'Made good connections': Amplifying teacher presence and belonging at scale through learning design and personalised feedback

Lisa-Angelique Lim, Amara Atif, Ian Farmer
University of Technology, Sydney

While online learning offers much flexibility for students in terms of time and place, students' experiences of online learning have been less than positive. A sense of belonging is key to students' success and retention in any learning environment. Teaching or teacher presence is significant for setting a climate for belonging. However, few studies have documented how teachers can foster students' sense of belonging in online settings and students' experience of these initiatives. This paper presents an exploratory case study of a teacher's initiatives to foster students' belonging in an online subject by amplifying teacher presence through technology-mediated, personalised feedback embedded within interactive, engaging subject design. Students' experiences of the subject and perceptions of their personalised feedback were captured through surveys and focus groups. Together, the findings indicate that the primary role of personalised feedback in fostering belonging was building connectedness between the teacher and students, thereby enhancing students' motivation to learn in the subject. The findings also resonate with other research highlighting the importance of teacher presence throughout the subject, not just during synchronous classes.

Keywords: sense of belonging, online learning, learning analytics, feedback

Introduction

Online learning offers students the flexibility of learning in their own time and place. However, it can be perceived by students to be an isolating experience (Arslan, 2021). Without a sense of belonging or connectedness, students may be less motivated to persist with their studies when faced with challenges such as managing workload or mastering content. Hence fostering a sense of belonging is critical for students' continued engagement in their learning, especially in online courses. Research has shown that teacher presence promotes student engagement and learning through a sense of connection, belonging, and feedback and guidance opportunities (Stone and Springer, 2019). Nevertheless, how can connection and belonging be fostered in online learning contexts with large enrolments? Current literature on belonging highlights the importance of engaging and interactive course design, together with regular and timely feedback and communication (Delahunty et al., 2014; Stone & Springer, 2019; Peacock et al., 2020). Learning analytics approaches to feedback offer a viable solution to scaling timely and personalised feedback (Pardo et al., 2017). However, few studies show how learning analytics can be harnessed to foster belonging in online learning. This paper presents a case study of how a teacher employed engaging and interactive course design, and harnessed learning analytics to personalise feedback and support to students to foster belonging in an online subject. This case study contributes to the emerging research and practice of fostering belonging in online courses through technology by documenting an innovative approach as well as the students' experience especially concerning their sense of belonging.

Background

Learning and belonging in online learning

Belonging is an integral part of students' subjective experience that influences their success at University (Araujo et al., 2014; Tinto, 2003) and is an important factor for retention (Meehan & Howells, 2019; Thomas, 2012). While many definitions of belonging have been proposed (e.g., Thomas, 2012), we rely on Goodenow and Grady's (1993) influential definition, which emphasises students' sense of 'being accepted, valued, included and encouraged by others (teachers and peers) in the academic classroom and of feeling oneself to be an important part in the life and activity of the class' (p.25). Online learning can present significant challenges in

fostering a sense of belonging. Belonging is inherently relational (Kahu & Nelson, 2018), but students in online learning settings learn remotely from each other and the teacher. Recent empirical evidence indicates greater feelings of isolation and, accordingly lower sense of belonging (Garrad & Page, 2022) and higher attrition rates for online courses (Shelton, Hung, & Lowenthal, 2017).

In addressing the poverty of students' experience in online learning, literature has emerged in recent years, introducing evidence-based strategies for fostering belonging in a fully online context. Essentially, the research indicates that students' sense of belonging in online courses can be fostered by two critical elements perceivable by students in the learning environment: teacher presence and interactive course design (Fiock, 2020; Peacock, et al., 2020; Stone & Springer, 2019). When these are present, students feel a sense of belonging that enhances greater motivation and engagement, leading to academic success, a positive learning experience, and ultimately, retention. At the classroom level, emerging research indicates that the critical factor in fostering belonging is the teacher (Kirby & Thomas, 2022; Stone & Springer, 2019), who demonstrates care and support for student learning, and who orchestrates features of the learning environment to provide a strong community of learning with clear expectations. However, the challenge of fostering belonging through teacher presence is exacerbated with large cohorts (Stone & Springer, 2019). How can teachers sustain students' engagement in their learning from week to week, given large enrolments in online courses and the limited time for interaction?

Learning analytics: Using data to personalise feedback and support

Learning analytics has the potential to foster belonging in students by enabling teachers to tailor support and feedback according to students' progress at a scale hitherto unachievable. Feedback for students 'is seen as a relational process through which teachers may encourage positive motivation and help learners build confidence and self-esteem' (Khosravi et al., 2022, p.3). Given that online courses can see enrolments in the hundreds of students, the communication of feedback to every student, in a personalised way, presents considerable challenges for teachers. Learning analytics offers a technological solution to scaling feedback that is personalised to students' progress and ongoing performance in a course (Pardo et al., 2017).

Learning analytics feedback interventions can be categorised into two types. *Fully-automated feedback systems* in the form of dashboards and recommender systems are prevalent in the literature due to technological advancements and educational data-mining approaches (e.g., Sahin & Ifenthaler, 2021). However, dashboards are silent, visual displays, and as such, may be unable to foster in students a sense of belonging. On the other hand, *learning analytics feedback interventions* that involve humans in the loop are mediated by the teacher and delivered in the teacher's voice. These systems may therefore be more able to augment teacher presence and foster a sense of belonging in students. One example of a human-in-the-loop learning analytics feedback system is OnTask (Pardo et al., 2018).

Emerging research in learning analytics feedback interventions has shown benefits for students' self-regulated learning (Lim et al., 2020) and performance (Lim et al., 2021) in blended learning settings. Evidence has also emerged showing students' appreciation of the relational value of this novel feedback approach (Tsai, et al., 2021). However, less is known about the specific role these automated, data-informed interventions could play on students' sense of belonging in online learning. Indeed, the literature is limited in documenting how teachers can leverage these technologies effectively to foster belonging in fully online courses.

Aim and research questions

Given the research gaps outlined above, the present paper reports on a case study to foster student belonging in a fully online subject through interactive learning design and supportive student-staff relations. The intervention involved using OnTask, together with interactive and engaging learning design, to create and communicate regular, personalised messages of feedback and support to all students in a fully online postgraduate subject. In this paper, we report on the students' perspective of personalised feedback and support on their learning experience and belonging in this context. The following questions guided the study:
RQ1. To what extent were students satisfied with their personalised feedback sent by the teacher using OnTask?
RQ2. From the students' perspective, what was the role of their personalised feedback emails in enhancing their learning experience, especially their sense of belonging?

Methodology

Context

This study was carried out in an online postgraduate subject in the IT discipline at an Australian University during the Spring 2021 semester. The subject was enrolled by 101 students, of whom 86 were international. Due to the COVID-19 pandemic, many of these students were learning remotely from their home countries. The cohort was mostly male (67%), and between the ages of 26-30 years old (62%). The subject was structured around a weekly 3-hour collaborative synchronous class conducted over Microsoft Teams, supplemented with pre-readings, post-class formative assessments and group work. The learning design consisted of the following elements. Before attending the weekly class, as pre-reading, interactive H5P activities were designed to gamify learning related to the weekly topic. During the synchronous class, interactive, collaborative activities were specifically designed to promote engagement with the material, maintain student interest, provide opportunities for peer-to-peer interaction, and reinforce the student's opportunity for learning. The class began with the teacher's 'check-in, check-out questions' to interact more personally with the students. This five-minute activity involved the teacher posting a friendly question on the chat and inviting students to respond informally to it; this activity intended to help the teacher know more about the students at a personal level, as well as for students to know each other. After this activity, the teacher delivered a short teaching session on the week's topic. Following this, students worked through small group collaborative activities conducted within online breakout rooms (referred to as 'virtual tables'). They then presented their group's discussion to the class after the breakouts. Post-class formative weekly quizzes assessed students' understanding of the content and included open-ended text to encourage students to record self-reflections of their learning. The summative assessment comprised weekly case study discussions, a blog post, and a final group project, facilitating peer learning and feedback, reflexivity, and student presentations. Additional learning support was given through weekly drop-in sessions for students to approach the teacher with subject-related questions, and an online subject discussion forum was provided to facilitate ongoing student discussions and to provide feedback to the teacher to highlight student learning progress.

Regular, personalised feedback was integrated into the learning design through OnTask, a web-based platform that helps teachers create rule-based messages informed by students' learning data to trigger personalised feedback at scale. These messages are then sent out as personalised emails to all students at appropriate times as deemed by the teacher. In this subject, feedback emails were personalised based on class attendance, completion of weekly learning activities, and performance on assessments. In this way, students received regular communication from the teacher about their ongoing progress to support their engagement and belonging. Figure 1 shows the design of personalised feedback within the curriculum across the 13-week semester (including the mid-session study vacation). Figure 2 shows an example of personalised feedback generated after the first assessment, highlighting the rule-based conditions for messages to: 1) students who passed the first quiz and 2) students who failed the first quiz. The feedback for students who had failed the quiz was carefully worded to convey the teacher's concern for the students' success and belief in the students' ability and to provide actionable advice on how to improve their performance.
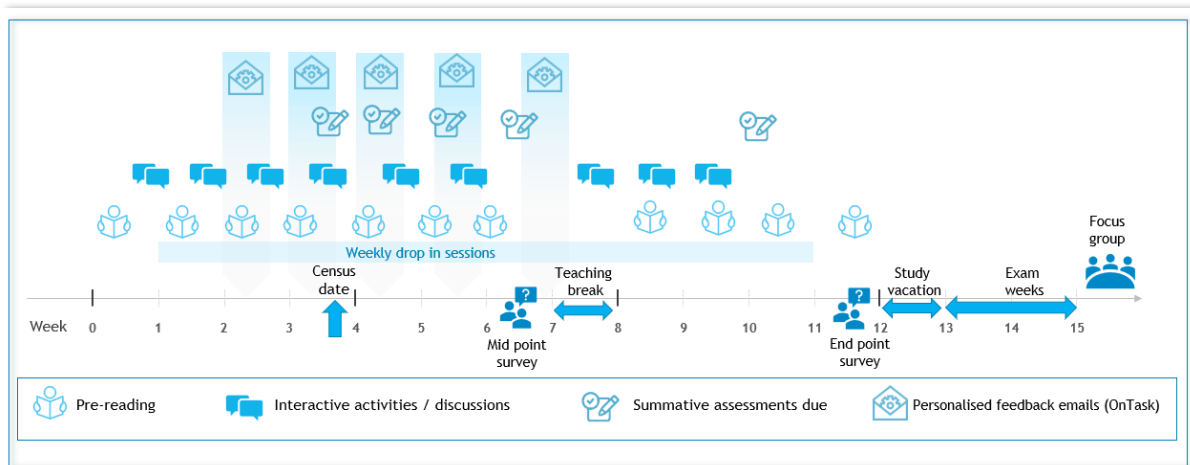

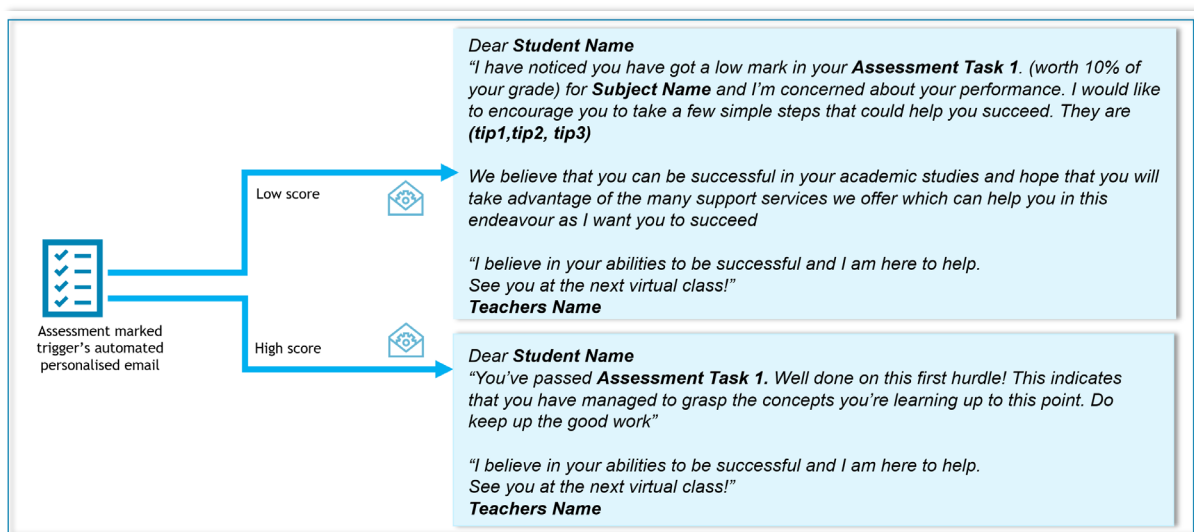**Figure 1: Personalised feedback within an online learning design to foster belonging**

Figure 2: Example of a rule-based personalised feedback email using OnTask

Data collection

This study received ethical approval under a wider project evaluating the implementation of personalised feedback at the institution. Students were invited to participate in the study through voluntary participation in anonymous surveys and focus groups. Data were collected at different points of the semester to understand students' experiences with their personalised feedback (see Figure 1). The first was a short survey disseminated at the midpoint of semester, to capture students' early perceptions of their feedback in order to redress any possible negative experiences that may arise for the student receiving feedback based on their learning data. The second survey was administered towards the end of the semester, and comprised four questions asking students to rate the extent to which their personalised feedback supported their learning. The four items, rated on a 6-point Likert scale (1 = Strongly disagree, 6 = Strongly agree), were informed by principles of effective feedback (Henderson et al., 2019). A fifth item on the survey was an optional, open-ended question where students could add additional comments about their feedback experience. The survey also invited students to participate in focus group discussions to discuss their feedback experience with the researcher.

Five students (3 males, 2 females) volunteered to participate in the focus group discussions. Approximately a week after the semester had ended, two focus groups were conducted online over Zoom. The first focus group comprised two students, while the second group comprised three students. The focus groups, which ran for approximately an hour each, took the form of a semi-structured interview to facilitate the collation and analysis across the two groups. The guiding questions centred around students' experiences of learning in the subject, as well as of their experience with their personalised feedback. These two central foci were important for answering RQ2 to obtain an in-depth understanding of the role of feedback in enhancing students' learning experience in this context. The researcher facilitated discussions about what students enjoyed and found challenging in the subject, their perceptions of their feedback emails and their response to them, and how they perceived the influence of their feedback on their study habits and performance in the subject.

Data analysis

To answer RQ 1, quantitative data from the mid-point and semester-end surveys were analysed to obtain simple descriptive statistics, while the qualitative data from the open-ended questions in the surveys were analysed using open coding to identify main themes. To answer RQ 2, student interview data were transcribed before being imported to a NVivo 12 Pro[1] for thematic analysis adapted from Braun and Clarke (2006). We chose thematic analysis for this case study as it was guided by both the study aim (deductive) and interpretations for subjective information, which is students' experiences of learning in the subject and personalised feedback

---

[1] QSR International Pty Ltd. (2018) NVivo Pro (Version 12), https://www.qsrinternational.com/nvivo-qualitative-data-analysis-software/home

(inductive). Two researchers (also authors) independently performed the coding based on Strauss and Corbin (1998). Open coding helped to group the transcribed text from the student interviews into categories. After open coding, both researchers developed a mutually agreed coding scheme and cross-coded one random transcript to check coding agreement. The coding agreement, also known as inter-rater reliability, was measured by the statistical method of 'percentage agreement'. Later, both researchers, in various collaborative sessions, performed the axial and selective coding and finalised the themes, sub-themes, and descriptions.

Results

RQ1. To what extent were students satisfied with their personalised feedback sent by the teacher using OnTask?

Mid-semester survey results
52 students (51% of the cohort) responded to this survey asking them to rate the extent to which they found their personalised feedback helpful. Students responded with a mean rating of 4.6 (SD = 0.8). An overwhelming proportion of survey respondents (71%) rated their personalised feedback as being very helpful at this stage.

All respondents answered the open-ended question. Four major themes were identified through open coding. The most frequently occurring theme (n = 23, 37% of all themes) was that of feedback helping students to understand their current progress, for example: 'It helped me understand where am I lacking and what are my strong points'. The following frequently occurring theme (n = 18, 29% of all themes) described students' perception about the role of their personalised feedback in fostering a sense of belonging. Especially, students described the motivational effect of their personalised feedback, for example: 'you encouraged me a little to strive for better'. Students also commented on how their personalised feedback enhanced connectedness: 'I feel more connected in this subject than any other due to the feedback provided on time to time basis'. Students also sensed the support of the teacher through the feedback: 'Feels heard, observed and taken care of by teacher'. The next theme described how the feedback improved the learning experience (n = 10, 16% of all themes), by facilitating the understanding of the content, improving the class experience, and alleviating stress. A few responses described the feedback as not helpful (n = 3, 5% of all themes). In this theme, students expressed that the emails did not provide information about how to improve or did not give them insights into their progress in additional to what they already knew. For the remaining responses, six responses merely reiterated that their feedback was helpful without giving further elaboration, while two responses were irrelevant.

End of semester survey results
41 (41% of the cohort) students responded to this survey. Similar to the mid-semester results, students held positive views of their feedback at this stage. Students' ratings were highest, on average, for the item *This feedback made me feel more supported by my teacher* (M = 5.24, SD = 1.2). Students also held a high level of agreement that *The feedback and support improved the quality and standard of my work* (M = 4.83, SD = 1.4).

Sixteen respondents answered the open-ended question i.e., *Do you have any other comments about your feedback experience?*. Four main themes were identified from the open coding. The most frequently mentioned theme described how the students perceived that their personalised feedback fostered a sense of belonging (n = 6, 35% of all themes). Similar to how this theme was described in the mid-point of the semester, students felt the care of the teacher through the feedback emails, which enhanced their belonging: 'I like how we use to get the emails from our professor making us look valuable and the efforts given by the professor'. The second most frequently mentioned theme described negative perceptions of the personalised feedback, specifically, that the feedback was insufficient to support their learning, in particular, that the emails did not provide information on how to improve their performance, for example, for future assignments. The third theme described how the feedback enhanced the subject experience, especially in making the learning experience more personalised: 'The feedback… gave a more tailored feel to taking this subject'.

RQ2. From the students' perspective, what was the role of their personalised feedback and support emails in enhancing their learning experience, especially their sense of belonging?

After the open-coding based on the focus group interview protocol, two researchers (R1 and R2) defined categories as shown below. Inter-rater reliability was measured by using the coding comparison queries in NVivo 12 Pro. The percentage agreements for researchers R1-R2 is 99.18%, and R2-R1 is 99.53%, respectively, indicating that the codes and categories were reliable (Saldana, 2013). The researchers identified 9 categories and 33 main themes from this iterative process. The nine categories are: 1) learning experience [from the

<subject code>]; 2) predicaments [with the <subject code>]; 3) perceptions of the personalised feedback emails; 4) action/s taken in response to the feedback; 5) impact on performance; 6) feedback emails, affect and learning; 7) feedback emails and motivation to study in <subject code; 8) factors influencing the way students performed; and 9) edification (i.e., how the personalised feedback could be improved).

Next, through selective coding, the main themes in each category were reviewed and organised into 1st and/or 2nd order sub-themes (shown in Table 1). In this paper, we report our thematic analysis of the transcribed student interviews focusing on the four main themes (1, 6, 7, and 8) relating to RQ2. In Table 1, the number in parenthesis describes the frequency of the theme.

Learning experience [from the <subject code>]
Students frequently commented on the teacher's frequent interactions with them during the weekly synchronous classes, especially in terms of the check-in, and check-out questions. Students appreciated how this particular strategy fostered connection and made them feel valued, as illustrated in the following quote:

> it *made us feel connected to the professor* even though we're not onshore. So that's helped us. Like, this was the one subject throughout the three semesters I did with [institution blinded] is that I felt that this professor actually cared for us enough, even if we're not in class, and she can see us every day, she made an effort *to make sure that we feel valued*' [Respondent 3]

The quote above highlights that the sense of connection and belonging was particularly significant for these students who were learning remotely from their home countries. Students also frequently expressed appreciation for the subject design, particularly the weekly case study activity post-class: 'because every week could provide a different perspective, from the case study for us to learn about business intelligence, big data, or data visualisation, all about data, which is expanded my knowledge a lot, actually' [Respondent 4]. This quote highlights how students recognised the value of the collaborative exercise in terms of their understanding of the subject content. Students' comments also expressed perceptions of interactive and engaging subject design, which was instrumental for their attendance at the weekly synchronous class, for example: 'I like to attend the classes, because the classes were pretty interactive and I liked the way [the teacher] designed the classes [summary of weekly content followed by] group work and learning variety of tools for various purposes' [Respondent 2]. In fact, for some students, the highly interactive session 'felt like it's an actual classroom' [Respondent 5]. Taken together, students' desire to attend classes as well as the perception of being in an actual classroom provide evidence that the students had felt that they were a part of a community.

Feedback emails, affect and learning
Students frequently expressed appreciation for the encouraging tone of the personalised feedback, which was necessary for their motivation. For example,

> I can just remember the last line she wrote, and it was really amazing. She said, [R3], I believe in your abilities, and I believe you will be successful, and I will see you in the next virtual class. And that that line is like was really motivational for me. [Respondent 3]

From the students' perspective, the feedback emails made a visible difference to students' sense of belonging in this subject as opposed to other subjects: 'In this [subject], … we have made good connections throughout the [subject] with our peers, and especially with our professor' [Respondent 5].

Students also frequently noted how the subject learning design played a significant role in fostering iterative cycles of learning, as illustrated in the following quote: 'I think it's like mostly *the weekly discussions, which was driving me towards learning more about this subject* rather than the emails. … And it was just that *weekly activities, which ensure that I actually take part in the subject* and study and learn new stuff' [Respondent 5, italics added]. This quote clearly illustrates the role of well-structured, interactive subject design in fueling students' active engagement in the subject. In comparison, students felt that the feedback emails did less to foster independent learning or make them more independent, mainly because they felt they were already performing well, or because they perceived the emails to be generic. In regard to the latter, students felt that there was no clear feedback about strengths and weaknesses or information about resources to improve learning.

Table 1: Students' experiences of learning in the subject and with the personalised feedback

Theme 1: Learning experience [from the <subject code>]	
Description: How students perceived that the subject design, subject matter, means of teaching (pedagogy), teacher presence, enhanced their learning individually and collaboratively in the subject.	
Main-Themes	**Sub-Themes (1st Order)**
appreciate subject design (4)	
interesting and applied content (4)	weekly case study is interesting (2); learned variety of tools for different purposes (1)
teamwork (2)	interactive collaborative classes and group activities (2)
student characteristics	self-learning (5); revisits lecture recordings (1); positive in-class feedback (1); contrast with other subjects for less/no interaction between students and teacher (1)
teacher was really interactive-(inside the class) (6)	check-in check out questions made us feel connected (6)
teacher was very approachable-(outside the class) (2)	
Theme 6: Feedback emails, affect and learning	
Description: How students perceived their personalised feedback through the emails, the role it played in their learning, and their affective response to it.	
Main-Themes	**Sub-Themes (1st Order)**
Positive tone of feedback	emails were motivational and encouraging (7); emails opened a dialogue with the lecturer that encouraged the student (1); constructive feedback (1)
feedback emails did improve learning	spent more time studying this subject than others (1)
feedback emails did not improve learning	student performed well without attending the classes (2); learning did not change - learning design fostered iterative agile cycles of activity (2)
feedback emails fostered independent learning (2)	
feedback emails did not make student more independent	because emails were very generic (3) **[2nd Order**: there could be more feedback about strengths and weaknesses (1); there could be more resources to help improve learning (1)**]**; because already pretty independent student (1); because only received email at the beginning (1)
Theme 7: Feedback emails and motivation [to study in <subject code>]	
Description: How students perceived the impact of the feedback emails on their motivation.	
Main-Theme	**Sub-Themes (1st Order)**
feedback emails enhanced motivation to learn in the subject	teacher-approachable, comfortable to talk to and willing to help (6); a good reminder (1); someone watching me- giving a more personalised learning experience (2)
Theme 8: Factors influencing the way students perform	
Description: How students engaged and responded to the learning design and pedagogy, and how they felt the teaching practices fostered a sense of belonging and inspired re-engagement.	
Main-Themes	**Sub-Themes (1st Order)**
learning design influenced performance positively	well-structured weekly content (2); learning material, drop-in session, check-in and check-out question (1)
learning subject related knowledge influenced performance positively	learning new BI related tools (1); learning new content (1); relevant case studies (2)
learning domain related knowledge influenced performance positively	related recent news and current events (2)
timely feedback influenced performance positively (1)	
teamwork and collaboration influenced performance positively (3)	
teacher presence influenced performance positively	care shown by the teacher made me want to have a good impression on the teacher (3); can feel the effort the teacher put in - so I want to perform well (1); teacher's advice (not email) was really helpful (1); teacher's weekly drop in session (1); learning design foster student-teacher relationship (1); appreciate the coordinator's effort for feedback emails (1)

Feedback emails and motivation [to study in <subject code>]
The impact of the feedback emails was most keenly felt in terms of enhancing students' motivation, as evidenced by the frequency of occurrence of motivation-related themes. Notably, there were frequent comments about the teacher being approachable, comfortable to talk to, and willing to help: 'when I received the email, I can think like, the lecturer was already there. And she's always willing to help out with every matter. So I think *it makes me feel like, if I have any questions, I always can go [to] her*. So yeah, I feel like comfortable with it' [Respondent 1]. Moreover, students also expressed that the feedback provided them a more personalised learning experience: 'it was good to see that *the faculty is taking as much interest as you are taking in the subject*. I mean, in terms of *personalising it and focusing on me*. … So it did motivate me' [Respondent 2]. Again, both these quotes clearly illustrate how the teacher's presence – demonstrated through her approachability and regular personalised feedback –fostered a sense of belonging in the students, by making them feel valued, thereby enhancing their motivation.

Factors influencing the way students perform

From the students' perspective, teacher presence is the most significant factor influencing their performance in the subject. Students frequently commented on the care and effort shown by the teacher through the personalised feedback emails as well as through other interactions with them; for some, this made them want to leave a good impression on the teacher: 'I can feel the effort the professor put in, …so I want to perform well' [Respondent 4]. Students also credited the interactive course elements as being important for their learning while recognising the teacher's role in orchestrating collaborative learning: 'hats off to [the teacher] that she'd set up (virtual) tables for us, so that we could like, talk to people' [Respondent 3].

Above all, students were well aware of how the teacher had orchestrated various pedagogical elements to build strong connections with students, enhance motivation, and therefore foster belonging in the subject. This is well-summarised in the following quote:

> all the things the professor did, like a case study material, learning material and drop-in, check-in question and check-out question is small, small piece… but is *make a link between the professor and student*. So every time professor say- is saying something, we get more concentrate on that. And I think that is a benefit for students, for us to improve, to gain the knowledge. … because I think it's common if people by motivation or encouraged by someone you want to show yourself to perform well [Respondent 4].

Discussion

A sense of belonging is central to students' continued motivation, engagement, and success in learning. Belonging is inherently relational and is fostered within the context of a community. As online learning tends to offer fewer opportunities for interaction and lacks a shared physical space, fostering a sense of belonging in such settings can pose a significant challenge. In this case study, we described how one teacher attempted to foster belonging in an online subject by augmenting teacher presence through the use of technology-mediated, personalised feedback, within the context of interactive and engaging subject design.

Taken together, the survey responses and focus groups provided evidence from the students' perspective, of the role of the personalised feedback emails, on their experience of belonging and connection in the subject. The main recurring themes related to the perception of care and support conveyed through the feedback, as well as the resultant enhanced motivation felt by the student. The motivational and relational impact of personalised feedback has been demonstrated in other research (e.g., Lim et al., 2021, Tsai et al., 2021). The present study has added further insight to this area of research by documenting more specifically how students experienced a greater sense of connectedness through personalised feedback, thereby enhancing belonging and motivation. The findings from this study also resonate with the work of Peacock et al (2020) on what students deem important in fostering belonging. A frequently mentioned theme was observed in this study of the teacher's care, which demonstrates that the teacher was 'pivotal to the development of students' sense of belonging' (Peacock et al., 2020, p.25), especially in the online space. Moreover, students frequently described how the collaborative and other learning activities kept them engaged and motivated their attendance at the synchronous classes. This finding further demonstrates the importance of interactive, engaging pedagogy to foster belonging in online learning (Peacock et al., 2020; Stone & Springer, 2019).

Implications for teaching in online spaces: strategies to foster belonging

Overall, this case study illustrates that fostering a sense of belonging entails a curriculum-wide approach, an approach that involves a community of students supported by strong teaching presence (Garrison, 2011). This study identifies three possible strategies for fostering belonging in online learning. The first strategy involves leveraging learning analytics to personalise feedback and support and therefore amplify teacher presence in the online learning setting. In this study, tailoring feedback to students' learning data facilitated 'regular and prompt communication between teacher and students' (Stone & Springer, 2019, p.164), and helped students to feel the teachers' care and to know that they were valued (Atif et al., 2020). The second strategy is the use of weekly check-in, check-out questions at the start of each synchronous class. For the students taking this subject, these questions played an important role in connecting them to the teacher because they helped the teacher know more about and understand her students not just at the start of the subject but in a dynamic way over the semester. This interactive element created a sense of belonging by building connections between the teacher and students, which fostered student motivation to learn. A third strategy that was enjoyed by students and fostered their belonging in terms of a desire to attend every synchronous class, was the use of collaborative learning activity

around 'virtual tables'. This strategy involves small group work where students collaborate on in-class activities to learn the content. It allowed for thinking time and encouraged students to present and share their work. By giving students advance notice about who would be sharing and presenting in the large group, students were encouraged to participate as part of the learning community.

Limitations & Future research

The exploratory case study presented in this paper is not without its limitations. Foremost, we acknowledge that the evidence of belonging came mainly from a small number of students' self-described experiences. The findings, therefore may not be generalised to all online learning settings. However, the research was intended to be qualitative, with the focus group discussions drawing out the intricacies of students' experience of the subject and the personalised feedback therein to obtain deep insights into the distinct role of personalised feedback in fostering belonging. The additional survey data gathered from half of the cohort also lent some support to the experiences described by the handful of students who volunteered for the focus group. Future studies could be carried out in different contexts, using validated instruments to measure students' belonging, feedback experience, and motivation to explore more systematically the relationship among the different factors and antecedents of belonging. Future work could also explore in more detail, teachers' perspectives of their pedagogies to foster belonging, and how their intentions aligned with students' perceptions.

Conclusion

Undoubtedly, online learning will continue to be a mainstay in contemporary HE, along with the challenge to keep students connected and having a sense of belonging to persist in their studies while learning remotely. The present study has described the use of a learning analytics approach to personalise feedback and support for students in a large online subject to facilitate 'regular and prompt communication between teacher and students' (Stone & Springer, 2019, p.165). The findings from this study highlight that the combination of personalised feedback and support with an interactive and engaging learning design fostered a sense of belonging and enhanced students' motivation to stay engaged and do their best in the subject.

References

Araújo, N., Carlin, D., Clarke, B., Morieson, L., Lukas, K., & Wilson, R. (2014). Belonging in the first year: A creative discipline cohort case study. *The International Journal of the First Year in Higher Education, 5*(2), 21-31. https://doi.org/10.5204/intjfyhe.v5i2.240

Arslan, G. (2021). Loneliness, college belongingness, subjective vitality, and psychological adjustment during coronavirus pandemic: Development of the College Belongingness Questionnaire. *Journal of Positive School Psychology, 5*(1), 17-31. https://doi.org/10.47602/jpsp.v5i1.240

Atif, A., Richards, D., Liu, D., & Bilgin, A. A. (2020). Perceived benefits and barriers of a prototype early alert system to detect engagement and support 'at-risk' students: The teacher perspective. *Computers & Education, 156,* 103954. https://doi.org/10.1016/j.compedu.2020.103954

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Delahunty, J., Verenikina, I., & Jones, P. (2014). Socio-emotional connections: identity, belonging and learning in online interactions. A literature review. *Technology, Pedagogy and Education, 23*(2), 243-265. https://doi.org/10.1080/1475939X.2013.813405

Fiock, H. (2020). Designing a Community of Inquiry in online courses. *International Review of Research in Open and Distributed Learning, 21*(1), 135-153. https://doi.org/10.19173/irrodl.v20i5.3985

Garrad, T.-A., & Page, A. (2022). From Face-To-Face to the Online Space: The Continued Relevance of Connecting Students With Each Other and Their Learning Post COVID-19 [Original Research]. *Frontiers in Education, 7*. https://doi.org/10.3389/feduc.2022.808104

Goodenow, C., & Grady, K. E. (1993). The Relationship of School Belonging and Friends' Values to Academic Motivation Among Urban Adolescent Students. *The Journal of Experimental Education, 62*(1), 60-71. https://doi.org/10.1080/00220973.1993.9943831

Henderson, M., Molloy, E., Ajjawi, R., & Boud, D. (2019). Designing Feedback for Impact. In M. Henderson, R. Ajjawi, D. Boud, & E. Molloy (Eds.), *The Impact of Feedback in Higher Education: Improving Assessment Outcomes for Learners* (pp. 267-285). Springer International Publishing. https://doi.org/10.1007/978-3-030-25112-3_15

Kahu, E. R., & Nelson, K. (2018). Student engagement in the educational interface: understanding the mechanisms of student success. *Higher education research & development, 37*(1), 58-71. https://doi.org/10.1080/07294360.2017.1344197

Khosravi, H., Shum, S. B., Chen, G., Conati, C., Tsai, Y.-S., Kay, J., Knight, S., Martinez-Maldonado, R., Sadiq, S., & Gašević, D. (2022). Explainable Artificial Intelligence in education. *Computers and Education: Artificial Intelligence, 3,* 100074. https://doi.org/10.1016/j.caeai.2022.100074

Kirby, L. A. J., & Thomas, C. L. (2022). High-impact teaching practices foster a greater sense of belonging in the college classroom. *Journal of Further and Higher Education, 46*(3), 368-381. https://doi.org/10.1080/0309877X.2021.1950659

Lim, L.-A., Dawson, S., Gašević, D., Joksimović, S., Fudge, A., Pardo, A., & Gentili, S. (2020). Students' sense-making of personalised feedback based on learning analytics. *Australasian Journal of Educational Technology, 36*(6), 15-33. https://doi.org/10.14742/ajet.6370

Lim, L.-A., Gentili, S., Pardo, A., Kovanović, V., Whitelock-Wainwright, A., Gašević, D., & Dawson, S. (2021). What changes, and for whom? A study of the impact of learning analytics-based process feedback in a large course. *Learning and Instruction,* 101202. https://doi.org/10.1016/j.learninstruc.2019.04.003

Meehan, C., & Howells, K. (2019). In search of the feeling of 'belonging' in higher education: undergraduate students transition into higher education. *Journal of Further and Higher Education, 43*(10), 1376-1390. https://doi.org/10.1080/0309877X.2018.1490702

Pardo, A., Bartimote-Aufflick, K., Buckingham Shum, S., Dawson, S., Gao, J., Gašević, D., ..., & Vigentini, L. (2018). OnTask: Delivering Data-Informed Personalised Learning Support Actions. *Journal of Learning Analytics, 5*(3), 235-249. http://dx.doi.org/10.18608/jla.2018.53.15

Pardo, A., Poquet, O., Martinez-Maldonado, R., & Dawson, S. (2017). Provision of data-driven student feedback in LA and EDM. In C. Lang, G. Siemens, A. F. Wise, & D. Gašević (Eds.), *Handbook of learning analytics* (pp. 163-174). https://doi.org/10.18608/hla17.014

Peacock, S., Cowan, J., Irvine, L., & Williams, J. (2020). An exploration into the importance of a sense of belonging for online learners. *International Review of Research in Open and Distributed Learning, 21*(2), 18-35. https://doi.org/10.19173/irrodl.v20i5.4539

Sahin, M., & Ifenthaler, D. (2021). Visualizations and dashboards for learning analytics: A systematic literature review. In M. Sahin & D. Ifenthaler (Eds.), *Visualizations and dashboards for learning analytics*. Springer. https://doi.org/10.1007/978-3-030-81222-5

Shelton, B. E., Hung, J.-L., & Lowenthal, P. R. (2017). Predicting student success by modeling student interaction in asynchronous online courses. *Distance Education, 38*(1), 59-69. https://doi.org/10.1080/01587919.2017.1299562

Stone, C., & Springer, M. (2019). Interactivity, connectedness and 'teacher-presence' : *Engaging and retaining students online (Vol. 59)*. Adult Learning Australia. https://doi.org/10.3316/aeipt.224048

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory (2nd ed.)*. Sage Publications.

Thomas, L. (2012). *Building student engagement and belonging in higher education at a time of change: A summary of findings and recommendations from the what works? Student retention & success programme.* Paul Hamlyn Foundation. Retrieved from https://www.phf.org.uk/wp-content/uploads/2014/10/What-Works-Summary-report.pdf.

Tinto, V. (2003). *Student success and the building of involving educational communities (Vol. 2)*. Higher Education Program, School of Education, Syracuse University.

Tsai, Y.-S., Mello, R. F., Jovanović, J., & Gašević, D. (2021). Student appreciation of data-driven feedback: A pilot study on OnTask. In *LAK21: 11th International Learning Analytics and Knowledge Conference (LAK21), April 12–16, 2021, Irvine, CA, USA* (pp. 511-517). ACM. https://doi.org/10.1145/3448139.3448212