans, H. J., & Mulder, M. (2020). Students' online argumentative peer feedback, essay writing, and content learning: does gender matter?. *Interactive Learning Environments*, 28(6), 698-712. https://doi.org/10.1080/10494820.2018.1543200

Noroozi, O., McAlister, S., & Mulder, M. (2016). Impacts of a digital dialogue game and epistemic beliefs on argumentative discourse and willingness to argue. *International Review of Research in Open and Distributed Learning*, 17(3), 208-230. https://doi.org/10.19173/irrodl.v17i3.2297

Reeve, J., & Tseng, C. M. (2011). Agency as a fourth aspect of students' engagement during learning activities. *Contemporary Educational Psychology*, 36(4), 257–267. http://dx.doi.org/10.1016/j.cedpsych.2011.05.002

Rob, M., & Rob, F. (2018). Dilemma between constructivism and constructionism: Leading to the development of a teaching-learning framework for student engagement and learning. *Journal of International Education in Business*, 11(2), 273-290. https://doi-org.ezproxy.library.wur.nl/10.1108/JIEB-01-2018-0002

Shahali Zadeh, M., Dehghani, S., Banihashem, S. K., & Rahimi, A. (2016). Designing and implementation of blending of problem solving instructional model with constructivism's principles and the study of its effect on Learning and creative thinking. *Journal of Innovation and Creativity in Human Science*, 5(3), 83-117. https://journal.bpj.ir/article_522444.html?lang=en

Siemens, G., & Long, P. (2011). Penetrating the fog: Analytics in learning and education. *EDUCAUSE review*, 46(5), 30. https://eric.ed.gov/?id=EJ950794

Tsemach, E., & Zohar, A. (2021). The intersection of gender and culture in argumentative writing. *International Journal of Science Education*, 43(6), 969-990. https://doi.org/10.1080/09500693.2021.1894499

Valero Haro, A., Noroozi, O., Biemans, H. J., & Mulder, M. (2019). The effects of an online learning environment with worked examples and peer feedback on students' argumentative essay writing and domain-specific knowledge acquisition in the field of biotechnology. *Journal of Biological Education*, 53(4), 390-398. https://doi.org/10.1080/00219266.2018.1472132

Verstege, S., Pijeira-Díaz, H. J., Noroozi, O., Biemans, H., & Diederen, J. (2019). Relations between students' perceived levels of self-regulation and their corresponding learning behavior and outcomes in a virtual experiment environment. *Computers in Human Behavior*, 100, 325-334. https://doi.org/10.1016/j.chb.2019.02.020

Wong, J., Baars, M., de Koning, B. B., van der Zee, T., Davis, D., Khalil, M., . . . Paas, F. (2019). *Educational theories and learning analytics: From data to knowledge. The whole is greater than the sum of its parts*. In D. Ifenthaler, D. K. Mah, & J. K. Yau (Eds.), Utilizing learning analytics to support study success (pp. 3-25). Springer. http://dx.doi.org/10.1007/978-3-319-64792-0_1

Zwart, D. P., Noroozi, O., Van Luit, J. E., Goei, S. L., & Nieuwenhuis, A. (2020). Effects of Digital Learning Materials on nursing students' mathematics learning, self-efficacy, and task value in vocational education. *Nurse Education in Practice*, 44, 102755. https://doi.org/10.1016/j.nepr.2020.102755