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The influence of supervisors and peers on PhD students' sense of belonging and their success at Kenyan universities

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Abstract

Purpose – Given declining tuition funds and government grants, Kenyan universities need to develop strategies, including increased research grants and collaborations, to diversify their income sources. Well-managed doctoral students can boost a university's teaching and research outputs. However, numbers of students enrolled in doctoral programmes at Kenyan universities are low, and graduation rates and time-to-graduate statistics are disturbing. Research undertaken elsewhere underline the important role played by supervisors and peers in facilitating students' sense of belonging and their success. Therefore, this study aims to investigate the influence of supervisory and peer support on PhD students' sense of belonging and their success at Kenyan universities.

Design/methodology/approach – In this cross-sectional study, data were gathered through an online questionnaire from 614 students admitted to doctoral programmes at Kenyan universities between 2010 and 2018. We used multi-item scales to collect data on PhD students' self-efficacy, supervisory and peer support and a sense of belonging.

Findings – Structural equation modelling results revealed that PhD students' modes of study and self-efficacy were significantly associated with the quality of supervision, peer support and a sense of belonging. However, only age, a sense of belonging and the quality of supervision were directly linked to their success.

Originality/value – This study contributes to the literature on doctoral-level education, responding to the need for research on the influence of relationships with supervisors and peers on PhD students' sense of belonging and their success, especially in developing countries.

Keywords PhD completion, Attrition, Supervisory support, Peer support, Sense of belonging

Paper type Research paper

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Introduction

In an era of increased globalisation and internationalisation, Kenyan universities must now compete globally for limited research resources, potential students and opportunities to collaborate. Increasingly, government funding is tied to outputs and requires justification in terms of research outputs and number of graduates (Ferrer de Valero, 2001). Governments, potential students, development partners and project collaborators use university rankings to evaluate universities objectively, with research outputs featuring prominently in most universities' rankings. However, the research outputs of Kenyan universities are constrained by a lack of qualified academic staff (Commission for University Education, 2020). For example, in the 2023 Webometrics rankings, the University of Nairobi, at a ranking of 1,069, was the highest-ranked Kenyan university (Ranking Web of Universities, 2023 – www.webometrics.info/en/Ranking_africa). Postgraduate students, especially at the doctoral level, can potentially increase a university's research outputs and consequently its ranking. However, enrolment and graduation rates in doctoral programmes at Kenyan universities are low, and the few students who persist with their studies take a long time to publish their work and graduate. Consequently, their research contributions are limited.

The process of obtaining a doctoral degree is a long, lonely and challenging one. The doctoral trajectory entails a transition from more structured, lecturer-led programmes at the bachelor's and master's levels to relatively unstructured, autonomous and highly demanding programmes (Gittings *et al.*, 2018). This transition can be experienced as stressful and isolating. Researchers have identified several factors that contribute to doctoral students' attrition. They include individual psychological and non-psychological characteristics, supervision-related factors, lack of a sense of belonging to the department and limited availability of facilities and support structures (Bair and Haworth, 2004; Rockinson-Szapkiw *et al.*, 2016; Sverdlik *et al.*, 2018). Other studies have shown that feelings of isolation and a lack of engagement of doctoral students are predictive of their attrition or delayed graduation (Rockinson-Szapkiw *et al.*, 2016; Tinto, 2017; Sverdlik *et al.*, 2018). There is a consensus among scholars that supervisor–student relationships play a critical role in the decision to leave or persist. However, studies have increasingly highlighted the important role of peers and other departmental staff, who facilitate students' integration into the department and university (Tinto, 1993, 2017; Bair and Haworth, 2004; Rockinson-Szapkiw *et al.*, 2016; George *et al.*, 2018; Sverdlik *et al.*, 2018). These studies have found that relationships within the academic community are vital aspects of doctoral students' lives, as they determine students' levels of connectedness with their departments, universities and professions. However, most of these studies have been conducted in developed countries, and none have included Kenyan universities. To address this research gap, we conducted a cross-sectional study to investigate the influence of supervisors and peers on PhD students' sense of belonging and success at Kenyan universities.

Theoretical framework

Although Tinto mainly focused on undergraduate students' persistence, he developed a longitudinal model of doctoral persistence (Tinto, 1993, 2012; see also Welhan, 2000; Gittings *et al.*, 2018; Ruud *et al.*, 2018). In this model, he categorised factors influencing doctoral completion into student attributes (experiences, background and financial resources), entry orientations (goals, commitment and financial assistance), institutional experiences (engagement with academic and social systems) and research experience (research opportunities, relationships with faculty and advisers and financial support).

He found that students' attributes, which were linked to their entry orientations, determined their engagement levels. Experiences relating to academic and social systems influenced doctoral students' perceived connectedness with their departments and institutions.

Doctoral students' background characteristics

Many studies have shown that doctoral students' background characteristics (e.g. age, gender, financial support, nationality, employment status and self-efficacy) influence their success (Jiranek, 2010; Groenvynck *et al.*, 2013; Maher *et al.*, 2020), though specific findings are mixed. Some studies reported that students below a certain age (30 or 40 years) are more successful than their older counterparts (Groenvynck *et al.*, 2013; Johnson-Motoyama *et al.*, 2014), whereas others found that age does not influence students' success (Wright and Cochrane, 2000). Gender appears to have a limited effect on progress, as studies have shown that male and female students are equally successful (Wright and Cochrane, 2000; Parker, 2005).

Family commitments and major life events can delay doctoral degree completion and lead to attrition (Khozaei *et al.*, 2015; Maher *et al.*, 2020). Financial support critically influences the success of doctoral students (Jiranek, 2010; Herman, 2011; Wao and Onwuegbuzie, 2011; Mohamed *et al.*, 2012; Van der Haert *et al.*, 2014; Khozaei *et al.*, 2015; Geven *et al.*, 2018). However, findings on the influence of employment status on doctoral students' success vary. Thus, Gittings *et al.* (2018) found that doctoral students who were employed full time were more likely to complete their studies. In contrast, other scholars have found that employment can impede students' progress, especially if the job location is not the university (Herman, 2011; Wao and Onwuegbuzie, 2011).

Supervision

Supervisors play a key role in doctoral students' trajectories (Latona and Browne, 2001; Pitchforth *et al.*, 2012). Students' relationships with their supervisors are often cited as among the most critical factors influencing the doctoral trajectory (Bair and Haworth, 2004; Moxham *et al.*, 2013; George *et al.*, 2018). In a comprehensive review of factors influencing doctoral programme completion, achievements and well-being, Sverdlik *et al.* (2018) found that of all of the factors they identified in their review paper, supervision was the most widely researched. They concluded that the strength of this relationship depends on supervisor–student compatibility, effective feedback mechanisms, the frequency of meetings and support provided by supervisors.

Doctoral supervision is dynamic, as it entails dealing with individual students with varying needs and expectations at different stages of their programme. Therefore, supervisors must adapt their role and style accordingly. However, this is a difficult task, as it requires simultaneously balancing the roles of adviser, project manager, examiner, critic, research methodology guide and provider of emotional support (Dobson, 2012; Moxham *et al.*, 2013). The supervisor has a duty to mould the student into an independent researcher, while ensuring that the doctoral project timeline is met. Studies have shown that this relationship, if poorly managed, can cause delays or even the termination of doctoral studies. Therefore, supervisors must understand their roles, be competent and adapt their roles to specific situations and individual students' needs (Moxham *et al.*, 2013; Lindsay, 2015).

Existing studies have highlighted many facets of effective supervision. They include numbers of supervisors and their availability; their experience and expectations; the frequency and quality of feedback as well as the academic and personal support that they

provide; the level of their commitment to their students' projects; and their engagement in the students' research field (Trigwell and Dunbar-Goddet, 2005; Moxham *et al.*, 2013; Khozaei *et al.*, 2015). Khozaei *et al.* (2015) identified three areas in which supervisors could either be enablers or constrain students' progress. These areas are their relationships with their students, their expertise in the subject matter and their availability and commitment. Whitelock *et al.* (2008) noted that positive interpersonal interactions are critical for the development of independent scholarship, fostering trust and enhanced abilities to think and act creatively during the doctoral research process. Furthermore, Trigwell and Dunbar-Goddet (2005) identified the quality of supervision and awareness of assessment requirements as important influencers of the completion rate of British postgraduate students.

Lindsay (2015) found that students who experienced a change of supervisors and those whose supervisors were emotionally unsupportive or provided unconstructive feedback had problems finalising their theses. Conversely, those who had a good relationship with a supervisor who was a highly qualified and renowned researcher were at an advantage. Furthermore, Doctoral students in Lindsay's study reported that they worked well with supervisors who adopted a functional style (assuming the role of project manager). They expected supervisors who adopted this approach to offer academic and personal support to help them to navigate the doctoral journey, while remaining cognisant of their need for autonomy.

Peer support

Given the considerable amount of time and effort expected of students, doctoral studies can be isolating. The heavy workload leaves limited time for social events and activities (Orellana, 2016). In addition, students have limited opportunities for interactions with their peers and can face isolation in the absence of departmental or university-wide academic and social events (Tinto, 2017; Sverdlik *et al.*, 2018). A lack of supportive departmental relations can contribute to their attrition (Lovitts, 2001; George *et al.*, 2018). Conversely, Bair and Haworth (2004) found that departments with formal and informal structures for interaction and effective communication evidenced increased retention and completion rates. Nicpon *et al.* (2007) noted that social support influences students' persistence and successful completion. However, they did not find any relationship between social support and academic achievement.

According to Tinto (2017), not only supervisors but also peers and other university staff contribute to fostering a student's sense of belonging. However, a culture of engagement among doctoral students is best cultivated at the departmental level through physical or online interactions with colleagues. This support differs from supervisory support, as it is non-hierarchical. Tinto concluded that universities and departments could accelerate the integration process by establishing systems and structures that promote a culture of inclusivity. For example, departments could organise peer-to-peer writing support groups to help doctoral students during the dissertation-writing process and provide an avenue for socialising (Ferrer de Valero, 2001; Lindsay, 2015).

Sense of belonging

A sense of belonging entails a feeling of connectedness, signifying acceptance as a valued member of a group. Studies on higher education have shown that a sense of belonging is linked to academic success and persistence in the completion of undergraduate and postgraduate degrees (Baxter, 2012; Castaño-Muñoz *et al.*, 2013; O'Keeffe, 2013; Strayhorn, 2020). Tinto (1993, 2012, 2017) underscored the importance of students' integration and

engagement within their university communities, arguing that students need to feel that they belong, are needed and matter. Van Rooij *et al.* (2019) also found that a sense of belonging is significantly related to PhD students' satisfaction levels and their intention to drop out of their programmes. In another study, Maher *et al.* (2020) reported that the likelihood of attrition was high among students who felt isolated and out of place in their departmental or laboratory-based community.

Relationships with supervisors and peers are key antecedents of students' sense of belonging (O'Keeffe, 2013; Asamenew, 2019) and doctoral programme completion (Meeuwisse *et al.*, 2010). Formal and informal interactions with peers and departmental staff contribute to a sense of belonging among doctoral students, and their supervisors facilitate their connectedness by introducing them to the department, university and professional environments (Bair and Haworth, 2004). Zahl (2015) found that interactions with peers, integration into a community of practice and feeling of connectedness are most effective at the departmental level, encouraging students' perseverance towards graduation.

The present study extends existing theory by linking PhD students' success to a sense of belonging, effective supervision and peer support in a developing country, specifically Kenya. Figure 1 depicts the research model.

Research questions

This paper aims to address the following broad question:

Q1. To what extent do PhD students' background characteristics and factors relating to supervision and peer support contribute to their sense of belonging and success?

Our hypotheses were as follows:

H1. Younger PhD students achieve significantly greater success than their older counterparts.

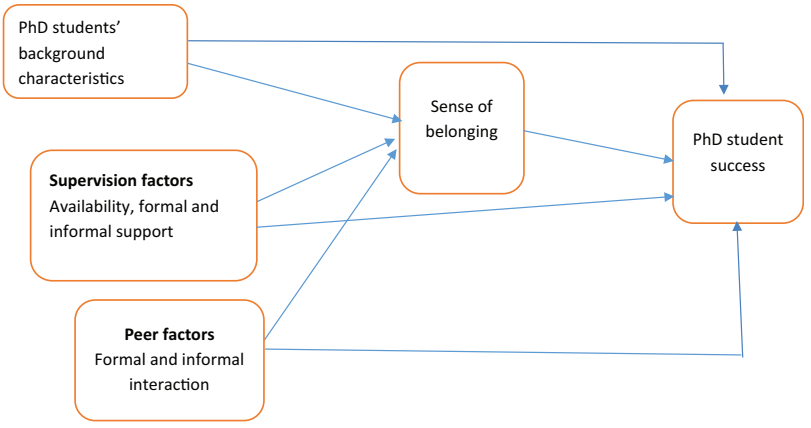

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Figure 1.
Research model

H2. PhD students who receive more supervisory and peer support have a significantly stronger sense of belonging than those who receive less supervisory and peer support.

H3. PhD students who have a stronger sense of belonging achieve significantly more progress than those with a weaker sense of belonging.

Methods

Study design and data collection

We obtained data on PhD students by administering a large online survey using the Sosci Survey (online tool). All respondents provided informed consent before accessing the survey, and the study proposal was approved by Kenya's National Council for Science and Technology. We used the online questionnaire to collect data on students' progress relating to their PhD trajectory, their relevant background characteristics, their perceptions of supervisory and peer support and a perceived sense of belonging. We used multi-item scales to collect data on PhD students' self-efficacy, supervisory and peer support and a sense of belonging. Four scales were used to assess students' PhD supervision experiences: supervisors' availability, support for autonomy, academic support and personal support. Two scales were used to measure formal and informal peer support. Table 1 presents the scales characteristics and reliabilities.

Background characteristics

We focused on five background characteristics: age, gender, mode of study, self-efficacy and programme cluster. We used single items for the following parameters: age, gender, mode of study and programme of study. Programmes were grouped into five clusters identified by the Commission for University Education (2020). Self-efficacy was assessed using the general self-efficacy scale (Chen *et al.*, 2001), which had a Cronbach's alpha coefficient of 0.90, indicating good reliability.

Sense of belonging

To operationalise the students' sense of belonging, we adapted a scale developed by Meeuwisse *et al.* (2010) for undergraduate students. The reliability test scores were high, as shown in Table 1.

Supervision-related factors

We examined four supervision-related factors: supervisor availability, support for PhD students' autonomy and academic and personal support. To measure these factors, we used scales developed by Overall *et al.* (2011). All the scales indicated satisfactory reliability (see Table 1).

Peer-related factors

We investigated formal and informal peer support, which we measured using scales developed by Meeuwisse *et al.* (2010). Although these scales were developed for undergraduate students, we adapted them to fit the context of PhD students (see Table 1 for scale characteristics).

To determine the construct validity of supervision experiences and peer support, we first performed an exploratory factor analysis (EFA). We selected the number of factors following the Kaiser–Guttman rule (those with eigenvalues >1), interpretation of the scree

Factor	Sample item	No. of items	Cronbach's alpha
Sense of belonging factor			
Sense of belonging	I enjoy/enjoyed the atmosphere in my department	5	0.944
Supervisory factors			
Supervisor availability	My supervisor provides/provided me with prompt feedback whenever I submit written work to him/her	3	0.922
Supervisor academic support	My supervisor helps/helped me to plan and manage the different research tasks I have to complete	10	0.935
Supervisor personal support	My supervisor behaves/behaved warmly towards me when discussing my research and/or any problems I am experiencing	8	0.957
Supervision autonomy	My supervisor listens/listened to how I would like to do things	8	0.844
Peer factors			
Peer formal support	It is/was easy to find colleagues to collaborate with	8	0.938
Peer informal support	I know/knew people in my university department quite well	4	0.859

Source: Authors' own creation

Table 1. Measurement characteristics of the sense of belonging, supervision and peer factor variables used in this study

plot and the content of the factors. Because we assumed that the above two factors were correlated, we applied an oblique rotation method (Promax). After conducting the EFA, a confirmatory factor analysis (CFA) was performed using the R package, lavaan (Rosseel, 2012) to determine whether the supervision and peer support scales adequately represented two distinct factors. The CFA results showed an acceptable fit (CFI = 0.987, TLI = 0.976, RMSEA = 0.074, SRMR = 0.026). The perceived PhD supervision factor accounted for 71.3% of the variance in the four scales and the peer support factor accounted for 62.8% of the variance in both scales. Considering these results, we decided to use standardised scores for both factors in our analysis to assess the influence of supervision and peer support on students' sense of belonging and their PhD trajectory.

Students' success

We operationalised students' success as actual progress made compared with progress they should have made (Matheka *et al.*, 2020). The students' actual study duration (from their start date to their graduation date or a cut-off point of 31 December 2018) were compared against the official PhD programme duration of 48 months (36 months plus a one-year extension) to obtain the success variable. We delineated this variable into four categories: on track, delayed by one year, delayed by two years and delayed by three or more years. We classified students who took 48 months or less to graduate as being on track; those who took 49–60 months were considered delayed by one year and so on. For continuing students, we compared the expected milestone or output with the actual milestone or output attained by 31 December 2018. For example, a student who reported an output of "undertaking coursework" and a study duration of 48 months would be considered to be in the first year of the programme, indicating a two-year delay.

We collected data on 621 students' progress regarding their PhD trajectories. However, as seven respondents did not name their programmes, we ultimately analysed data from 614

respondents across five programme clusters (Table 2). Of the 614 students, 476 supplied additional background data on their gender (171 female and 305 male students), age (mean = 46.4 years, SD = 8.04) and self-efficacy. These students also supplied information on their experiences during their PhD trajectory.

To explore any differences between the group of students who supplied additional information on their self-efficacy, sense of belonging and PhD experiences and the group that did not provide such information, we conducted a logistic analysis using the GLM in the SPSS package. We specified a binary dependent variable (provision of these data), coded "yes" or "no" and used gender, programme cluster, financial sponsorship and success as predictors. The results of this analysis indicated that readiness to provide additional data was not significantly associated with programme cluster (Chi-square = 6.76, df = 4, p = 0.15), gender (Chi-square = 0.27, df = 1, p = 0.60) or mode of study (Chi-square = 3.25, df = 1, p = 0.07). However, sponsorship (Chi-square = 5.40, df = 1, p = 0.02) and students' success (Chi-square = 12.49, df = 3, p = 0.006) were significantly associated with readiness to respond to the questionnaire items. Sponsored students were somewhat more willing to provide information. No significant differences in readiness to provide information were found between students on track and those with a study delay at the 5% level. Overall, only a slight bias was found in the provision of information by students who responded to the questionnaire.

PhD students' success across programme clusters

Four categories of student success were delineated: on track, a one-year delay, a two-year delay and a delay of three or more years. We analysed students' success for each programme cluster (see Table 2).

Table 2 shows that the majority of the students were in programmes in the humanities and social sciences (43.3%), followed by business and economics (25%). Numbers of students in programmes in the physical and life sciences were lowest (6.3%). Overall, 29.2% of all PhD students were on track, approximately two-thirds were delayed by at least one year and 25.8% were delayed by three or more years. Almost half of the students in programmes in the physical and life sciences were on track compared with only one-fifth of those in programmes in the humanities and social sciences and one-third in programmes in the medical sciences.

Table 2. Student' progress in their PhD trajectory per programme cluster

Students' success	Programme cluster: Humanities and social sciences (%)	Business and economics (%)	Physical and life sciences (%)	Applied sciences (%)	Medical sciences (%)	Total (%)
Delayed three or more years	35.9	15.1	13.3	18.6	27.5	25.8
Delayed two years	23.3	25.2	16.7	27.1	25.5	24.2
Delayed one year	20.9	23.5	23.3	17.1	17.6	20.8
On track	19.9	36.1	46.7	37.1	29.4	29.2
Total	43.3	25.0	6.3	14.7	10.7	100.0

Source: Authors' own creation

Research sample characteristics

Table 3 presents descriptive data on the research sample. The average age of students was >40 years, and most students reported high levels of self-efficacy.

Analysis

We aimed to assess the extent to which students' background characteristics and their perceived supervisory and peer support directly and indirectly influenced their sense of belonging and success. Our analysis comprised two phases. In the first phase, we evaluated the relevance of these factors by computing their correlations with the students' sense of belonging and success. We selected factors that were significant at the 1% level for inclusion in a subsequent path model.

In the second phase, we developed a path model that would summarise all direct and indirect effects of the relevant background and supervision and peer support factors on students' sense of belonging and their success. The following procedure was used to develop the path model using the lavaan package in R (Rosseel, 2012). First, we specified direct causal paths for background characteristics and supervisory and peer support factors to the students' sense of belonging and success as well as direct causal paths for their background characteristics to the supervisory and peer support factors. Next, we assessed the significance of all the paths and removed non-significant ones. We used the overall Chi-square test, the RMSEA and standardised residuals to assess the fit of the final model.

Results

Relevance of the variables

We assessed the relevance of background variables for inclusion in our analyses by inspecting correlations of background characteristics and supervision and peer variables with PhD students' sense of belonging and success. Table 4 displays these correlations.

As Table 4 shows, age was significantly correlated with experiences of peer support and success in the students' trajectory. The mode of study was significantly correlated with the students' sense of belonging and their success. This result indicates that full-time PhD students had a significantly stronger sense of belonging, experienced higher levels of peer support and made better progress compared with part-time PhD students. Similarly, PhD students with high self-efficacy scores experienced significantly higher levels of supervision, peer support, a sense of belonging and success. Gender and sponsorship were not significantly correlated with any of the variables at the 1% level and were, therefore, excluded from further analyses. PhD students with higher levels of supervision and peer support experienced a significantly stronger sense of belonging and more success. Similarly, students' peer support and supervision were significantly correlated.

Variables	Mean	Standard deviation
Age (29–68 years)	46.42	8.04
Self-efficacy (scale 1–5)	4.22	0.52
Sense of belonging (scale 1–5)	3.68	0.87

Source: Authors' own creation

Table 3. Descriptive characteristics of the research sample

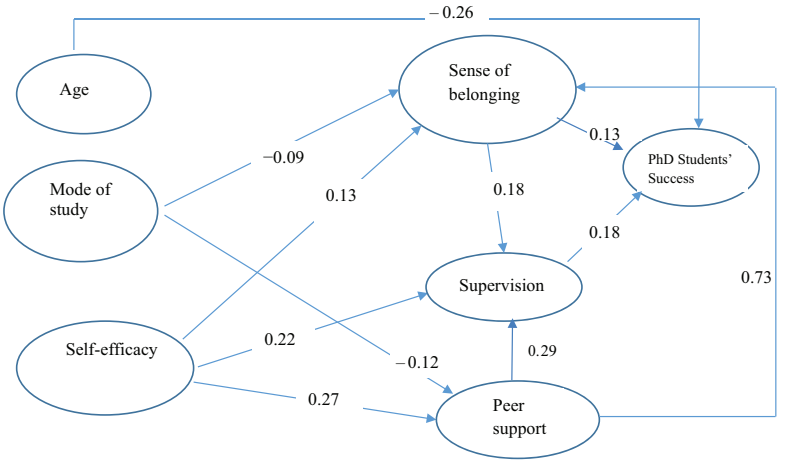
According to the results shown in Table 4, we developed a path model, including only variables with significant correlations to either a sense of belonging or students' success. We first specified direct causal paths for background and supervisory and peer support factors to the students' sense of belonging and success as well as direct causal paths for the background factors to the supervisory and peer support factors. Next, we assessed the significance of all paths and deleted non-significant ones. The resulting model had an acceptable fit (Chi-square = 6.76, df = 7, p-value = 0.45, goodness-of-fit index = 0.995, RMSEA = 0.000). The smallest and largest standardised residuals had values of −1.64 and 1.4, respectively. The model, shown in Figure 2, explains 62.5% of the variance in the sense of belonging and 14.7% of students' success. To elucidate effect sizes of the included factors and their relevance, the model included standardised path coefficients.

Figure 2 shows that students' success in the PhD trajectory depended on factors relating to age, a sense of belonging and the quality of supervision. The extent to which students experience supervision significantly depended on their self-efficacy, whereas peer support was affected by self-efficacy and the mode of study. Peer support is crucial in many ways; it affects the supervision that students receive and experience directly and indirectly by

Table 4. Correlations of the background characteristics, supervision and peer variables with sense of belonging and PhD students' success

Variables	Supervision	Peer factor	Sense of belonging	PhD students' success
Gender	0.053	0.041	0.049	−0.003
Age	−0.061	−0.101*	−0.083	−0.281**
Mode of study	−0.069	−0.144**	−0.202**	−0.122**
Sponsored	0.052	0.059	0.075	0.092*
Self-efficacy	0.357**	0.277**	0.339**	0.176**
Supervision	–	0.488**	0.477**	0.262**
Peer factor	0.488**	–	0.776**	0.233**

Notes: *Significant at the 0.05 level (two-tailed); **significant at the 0.01 level (two-tailed)
Source: Authors' own creation



Source: Authors' own creation

Figure 2. Structural equation model of PhD students' background characteristics, supervision and peer support, sense of belonging and PhD students' success

increasing their sense of belonging. Peer support itself is affected by students' mode of study; part-time students experience less peer support. Table 5 shows the direct and indirect effects of the various factors on PhD students' success.

Discussion

In our research question, we aimed to determine to what extent background characteristics and supervisory and peer support factors contribute to PhD students' sense of belonging and success. Our results indicated that three background characteristics, namely, age, mode of study and self-efficacy were significantly associated with PhD students' sense of belonging and success. Younger students graduated significantly faster than their older counterparts, whereas full-time students and those reporting greater self-efficacy experienced a stronger sense of belonging than their counterparts.

PhD students who received high levels of peer support had a significantly stronger sense of belonging. Although PhD students' supervision had no significant effect on a sense of belonging, those with a strong sense of belonging experienced better supervision. Although studies have emphasised the value of supervision and peer support in enhancing social integration and a sense of belonging (Meeuwisse *et al.*, 2010; O'Keeffe, 2013; Asamenew, 2019; Wairungu and Maina, 2021), only peer support was significant in our study. Tinto's (1993) longitudinal model of doctoral persistence posits that social and academic integration precedes doctoral degree candidacy, which influences a doctoral student's research experience, including the supervisory relationship and outcome. Our results, which indicated that a sense of belonging and integration influence PhD students' experiences of supervision and indirectly their success, confirm this finding.

Furthermore, we found that intense supervision significantly coincided with PhD students' success. This finding is in line with that of various researchers who have emphasised the importance of adequate supervision for doctoral students' success (Khozaei *et al.*, 2015; Sverdlik *et al.*, 2018) and will benefit universities looking to boost their PhD students' sense of belonging and success. Contrary to expectations, peer support had no significant direct effect on PhD students' success.

Upon testing the first hypothesis, our data indicated that a student who was 15 years older than their fellow students experienced a half-year delay relative to younger students, thus supporting H1. These results support Johnson-Motoyama *et al.* (2014) and Groenvynck *et al.* (2013), who found that younger students progress faster than their older counterparts. Further research is required to understand the challenges faced by older PhD students and to design possible interventions. Policies and programmes that encourage students to pursue their PhD studies at younger ages could be designed and implemented within the education sector.

Variables	Indirect effect	Direct effect	Total effects
Age	0	−0.26	−0.26
Mode of study (full-time = 1, part-time = 2)	−0.03	0	−0.03
Self-efficacy	0.11	0	0.11
Sense of belonging	0.03	0.13	0.17
Supervision	0	0.18	0.18
Peer support	0.27	0	0.27

Source: Authors' own creation

Table 5. Standardised indirect and direct effects of factors on PhD students' success

Other background characteristics, such as gender and financial sponsorship, were not significantly associated with experiences relating to supervision, peer support and a sense of belonging. This finding supports that of Thune *et al.* (2012), who noted that the progress of PhD studies does not differ significantly among men and women. Contrasting with other studies that reported a correlation between financial support and PhD progress, we did not find any relationship between the two variables, possibly because scholarship funds do not fully support students' needs, especially as most students are mature and have families. Moreover, scholarships may lack strict progress-related controls (e.g. funds disbursement tied to acceptable progress). These two factors may limit the role of financial aid in improving PhD students' progress.

Our data provide partial support for H2, namely, the expectation that PhD students receiving a high level of supervisory and peer support have a significantly stronger sense of belonging. We found that peers play an important role in improving PhD students' sense of belonging to their departments and universities, as emphasised by Lindsay (2015) and Lovitts (2001). Therefore, PhD students' sense of belonging can be enhanced through formal and informal interactions among peers. This finding supports that of other studies on factors influencing a sense of belonging (Meeuwisse *et al.*, 2010; O'Keeffe, 2013; Asamenew, 2019). Our results provide university leaders with an opportunity to improve PhD students' sense of belonging by influencing the quality and quantity of peer interactions (e.g. organising formal and informal events, especially at the start of the PhD trajectory).

Our data supported H3. As reported by other scholars, PhD students' sense of belonging is related to their success. Previous studies have shown that a strong sense of belonging is associated with persistence, success and a strong academic self-concept (Meeuwisse *et al.*, 2010; Curtin *et al.*, 2013; Maher *et al.*, 2020). We found that factors other than age that affect students' progress are a sense of belonging and intense supervision, which can decrease students' time to graduate by two to five months.

This study also had limitations. First, it relied on self-reporting, which may have been biased by individual circumstances of responding. In addition, the respondents were from Kenyan universities. Thus, although generalisation is possible, careful consideration of doctoral study contexts is required. For instance, differing from PhD students in many European countries, those in Kenya are generally older, lack employment contracts with their universities and usually perform full-time jobs alongside their PhD projects, which greatly limits the amount of time available to spend on their doctoral studies and opportunities for social interaction. These circumstances could explain the weak effects of a sense of belonging and peer and supervisory support on PhD students' success.

Conclusion

This study set out to establish the extent to which the background characteristics and factors relating to supervision and peer support of PhD students contribute to PhD students' sense of belonging and success. Three of the background characteristics studied, namely, age, mode of study and self-efficacy, were significantly associated with the sense of belonging and success of a student. Further, we report that age, a sense of belonging and quality of supervision significantly related to students' success. Students' sense of belonging was buttressed by high levels of peer support even though peer support itself did not significantly contribute to student success. The study also established an inverse relationship between age of the student and success, an issue that needs further study to establish the underlying factors delaying older students. These findings are important for universities aiming to improve doctoral students' connectedness and success.

We recommend a longitudinal study following a PhD student cohort, which combines self-reported data and university records to investigate factors influencing PhD completion in Kenyan universities. Future studies could also include qualitative research that explores how factors influencing success affect Kenyan students' study behaviours during different phases of the PhD trajectory.

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