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Sense of belonging in higher education students: an Australian longitudinal study from 2013 to 2019

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ABSTRACT

Student sense of belonging is a current challenge to higher education providers, with consistently declining ratings in national surveys. For universities globally, this is a concern linked to student attrition, student satisfaction, and student success. Importantly, low sense of belonging is typically associated with non-traditional learners, and building strategies to solve this challenge is essential for institutions to build equitable learning environments. This study seeks to understand the causal factors that predict when a student will belong using longitudinal data. Using the Australian national student experience survey data ($n = 1,159,768$ undergraduate and postgraduate students between 2013 and 2019), this study examines the predictors of a sense of belonging testing the accuracy of four machine learning models. The findings indicate overall educational experience, connection to students outside of class, and support to settle were key predictors, with skill development and curriculum supports a lesser predictor of a sense of belonging. Interestingly, identity and individual differences ratings seemed to have less importance than student experience factors. Implications for higher education policy developers and curriculum writers are considered.

Introduction

Massification of tertiary education has meant sustained growth in enrolment rates (Marginson 2016; O'Shea 2021). Yet, despite its high prevalence, higher education is still viewed, in many cultures and families, to be an essential step in adulthood for improved job prospects, elevated social status, or higher income earning potential (Ertem and Gokalp 2019). A successful transition to university remains important for many students, with a student's ability to feel a sense of belonging in their new institution a key component contemporary universities have focused on.

Conversely, student attrition remains a major issue for tertiary institutions (Middleton et al. 2021), with early drop out, family or work commitments, financial constraints, and study loads commonly

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reported as causes (Nieuwoudt and Pedler 2021). Feelings of belongingness have been recognised as a major antidote to student attrition (e.g. O'Keeffe 2013). Feelings of belongingness can help students to overcome challenges, hardships or struggles, and mitigate or reduce non completion of their degree (Ajjawi et al. 2019). Similarly, retention is dependent on the extent to which students feel satisfied with the university which is also influenced by feelings of belonging (Meehan and Howells 2017).

Belonging, in a general sense, has been defined as a feeling of being accepted, included, and valued (Allen et al. 2021). Rooted in Maslow's (1943) hierarchy of needs and Baumeister and Leary's (1995) belongingness hypothesis, the need for belonging is posited as a fundamental human drive, which plays a crucial role in an individual's overall wellbeing, self-esteem, and motivation (Leary 2010). Since humans have a natural need or fundamental motive to belong (Baumeister and Leary 1995), many people will seek a sense of belonging to multiple groups, places, or people. While human needs for belonging might vary, belonging has been shown to be a universal human need (Baumeister and Leary 1995). As far as tertiary institutions are concerned, a sense of belonging to university can involve feelings of acceptance, inclusion, and connectedness not only to the institution but also to its members (e.g. other students and academics) and interestingly, once established, a fulfilled sense of belonging can create positive outcomes (Strayhorn 2012). Yet, there are different perspectives on the topic, with Naylor, Baik, and Arkoudis (2018) using questions of likeability and community in their sense of belonging scale. Sense of belonging seems to be connected to early literature on a psychological sense of community, that is themes of loneliness, alienation, rootlessness, and feelings of not belonging were argued as associated with its decline (Sarason 1974). In this study, we do not adopt a specific approach on belongingness, and instead explore the data results to generate such meaning, as we discuss further. What is evident is that a sense of belonging is critical for positive university experiences, and understanding causal predictors is the foundation we use to structure this study.

As we go onto discuss, most studies that speak to belonging and student engagement tend to rely on smaller scale datasets using regression and exploratory qualitative research. These studies, discussed in the next section, are critical in seeking to unpack possible student interfaces with belonging. In this study, we seek to take a deep causal analysis of what predicts belonging. To our knowledge, this level of analysis using the size and timeframe of data reported has not occurred, and may offer some direct inferences that universities, governments, and educators can use to change general declines in student sense of belonging. To do this, we begin with a brief discussion of student success, retention, and belonging; with existing evidence suggesting that when people belong, they stay (or are retained and are successful), and discuss the extant literature on belonging in universities and colleges. Next, we consider the machine learning approaches taken, what our results say, and provide an extended discussion on the significance of this data from research, theory, and practice perspectives.

Student success, retention, and belonging

Student success and retention are of considerable importance to universities and governments, regardless of the frame of measurement (e.g. grade performance, students retained, completion rates). This is particularly true in underserved populations, who are often find it more difficult to belong, fit-in, and succeed. In the United States, student attrition was at 45%, with many Australian institutions above 20% student attrition (O'Keeffe 2013). These numbers have largely remained the same since, although expectations of education cost increases could place downward pressure on student success.

There have been diverse perspectives on how universities can support student success, as a suggested antecedent to longer-term retention. In one review, academic achievement, critical thinking, and wellbeing were identified as key to first-year student success (van der Zanden et al. 2018). Historically, this has changed over time, with a 10 year meta-analysis (1981–1990)

indicated grade point average, parental education, and age were the greatest predictors of student success (Campbell and Dickson 1996), with academic performance in high school still a key predictor of retention (Han, Farruggia, and Solomon 2022). In 2018, Sneyers and de Witte identify that interventions like academic probation, student–faculty mentoring, and need-based grants can influence both success and completion rates. Goldrick-Rab (2010) argues that policy beyond the individual level, and recommends for institution- and student-level reforms can support sustained student success.

More recently, approaches to student success and retention have extended on Tinto's (1975; 2006) work on attrition (or 'dropout') to focus on creating social integration opportunities for students. This has also extended to understanding the role that sense of belonging plays in creating environments students want to be in, and do well in (Strayhorn 2018). Kahu and Nelson (2018) in a proposed model of student engagement articulate that student engagement is the key to achievement, success, and retention. Within their model, they propose that four key psychosocial constructs on the educational interface are critical mechanisms that enable student engagement and success: self-efficacy, emotions, belonging, and wellbeing. In a later empirical test (Crawford et al. forthcoming), this model was held true across multiple geographical contexts; with belonging positioned as the key (negative) predictor of student intentions to leave along with student wellbeing. Bowden, Tickle, and Naumann (2021) with 952 students in an Australian university, confirm the model similarly with antecedents of expectation and involvement as key differences.

Belonging in tertiary student populations

Beyond retention and success, a sense of belonging to university has also been found to increase student well-being and reduce feelings of loneliness. The start of university can mark a major developmental shift in the life of a young adult associated as it is with social group changes, adjustments to social support, changes in relationships with parents, and social identity, which can result in feelings of loneliness and lead to further mental health problems including depression (Parker et al. 2020). This can be further exacerbated for international students or students from marginalised social groups, with diverse students identifying material boundaries that enabled social capital in permeability, content, and salience of symbolic boundaries as barriers (Buckley 2023). Under these conditions, the ability to successfully form new social bonds at university can not only provide a smooth transition to university but also ensure that feelings of loneliness and its associated negative outcomes can be prevented (Thomas, Orme, and Kerrigan 2020).

A major concern about higher education student belonging exists for students who feel they do not belong, or in this study are in the 'low' self-reported category of belonging. For example, in one study, it was identified students want their names to be known, as a manifestation that they perceive a relationship to exist between them and their teacher (Cooper et al. 2017). Research from two Australian universities highlights that some groups in particular, such as first-in-family, question their ability to succeed, or right to attend the institution in the first place (O'Shea 2021). While students with low belonging are a minority, perceptions of fit can vary and students from minority backgrounds are most at risk (Weng et al. 2021). For example, Chinese, Indian and Russian international students studying in Melbourne and Hobart had external factors beyond the university that affected their sense of belonging; such as geopolitical relationships between Australia and their home countries or the level of religious support they receive (Weng et al. 2021). International students may even benefit the most from a sense of belonging as belonging has been found to be a protective factor for resilience.

Other correlates of belonging found in Australian Universities specifically include associations with motivation, enjoyment, and retention (Pedler, Willis, and Nieuwoudt 2022). Student friendship networks, social connections, and having campus spaces for peer interactions and space to 'be themselves' also have significant associations with belonging (van Gijn-Grosvenor and Huisman 2020). Ahn and Davis (2020), using thematic analysis with 426 participants also extend to highlight

expectations that personal space and environmental surrounding influence student sense of belonging. In addition, students also report feeling respected, accepted, and valued when clubs and events are available to them. Young Ahn and Davis (2023) extend identifying that academic and social engagement influence belonging, but were independent of each other.

Current study

In Australia, there are 41 comprehensive universities, primarily public universities established by state-level Acts of Parliament. In 2022, Universities Australia reported that Australia has a below-OECD average public investment into university, and an above average private investment. In 2020, there were around 1.05 million domestic students and 413,088 international students, representing the fourth largest economic export for the country. Generally, the larger Australian universities occupy the top five per cent of universities on academic rankings globally, and out-represent most countries in the Times Higher Education Impact Rankings (2023). Across the country, the national Student Experience Survey (SES) is an annual survey conducted on behalf of the Federal Government that measures tertiary students' higher education experiences across six key indicators: overall educational experience, teaching quality, skills development, learner engagement, learning resources and support services (Social Research Centre 2022). Between 2013 and 2019, 1,431,083 responses have been received, with annual data collected and retained by the Australian government. This survey, like many others globally, highlights sustained lows in student belonging when contrasted to other experience metrics (e.g. the National Survey of Student Engagement: NSSE, 2021). As we go onto discuss, Australian institutions like others are seeking to respond.

The primary objective of this study is to identify the key predictors of students' sense of belonging in higher education and to understand how these predictors can be utilised to enhance student success, retention, and overall well-being. Drawing on data from the Australian national Student Experience Survey (SES), we focus on the Australian higher education context to provide insights applicable to a broader global audience. We employ a quantitative approach to examine the relationships between various factors related to student experiences and their sense of belonging, considering demographic information and historical data to determine the most influential predictors. By understanding these predictors, we aim to inform evidence-based strategies that can be implemented by tertiary institutions to create more inclusive and supportive environments for students, thereby fostering a stronger sense of belonging and yielding improved outcomes in terms of student success, retention, and well-being. Specifically What are the student experience predictors of a sense of belonging?

Method

The present study hypothesises that we can predict student belonging using the student experiences and demographics as major predictors. We do this through initially comparing four predictive models. This study uses large scale secondary data collected as part of the national Student Experience Survey between 2013 and 2019. Ali et al. (2021) provide critique on using national and local institutional student survey data without considering validity and reliability prior to data usage, and likewise considering the design and context of administration. In this study, we adopt these recommendations throughout.

Participants

The SES is administered annually online to all commencing and final year undergraduate and, since 2017, postgraduate (coursework) students enrolled at Australian HE institutions, including both domestic and onshore international students. In 2020, the scope of the survey was extended to include students who intended to be onshore at the time of the survey, but were studying

offshore due to government-imposed travel restrictions due to the COVID-19 pandemic. Commencing students are defined as first-year students admitted to a course who commenced study in the survey year and enrolled for at least one semester. Final year students are defined as final-year students admitted to a course and generally in their third year of study. While the data offers a somewhat historical analysis, it was essential for us that we gain baseline sense of belonging data without COVID-19 influences (Tice et al. 2021). This study offers a critical foundation in understanding what education was like before COVID-19, and indeed allows for us, or future scholars, to then test assumptions like these during and beyond the pandemic context. While there will be value in analysing the 2020 and beyond datasets, a clear pre-COVID-19 baseline is needed; of which this study offers. Indeed, there are several studies that refer to differences in belonging in the pre- and during-pandemic context, in this national survey, the approaches to inclusion criteria changed from 2020 to include a broader set of students. While this may be useful for future analysis, we opted to keep this dataset quarantined to a consistent set of controls around sampling.

A stratified sampling approach was employed, with strata defined on the basis of institution, study area, course level and stage of studies. However, as stratum-level results are reported at a level of precision of ±7.5 percentage points at a 90% level of confidence, the SES is effectively a census of commencing and final year students, except for those universities which offer a generalist degree (Social Research Centre 2022). Institutions are required to confirm that the selected students are in-scope. From 2013 to 2019 3,581,218 students received an invitation to participate in the SES. A total of 1,431,083 unique student responses were received, representing an overall response rate of 40%.

Measures

The SES was originally developed as the University Experience Survey (UES) in 2011, to provide a national architecture for collecting feedback on key facets of the HE student experience (Social Research Centre 2022). The UES items were selected based on the most relevant aspects of the student experience that research showed to be associated with positive learning outcomes for students in ways that could be generalised across all institutions, educational contexts and different demographic groups, and to focus on aspects of the student experience that can be shaped and influenced by universities (Radloff et al. 2011). The survey development process included extensive consultation with experts in the field and the sector more broadly, including focus groups with students. Prior to its implementation, the instrument underwent extensive face and content validation through a pilot with students, psychometric testing, a further review of items, and an independent technical review (Radloff et al. 2011). The UES was renamed the SES in 2015 to facilitate the inclusion of students from non-university higher education institutions. Other than minor wording changes to ensure survey relevance, the core SES questionnaire has remained relatively unchanged from the 2013 UES, consisting of 47 items across six focus areas: overall educational experience; teaching quality; learner engagement; learning resources; student support; and skills development. While there is unique value in the data prior to 2013, the differences in the tool prior to that period mean that there are different variables available only over some of the years, resulting in large scale missing data reducing the efficacy of our study. As such, we use data from 2013 onwards.

In this study, we excluded the items relating to careers advisors, other advisors, academic advisors, and English language support (from the student support subscale), and the items relating to laboratory or studio equipment quality and learning platform quality (from the learning resources sub-scale), because they were either only asked in a few timepoints, or they had very high missing or not applicable response rates (>30%). We did include the demographic variables available (listed in Table 1), although none were presented as high feature importance. A self-report student success measure (e.g. self-report GPA) was also included and was less performant than student experience items. The reliability for the SES subscales was consistently high, ranging from $\alpha = 0.74$ (engage subscale) to $\alpha = 0.93$ (teach subscale). The full instrument and extended sampling information are available in the Social Research Centre (2022).

Table 1. Description of sample.

	$n = 1{,}159{,}768^a$
Gender	
Female	737,072 (64%)
Male	422,060 (36%)
Indeterminate/Intersex/Unspecified	636 (<0.1%)
First in Family	
Not first in family	331,974 (29%)
First in family	257,098 (22%)
Not a commencing student	471,476 (41%)
No information	99,220 (8.6%)
Institution Group	
Group of Eight (Go8)	356,606 (31%)
Australian Technology Network (ATN)	181,445 (16%)
Innovative Research Universities (IRU)	176,572 (15%)
Regional Universities Network (RUN)	83,811 (7.2%)
Ungrouped	361,334 (31%)
Number of Years Enrolled	
More than four years	33,767 (2.9%)
Four years	58,800 (5.1%)
Three years	122,028 (11%)
Two years	160,350 (14%)
One year	141,835 (12%)
Less than one year	621,303 (54%)
Item skipped	21,685 (1.9%)
Proportion of Study Online	
None	195,256 (17%)
About a quarter	333,699 (29%)
About half	323,964 (28%)
All or nearly all	282,558 (24%)
Item skipped	24,291 (2.1%)
Feeling of belonging	
Not at all	31,019 (2.7%)
Very little	136,942 (12%)
Some	379,895 (33%)
Quite a bit	406,144 (35%)
Very much	205,768 (18%)
Highest Education of Parent/Guardian	
Not a commencing student	471,476 (41%)
Postgraduate qualification (e.g. Postgraduate Diploma, Masters, PhD)	131,689 (11%)
Bachelor Degree	124,501 (11%)
Other post school qualification (e.g. VET Certificate, Associate Degree or Diploma)	105,483 (9.1%)
Completed Year 12 schooling or equivalent	77,341 (6.7%)
Less than Year 12	109,005 (9.4%)
Don't know/not applicable/missing	140,273 (12%)

[a]n (%); Mean (SD).

Analysis

As the primary hypothesis related to prediction, we used an analysis approach consistent with evaluating the accuracy of predictions on future data (Parker et al. 2018). Importantly, prediction models and explanation models are fundamentally different, with social sciences rarely engaging in true prediction research. Our focus is on true prediction (i.e. prediction of unseen data). We collapsed the outcome variable to a binary indicator consisting of low belonging (those responding 'not at all' or 'very little') and those with more than low belonging ('some' or greater). We chose a dichotomous variable as it more closely aligns with the concerns of universities. That is, universities are concerned with accurately determining students who have low levels of belonging requiring intervention, and are less concerned with predicting a student's exact response. We used a training sample consisting of 80% of the available data, stratified by the outcome variable, with the remaining 20% of data used to evaluate the final models.

Models

To identify the most appropriate model, we evaluated the efficacy of four predictive machine learning modelling parameters using the training data: logistic regression (Friedman et al. 2021), random forest (Wright, Wager, and Probst 2021), boosted trees (Chen et al. 2021), and a neural network (Allaire and Chollet 2022). For each model, we performed hyperparameter tuning using five-fold cross-validation to reduce the risk of overfitting. Following the training, we selected the most performant model based on the F-measure (sometimes called the F1-score, Powers 2020). The F-measure is the harmonic mean of the precision and recall, and provides a better indicator of model performance than accuracy which can be misleading for unbalanced data. This allowed us to accurately select the appropriate modelling prior to examining the test data. To determine which features were most related with belonging, we examined the Gini index of variable importance. Variable importance is based on if the variable has positive influence on the prediction performance (Wright, Ziegler, and König 2016). In addition, we generated partial dependency plots for each item in the subscales. Partial dependency plots show how a prediction is influenced by a value of a variable. That is, as the variable changes value, what is the resulting effect on the prediction.

Results

Description of sample

The study includes annual survey responses between a low of 88,009 (7.6% response rate, 2013) and 211,163 (18% response rate, 2018). The respondents were primarily commencing students (59% first year), studying by internal/mixed mode (92%), were people without a disability (94%), domestic students (78%), and studying full-time (87%). The participants had an average age of 23.62 (standard deviation of 7.95), and only 1.2% identified as indigenous. Participants mainly came from an English-speaking background (77%) and studied at an undergraduate level (82%). For more specific descriptive sample statistics, see Table 1. When considering this against the national sample, we considered the Australian Government (2020)'s 2019 student tables, noting there were less students in the population that were commencing (40%), with less internal/mixed mode (84%), and 1.3% identified as indigenous.

Model evaluation

The metrics for the fit models is provided in Table 2. Hosmer, Lemeshow, and Sturdivant (2013) recommend a predictive accuracy for the area under the receiver operating characteristic (ROC) curve (AUC) of between 0.80 and 0.90, and all tested models met this criteria. On this basis, we conclude that our primary hypothesis is confirmed. That is, using national survey data we can predict student belonging with reasonable accuracy. The boosted trees model was the most performant across the majority of measures, and is the model used for further evaluation.

Feature importance

Figure 1 shows the eight most important variables in the boosted tree model. These are based on whether the variable has a positive influence on the prediction performance (Wright, Ziegler, and

Table 2. Model metrics comparison.

| Model	Accuracy	Precision	Recall	F Measure	AUC
Logistic Regression	0.78	0.38	0.78	0.51	0.86
Random Forest	0.78	0.38	0.81	0.52	0.88
Boosted Tree	0.79	0.39	0.80	0.52	0.88
Neural Network	0.78	0.37	0.80	0.51	0.87
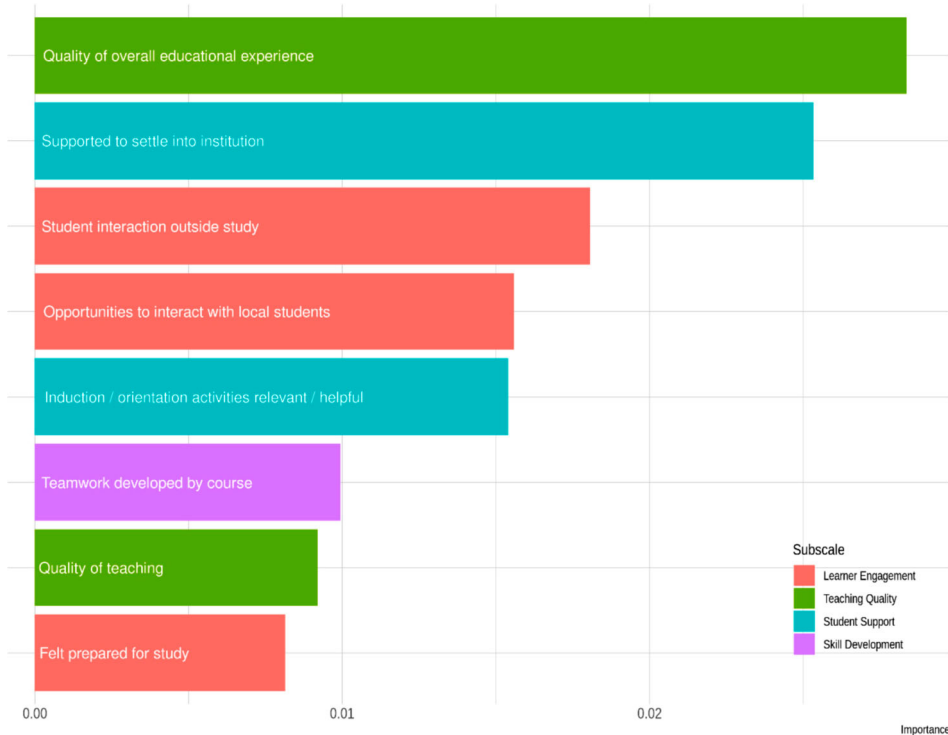
Figure 1. Top eight most important predictors of belonging.

König 2016). The quality of the overall educational experience (from the teaching quality subscale) and sense of support for settling into the institution were the most influential features in the model, with other variables having relatively minor influence. The relative variable importance was largely consistent across the boosted trees, logistic regression, and random forest models (data not shown). We did consider whether relative variable importance differed across undergraduate and postgraduate student. Results showed little meaningful differences in the most important features across course level.

Partial dependency analysis

In addition to variable importance, we also investigated how predictions are influenced by various levels of a predictor variable. That is, all other variables are held constant, and the effect of varying a single predictor on the probability of a prediction is measured. We used 25,000 iterations for each predictor variable to estimate the effect. The results are shown in Figure 2. We observe that for most items, the largest benefit to belonging is created by moving a student's response from the first or second value (from 'sometimes' to 'often' on four-point scales, and from 'very little' to 'some' on five-point scales). For most subscales, the partial dependency plots indicate a small number of areas which have drastic effects on the students who reported an either high or low sense of belonging.

Each subscale tended to have one or two items that had a stronger effect than others. In the *teaching quality* subscale, the quality of the overall educational experience was a strong contributor to changes in student belonging. The quality of student spaces from the *learning resources* subscale had clear differences in its predictive role. Interaction outside of study, and with local students, and preparedness for study were strong contributors to a sense of belonging (in the *learner engagement* subscale). It is not surprising that these have a contributory role, given that the sense of belonging
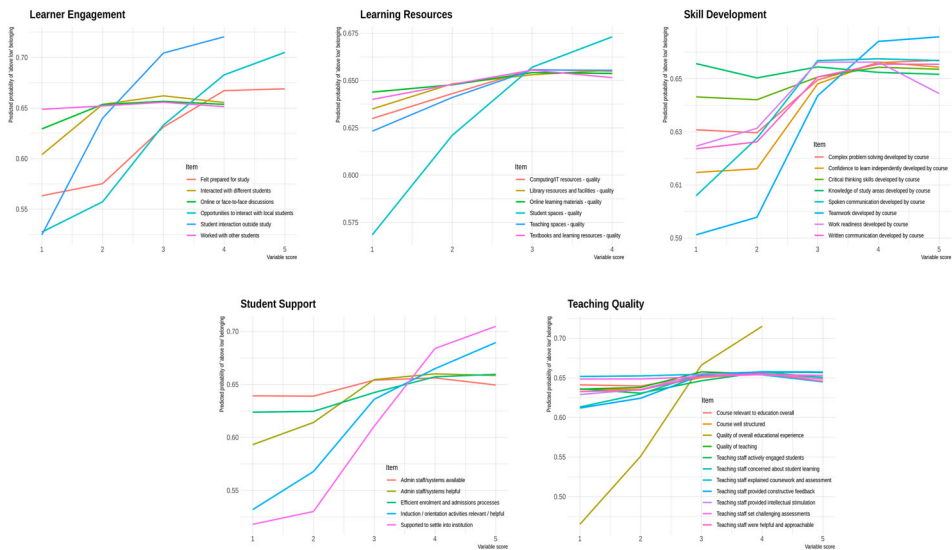
Figure 2. Prediction of above low belonging by subscale.

item sits inside of the learner engagement scale. The *skill development* subscale is the exception, providing a substantial number of areas which have a strong impact. Each of these is discussed in more depth within the discussion.

Discussion

Using the Australian SES dataset, the current study sought to determine which student experiences and student demographics predicted their sense of belonging. Of all the features, the self-reported overall quality of the students' educational experience was found to be the most important influencer of student belonging. This is an important observation, as the item asks, *overall how would you rate the quality of your entire educational experience this year?* (Social Research Centre 2022), which could be a form of general litmus test that students present their general feelings about their experience. Past research has found that the prospect of a better career is one of the driving factors for students' pursuing higher education (Balloo, Pauli, and Worrell 2017). This is also a factor found to determine student choice of university or course selection (Proboyo and Soedarsono 2015). Students may attach far greater importance to their educational experience, because this could be perceived as allowing them to fulfil or meet their career aspirations. An interesting contrast to this was the lower relationship between work readiness developed during the course and student belonging.

While results suggest a link between educational experiences and sense of belonging, it is important to note that other factors are likely to mediate this relationship. Poor educational experiences alone, for instance, may not be immediately influenced by the multidimensional construct of belonging or vice versa. The move to higher education can be a significant shift for students and many students can begin university with preconceived ideas for what their experience should look like (Hassel and Ridout 2018). These ideas may be based on their experiences in secondary school, and the misalignment between expectations and reality for some students can impact their sense of belonging or academic fit (Worsley, Harrison, and Corcoran 2021).

The second most influential factor for belonging was support for settling into the institution. The importance of general support in fostering belonging is well established in the literature and in a general sense, higher perceived support is linked with a greater sense of belonging (Allen et al. 2022). However, within the university context, the move to a tertiary institution can be particularly

challenging for students and as such, adequate support towards this transition, and predictive models for early detection (Hoffait and Schyns 2017) and a welcoming institution are essential for facilitating a sense of belonging.

Arguably the first source of support to settle into the institution may come from the family or prior educational contexts, which play a vital role in a student's transitional period. Given the importance of support for settling into the institution found in the current study, institutional mechanisms for a concerted and systematic way of offering support well before a student steps foot inside the university grounds (physically or online) may be beneficial to students. Navigating such support may be more crucial for the successful transition of underserved student cohorts such as those living with disability, those with culturally and linguistically diverse backgrounds, first generation students, or those with low socioeconomic backgrounds (McLean, Gaul, and Penco 2022). When individuals do not feel like they belong to their university they are more likely to also question their ability to succeed and even their 'right' to attend higher education in the first place (O'Shea 2021). Therefore it becomes important for institutions to be proactive in ensuring all students feel welcomed, accepted, and supported while settling in.

With respect to providing support to settle in, drawing on the existing strengths of student groups' support systems is key in providing such support. For example, Weng et al. (2021) found that for Chinese, Indian and Russian international students in two Australian cities, ethnic and religious community organisations offered an immense source of connectedness and belonging. Student groups with similar cultural needs were also important and thus institutions may wish to consider developing effective relationships with cultural and religious groups to enable students to practice their own cultural and religious beliefs while living abroad.

Entering university for the first time also tends to correspond with a major developmental and identity shift towards independence. While in this study, we allowed demographic factors that contribute to identity and individual differences in the machine learning dataset, they did not seem to be as important to a student's sense of belonging compared to their self-report ratings of factors of experience. This is perhaps quite a contrast to notions of identity-based belonging (e.g. Sulé and Brown 2023; Yuval-Davis 2006) worthy of future exploration. In the current study, opportunities for genuine connection were key to student belonging. Student ratings saw great incremental predictability at low levels of ratings associated with connection (opportunities to interact with local students, teamwork developed by course, student interaction outside of study), congruent with past research on the importance of peer support (Brouwer et al. 2022). Peers are a key source of support as students adjust to university, cope with stress, and academic demands. In addition, through group work and peer tutoring, university students also gain academic support which can enhance their educational experience and further foster belongingness. For many institutions, peer mentoring is a systemic support that facilitates peer interactions, and essential for a smooth transition to university. Such positive transitions ultimately lead to a greater sense of belonging (Worsley, Harrison, and Corcoran 2021). Socio-emotional interpersonal knowledge, gained through mutual disclosure, between members of a university community was found in one study to create a sense of community (Nistor et al. 2015), and the data in this study may reinforced their conclusions. Other systemic considerations include having places on campus for peers to interact and having clubs and events that facilitate social integration (van Gijn-Grosvenor and Huisman 2020).

Inductions and orientations were also great influencers of university students' sense of belonging. In the Australian context, orientations tend to be in the form of optional 'O-Week' activities the week prior to classes commencing. These environments tend to be coordinated by Student Associations and student experience departments, include free food, music, activities, and have heavy student involvement through societies. It may be that inductions and orientations provide a catalyst for making the first meaningful connection with new students, in an exciting on-campus environment, a key foundation to generating a sense of belonging (Baumeister and Leary 1995). Yet it appeared to suggest that development employment skills were less important, although this study did not stratify by demographics, and demographics have been shown to be predictive in this area (see Beasy et al. 2022).

All staff, but particularly those responsible for student learning may also have a role in facilitating peer interactions for the benefit of student belonging. In some ways, a focus on embedding opportunities to build social connection may align closely to conversations of community building that exist in different higher education jurisdictions (e.g. Dawson 2006). Staff professional development training emphasising the importance of belongingness in students is critical, especially in appreciating that belonging is dynamic and for many individuals, relational (Guyotte, Flint, and Latopolski 2021). Tice et al. (2021) found that even online, strengthening belonging was possible and that a core mechanism for maintaining belonging – even during uncertain times such as lockdown orders – was through facilitating peer interactions. And while some scholars report challenges for student belonging in online environments (e.g. DiGiacomo et al. 2023; Miller-Young, Jamieson, and Beck 2023; Mueller, Andrew, and Connor 2022), this was challenged in this dataset, with relationships between sense of belonging and student experience as more important.

The role of student skill development was found to have negligible benefits for belonging in the current study, and this comes in direct conflict with current assumptions around one key tenet of the transition pedagogy, which emphasises the importance of skill development for student belonging (Kift, Nelson, and Clarke 2010). This would suggest that rather than a focus on embedded critical literacies and skill development, a greater emphasis on connectivity would support students to transition to an institution they felt a sense of belonging to. Student skills developed in class, such as discipline knowledge, critical thinking, complex problem solving, and written communication had low incremental changes on their predictive effect on sense of belonging, whereas skills such as teamwork, confidence to learn independently, and spoken communication development in class were those that saw the greatest improvement over time for belonging. This finding highlights the importance of belonging-based skill and competency development in students specifically related to belonging, social skills, and building peer networks. Skills and attributes that help students relate, and develop a sense of relatedness, to others become very important for belonging alongside opportunities (Allen et al. 2021).

Strengths, limitations, and future directions

Given the importance of belonging in student motivation, retention, and enjoyment in studies (Pedler, Willis, and Nieuwoudt 2022) this paper provides a rigorous analysis of factors that predict belonging in higher education. The study is strengthened by a large sample size (exceeding one million participants), measured over multiple years (2013–2019), and the use of true prediction (i.e. prediction of unseen data). The latter is not frequently done in social science research. The study however was limited by drawing data from a single item measure of belonging, positioned within an engagement index.

In the literature, engagement and belonging are considered as very distinct and separate constructs (O'Brennan and Furlong 2010). Limitations also exist due to the nature of secondary data analysis. Because belonging is multifaceted and dynamic it is likely predicted by many more variables explored in the study. Future research on university policies, programs and learning contexts are needed to fully understand the variables that can be influenced and manipulated to build belonging through higher educational leadership (O'Shea 2021).

Despite these limitations, this study is strengthened by its large-scale longitudinal dataset having more than one million student respondents across almost one decade of higher education. To our knowledge, this is the largest scale study conducted on the predictors of belonging using longitudinal data and machine learning to develop predictive models. This study provides direct mechanisms for university policy developers and educators to respond to historically low levels of student belonging globally, using a national dataset. This is consistent with some calls to focus more on relational approaches to pedagogy to build belonging (Graham and Moir 2022). An interesting direction of future research relates to the skill development effects on a sense of belonging, which were considerably lower than other predictors. Indeed, a deeper understanding of the conflict that exists with

this finding and that of the transition pedagogy is important in supporting diverse student cohorts to transition effectively into higher education.

There is a growing consensus towards understanding belonging as a multifaceted and dynamic (as opposed to static) process involving multiple spaces and experiences of connectedness (Guyotte, Flint, and Latopolski 2021). This implies that we can expect that individual student's sense of belonging may fluctuate as they progress through their university experience, it seems the full dataset does not show that commencing versus final year, and undergraduate versus postgraduate students were not as performant as student experience variables. Generally, we would also expect the experiences of belonging to change in different spaces (physical/ virtual; class/cohort/program/university), for students from different backgrounds (e.g. international students: Weng et al. 2021), first in family students (O'Shea 2021) and to be influenced by the resources that are made available to foster belonging; yet these seemed less important in the dataset than ratings of student experience. This is perhaps related to what students perceive as 'belonging' and may call for deeper analysis with a wider range of subset questions for sense of belonging, as in studies like Naylor, Baik, and Arkoudis (2018).

The national survey data provides only one snapshot of belonging annually, and using a single-item that may be subjective to student perceptions of what it means to feel a sense of belonging. While this is perhaps beneficial to foster a genuine student voice void of academic interpretation, it does present the possibility of divergence between scholarly and student perspectives of belongingness. Universities that want to measure belonging should consider doing so at different time points and even consider experience sampling methodology, or a question battery, to facilitate this. This, of course, also is a limitation of the data. The data is typically captured at the same time point annually, and is situated in Australia only; meaning that while the data represents incredibly diverse and multicultural students, they are all based in Australia. The data is also specifically pre-COVID-19 to minimise the influence that the pandemic is having on students. We encourage future studies to baseline their COVID-19 results against these pre-pandemic indicators of belonging.

An important extension of the theory of the need to belong identified by Baumeister and Leary (1995) emerged from the current work, suggesting that there may be a minimum need for belongingness, and once that minimum need is met, further relationships have diminishing value. In the current study, there were a series of items that created rapid improvements in predictivity at low levels (the scores of 1 and 2 typically); however, they tended to plateau and sometimes decline in the higher levels (scores of typically 3, 4, and 5). We measured and tested belongingness as a binary state of low and above-low, and it seemed that the differences that appeared once a person had satisfied the threshold criteria of above-low, the model did not go on to see significant changes in most items. This perhaps provides evidence that belonging as a need once satisfied does not typically go on to be more deeply satisfied or increase feelings of belongingness once that need is met. This is perhaps a useful question to pose regarding sense of community in parallel; that is, whether sense of community has a saturation point with diminishing returns beyond.

Conclusions

This study sought to leverage the national Student Experience Survey data to better understand the predictors of student belongingness in higher education. Through the use of boosted tree predictive modelling, with high accuracy (0.79), we were able to use the national survey data to identify predictors of student belonging. Overall educational experience, support to settle, student interaction outside of study and with local students, inductions and orientations, course-developed teamwork, quality of teaching, and sense of preparedness were the top predictors of a student's sense of belonging. We found that skill development, while having a contributory role in sense of belonging, were generally lower in their predictive effect than others. This study contributes to the knowledge base on belonging in higher education by applying novel methods to a large-scale dataset to better understand what predicts a sense of belonging. Beyond this method, we begin to identify and rank the performance of institutional and curriculum supports that foster student belonging, and provide direct

opportunities for higher education policy makers and curriculum developers to embed supports that can enable students more opportunities to develop a sense of belonging on and off campus.

Disclosure statement

No potential conflict of interest was reported by the author(s). This manuscript was developed and written without any artificial intelligence support.

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