Interactive Personas: Towards the Dynamic Assessment of Student Motivation within ITS

Ishrat Ahmed[1(✉)], Adam Clark[2], Stefania Metzger[2], Ruth Wylie[2], Yoav Bergner[3], and Erin Walker[1]

[1] University of Pittsburgh, Pittsburgh, USA
{isa14,eawalker}@pitt.edu
[2] Arizona State University, Tempe, USA
{Adam.T.Clark,skmetzg1,Ruth.Wylie}@asu.edu
[3] New York University, New York, USA
ybb2@nyu.edu

Abstract. An intelligent system can provide sufficient collaborative opportunities and support yet fail to be pedagogically effective if the students are unwilling to participate. One of the common ways to assess motivation is using self-report questionnaires, which often do not take the context and the dynamic aspect of motivation into account. To address this, we propose *personas*, a user-centered design approach. We describe two design iterations where we: identify motivational factors related to students' collaborative behaviors; and develop a set of representative personas. These personas could be embedded in an interface and be used as an alternative method to assess motivation within ITS.

Keywords: Assessment of motivation · Collaborative learning · Intelligent Tutoring Systems (ITS)

1 Introduction

Adaptive collaborative learning support (ACLS) aims to design efficacious support that models students' interactions [12,15]. Student motivation is a key factor to consider as it contributes to learning from collaboration [8,11]. In an ITS context, one common way of assessing motivation is self-report. This is often done prior to an interaction, which has two drawbacks: 1) motivation is influenced by the environment [10], so it should be examined in the context of events; and 2) motivation is dynamic and fluctuates over time [6], so it should be assessed as such. In addition, responding to long questionnaires or to multiple surveys can lower student response rates as well as the quality of the responses [13].

We propose a novel method that captures student motivation dynamically during collaborative interactions. To achieve this, we describe an application of the *Persona* method [4], a user-centered design approach for understanding important end-users characteristics like preferences and goals. A persona is a

I. Roll et al. (Eds.): AIED 2021, LNAI 12749, pp. 43–47, 2021.
https://doi.org/10.1007/978-3-030-78270-2_7

fictitious representative target user created from a large number of heterogeneous users [4] consisting of a name, a picture or illustration, and a short narrative. The main purpose of this method is to provide a better characterization of the target audience for product design. Personas have also been used in educational research as part of the design of both technological and non-technological pedagogical interventions [2,3,14,16,18]. We believe that personas can be adapted to make them contextually sensitive, dynamic, and easy-to-use motivational assessments. In this paper, we focus on a primary research question: *How can we design a persona that represents student motivation?* We use co-design to develop and iterate on a set of representative personas using multiple motivational factors from interviews. Ultimately, these personas could be used to deliver adaptive support based on motivation within collaborative learning.

This work is part of a broader project to design an ACLS system focusing on middle school students help-giving [9,17] across three different collaborative learning platforms. We investigate why students gave help across these platforms with the goal of supporting individual students' needs in each platform [1].

2 Persona Design Process

We developed personas that represented clusters of student motivational factors and evaluated them in two co-design sessions. We wanted to determine how students responded to the personas as indicators of their motivation and get students' input on the personas' language. The two co-design sessions were conducted with 13 middle school students from the Southwestern United States (F = 4, M = 7, 2 did not report) in an after-school two-hour workshop. Participants were in 7th and 8th grade and reported their race and ethnicity as follows: Hispanic (6), Mexican (4), White (2), did not report (1).

We chose four factors for the personas: math self-concept, help-giving self-concept, familiarity, and contextual factors (e.g., off-topic comments). We selected these factors from an initial thematic analysis on interviews with 16 middle school students about their help-giving behaviors and motivations. These factors are also related to learning in literature [5,7]. Each persona included a name, an age, a goal, a quote, and a narrative describing the persona's help-giving interactions in mathematics using these factors. Six personas (Gracie, Maurice, Sarah, Tobi, Lisa, Harry) were designed to approximate a specific type of student participation and fit the characteristics of students in our study.

In the first co-design session, each student was given the six persona documents and asked to determine how much they were or were not like the persona answering with a likert scale ranging from 1 ("exactly like me") to 7 ("not like me at all"). 3 students rated themselves most like Gracie, 5 most like Harry, 3 most like Sarah, and the other 2 students were spread across the other three personas. This suggests that while five of our six personas resonated with at least one student, three appeared to particularly match the students in the session. Next, the students selected the persona they resembled the most and edited that persona characteristics to be more like them, e.g., (1) adding intermediary options

when talking about math performance, e.g., 'one of the top performers' to 'good performer' (7 students); (2) major editing of statements, e.g., 'during collaboration, he fears giving the *wrong* answer' to 'during collaboration, he *normally gives the* answer' (10 students); (3) minor editing of statements (5 students, e.g., modifying gender).

The second co-design session happened two weeks later with eleven students (2 from the first session were absent). Because there were many personas that students did not match to and because students made multiple edits to their persons, we decided to have students build their own personas. We gave a template of a persona to the students with two parts: a persona narrative and a persona figure. The persona narrative included free inputs (e.g., for persona hobbies) and fixed-choice inputs with a set of options to select from related to our four factors. For example, related to math self-concept, students had three options to choose: "Really good at doing math problems", "Just ok at doing math problems", "Not great at doing math problems". The intermediary statements were inspired by the edits observed during the first co-design session. After the session, we had eleven personas created by the students and analyzed them to look for common themes, an approach often used in persona design [4]. We first used math self-concept to group the students as a determining factor in our particular learning environment, resulting in three clusters: low (4 students), medium (4 students), high (3 students). However, from co-design session 1, we observed students move from high to medium math self-concept, e.g., 'good at math' to 'almost good at math', so we combined medium and high into a single group. Then, we chose 2 personas from the low group and 2 personas from the high group such that we had at least one persona from each group with a preference towards familiarity. We chose familiarity due to its importance in designing our learning environment, which had a public and a private collaboration space. Thus, we had a total of four representative personas, two with similar characteristics to the personas developed by the researchers in co-design session 1, and two more influenced by the students in this session.

We then created finalized personas from these four representative personas. As described above, the four representative personas had a range of values of math self-concept (MSC), help-giving self-concept (HSC), and familiarity (Fam)based on student responses. We decided to eliminate the contextual factors dimension from the personas because we wanted to focus on individual motivation factors. However, we replaced that dimension with a conscientious factor based on additional analysis of the interviews mentioned above. Since conscientiousness (Con) was added after the co-design sessions, we categorized each of the interviewed students under one of the four personas and then chose the level of conscientiousness that best described all the students in that persona category. The final characteristics for each of the four personas are: *Seel* (MSC:low, HSC:high, Fam:low, Con:high), *Abra* (MSC:low, HSC:high, Fam:high, Con:high), *Bellsprout* (MSC:high, HSC:high, Fam:low, Con:high), *Caterpie* (MSC:high, HSC: low, Fam:high, Con:low).

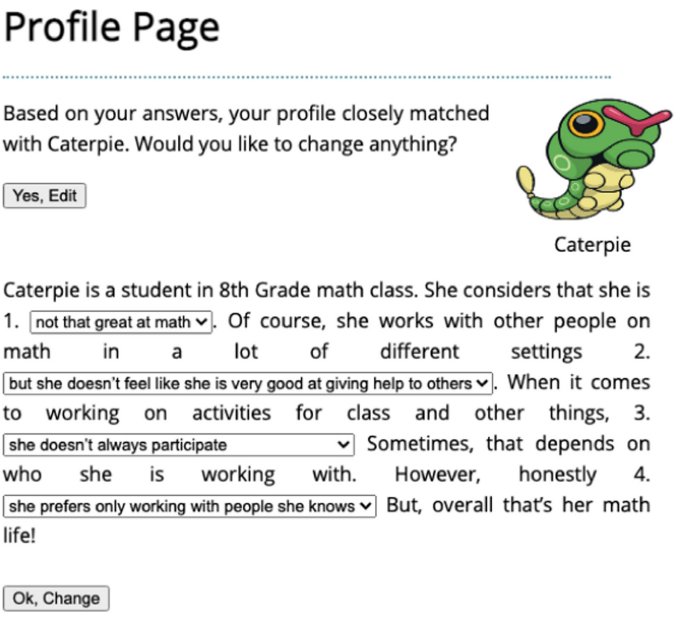

Fig. 1. Interface demo with dropdowns for students to self-indicate motivation

We embedded the final four personas as an interactive tool in the digital textbook interface with a name, a picture, and a short narrative following the original design. The design will allow the students to modify each of the four characteristic values using a dropdown menu (Fig. 1). The values are represented with words to fit in the narrative, e.g., 'pretty good at math' is mapped with high MSC, and 'not that great at math' is mapped to low MSC.

3 Discussion and Conclusion

In this paper, we used co-design to create personas for assessing motivation dynamically and in context. The students validated the factors used to develop the personas and brought their own perspectives in the process [2]. We embedded these personas in the interface, allowing students to report their motivation in context. This contextually embedded, easy to understand narrative may lead the students to respond differently than to surveys. It represents a multidimensional perspective on motivation as it suggests motivation cannot be adequately explained in terms of a single construct [10]. On a practical level, it may be intractable for ACLS to respond differently to permutations of multiple interacting motivational factors, and thus leveraging personas can be a way for ACLS to prioritize interventions based on logical clusters of individual characteristics. Our vision is for this persona approach to be incorporated in ACLS as a contextually sensitive way of dynamically assessing and responding to motivation.

Acknowledgements. This work is supported by the National Science Foundation under Grant No 1736103.

References

1. Mawasi, A., et al.: Using design-based research to improve peer help-giving in a middle school math classroom. In: International Conference of the Learning Sciences (ICLS) (2020)
2. Albrechtsen, C., Pedersen, M., Pedersen, N.F., Jensen, T.W.: Proposing co-design of personas as a method to heighten validity and engage users: a case from higher education. Int. J. Sociotechnol. Knowl. Dev. (IJSKD) **8**(4), 55–67 (2016)
3. Ali Amer Jid Almahri, F., Bell, D., Arzoky, M.: Personas design for conversational systems in education. In: Informatics, vol. 6, no. 4, p. 46. Multidisciplinary Digital Publishing Institute, December 2019
4. Cooper, A.: The Inmates are Running the Asylum. Macmillan (1999)
5. Choi, N.: Self-efficacy and self-concept as predictors of college students' academic performance. Psychol. Sch. **42**(2), 197–205 (2005)
6. Dörnyei, Z.: Motivation in action: towards a process-oriented conceptualisation of student motivation. Br. J. Educ. Psychol. **70**(4), 519–538 (2000)
7. Hew, K.F., Cheung, W.S., Ng, C.S.L.: Student contribution in asynchronous online discussion: a review of the research and empirical exploration. Instr. Sci. **38**(6), 571–606 (2010)
8. Järvenoja, H., et al.: A collaborative learning design for promoting and analyzing adaptive motivation and emotion regulation in the science classroom. In: Frontiers in Education, vol. 5, p. 111. Frontiers, July 2020
9. Johnson, D.W., Johnson, R.T.: Cooperative Learning and Achievement (1990)
10. Marsh, H.W., Trautwein, U., Lüdtke, O., Köller, O., Baumert, J.: Integration of multidimensional self-concept and core personality constructs: construct validation and relations to well-being and achievement. J. Pers. **74**(2), 403–456 (2006)
11. Noponen, M.: Learners' motivation to collaborate in online learning environments: a situational and social network analysis (2016)
12. Olsen, J.K., Rummel, N., Aleven, V.: Investigating Effects of Embedding Collaboration in an Intelligent Tutoring System for Elementary School Students. Grantee Submission (2016)
13. Porter, S.R., Whitcomb, M.E., Weitzer, W.H.: Multiple surveys of students and survey fatigue. New Dir. Inst. Res. **2004**(121), 63–73 (2004)
14. Sankupellay, M., Mealy, E., Niesel, C., Medland, R.: Building personas of students accessing a peer-facilitated support for learning program. In: Proceedings of the Annual Meeting of the Australian Special Interest Group for Computer Human Interaction, pp. 412–416, December 2015
15. Walker, E., Rummel, N., Koedinger, K.R.: Adaptive intelligent support to improve peer tutoring in algebra. Int. J. Artif. Intell. Educ. **24**(1), 33–61 (2014)
16. Warin, B., Kolski, C., Toffolon, C.: Living persona technique applied to HCI education. In: 2018 IEEE Global Engineering Education Conference (EDUCON), pp. 51–59. IEEE, April 2018
17. Webb, N.M., Farivar, S.: Promoting helping behavior in cooperative small groups in middle school mathematics. Am. Educ. Res. J. **31**(2), 369–395 (1994)
18. Varela, S., Hall, C., Bang, H.J.: Creating middle school child-based personas for a digital math practice application. In: EdMedia+ Innovate Learning, pp. 532–537. Association for the Advancement of Computing in Education (AACE), June 2015