Connecting Online: Can Social Networking and other Technology Support Doctoral Connectedness?

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Keywords

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Abstract

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Keywords

Sense of community, online learning, social integration, connectedness

1. Introduction

Historically, face-to-face doctoral attrition rates across disciplines in the United States have been reported at 40% to 60% (Bowen & Rudenstine 1992; National Center for Educational Statistics 2000; Sowell 2008). In education graduate programs, which are the focus of this study, the rates of attrition and time to completion are estimated to be even higher (National Science Foundation 2009; Wao & Onwuegbuzie 2011). Some researchers suggest that attrition rates are as high as 70% (Nettles & Millet 2006). Attrition rates for online programs in the United States (Rovai 2002; Lovitts 2001) and, more specifically, online doctoral programs (Terrell 2005; Terrell, Snyder & Dringus 2009) are reported to be 10% to 20% higher than those for traditional programs. Doctoral disengagement and attrition is detrimental to the student, the university and society, as it results in emotional distress, a limited number of job applicants and financial costs (Lovitts 2001; Vekkaila, Pyhältö & Lonka 2013; Wao & Onwuegbuzie 2011). While there have been numerous attempts to understand attrition and, in turn, to implement interventions to decrease it and increase persistence in traditional doctoral programs, less research has focused upon the phenomenon of online doctoral attrition, and fewer still have examined ways to increase persistence (Rockinson-Szapkiw 2012; Terrell Snyder & Dringus 2009). It is, therefore, imperative for researchers, faculty members and administrators to identify methods to increase online doctoral students' persistence.

Researchers have suggested that doctoral students who are socially integrated into the institution are more likely to persist (Earl-Novell 2006; Herzig 2002; Hoskins & Goldberg 2005; Ivankova & Stick 2007). Social integration is the result of students' sense of connection with their peers and faculty members. Hoskins and Goldberg (2005) defined connection as "the establishment of a relationship or the failure to do so, with faculty members or fellow students and a judgment of the quality of that relationship" (p.183). When students experience a feeling of connectedness with their peers and faculty members, they are more likely to feel a sense of belonging, trust, mutual interdependence and dedication to the community (Rovai 2002).

Connectedness, in turn, influences doctoral students' decisions to persist in a program (Terrell Snyder & Dringus 2009). Walker et al. (2008) and Anderson, Cutright and Anderson (2013) suggest that connectedness, especially with faculty members, is critical to students' development as scholars as well as their perceptions about the program. Thus, research examining tools for fostering doctoral students' connectedness during the dissertation phase of the degree are essential, especially for those in online programs, where isolation and loneliness are themes in the doctoral journey (Rockinson-Szapkiw 2012) and attrition rates are significantly higher than for traditional programs (Terrell 2005). Accordingly, this study examined the relationship between the use of social media and networking tools with peers and faculty members and the sense of connectedness reported by online doctoral students.

2. Literature Review
2.1. Reasons for Doctoral Attrition
Persistence and attrition, both face-to-face and online, within and outside the United States, have been attributed to a variety of factors. In the online environment, researchers have documented that feelings of isolation, personal and family issues and low levels of interaction with faculty members and peers lead to the decision to drop out (Ali & Kohun 2006; Golde 2005; Hackman & Walker 1990; Olgren 2004; New Media

Consortium 2006). Similarly, Ivankova and Stick (2007) identified seven primary factors that influenced persistence in one distributed doctoral program: advising, support services, the program, the environment, the faculty, a sense of community and internal motivation. And, although the decision to withdraw or persist is complex, research demonstrates that social and academic integration into the university are key contributors to this decision (Hall 2011; Tinto 1993). In fact, lack of integration into universities located in the United States, Australia, and Finland has been identified as a primary reason for doctoral-student attrition in a number of studies (Erwee, Albion & van der Laan 2013; Golde 2005; Terrell et al. 2009; Vekkaila, Pyhältö & Lonka 2013). This is consistent with what Tinto (1993) posited: a graduate student who fails to integrate into his or her university's academic and social communities is more likely to drop out.

2.2. The Need for Social and Academic Integration to Increase Doctoral Persistence

Persistence is "shaped by the personal and intellectual interactions that occur within and between students and faculty members and the various communities that make academic and social systems of the institution" (Tinto 1993, p.231). Golde (2005) explained this by saying that for doctoral students to persist, they need to integrate into the university at the macro-environment level (i.e., integration into the discipline and the department) and the microenvironment level (i.e., interaction with peers). Doctoral students need to experience a sense of connectedness with the discipline and the department as well as have meaningful interactions with peers and faculty members if they are to choose to persist (Erwee, Albion & van der Laan 2013). Similarly, Baird (1993) suggested that the process of socialisation to the professional role, including learning the specific skill set and embracing the attitudes, standards, ethics and interests of the profession, is necessary for success in a doctoral program. Critical agents in this process include doctoral candidates' faculty members and peers, and this process requires interaction among them. Social interactions with faculty members and peers within doctoral communities across types of programs (e.g. traditional and online), disciplines and countries result in personal connections; and thus, social and academic integration (Lee & Choi 2010; Vekkaila, Pyhältö & Lonka 2013; Wao & Onwuegbuzie 2011). Alternatively, low levels of interaction result in a low sense of community and feelings of alienation, which in turn create a decreased commitment to the university and hinder persistence (Motteram & Forrester 2005; Rovai 2002).

2.3. The Need for Sense of Community and Connectedness to Increase Online Doctoral Persistence

In the online environment, Rovai (2002) explained that sense of community is foundational, and significantly influences retention. He stated, "Online learners who have a stronger sense of community...should feel less isolated and have greater satisfaction with their academic programs, thereby resulting in fewer dropouts" (p.328). Moreover, student satisfaction is one of the five pillars identified by the Sloan Consortium for the development of effective online learning programs (Moore 2005), and student satisfaction is undergirded by a sense of belonging to an academic community (Overbaugh & Nickel 2011).

Early research defined a generalised sense of community as relating to relationships that reflect students' spirit, trust, safety and interdependence. McMillan and Chavis (1986) defined community as "a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together" (p.9). Hall (1996) noted that a sense of

community might be very different from one setting to another, which suggests that the construct of sense of community is setting-specific. Overbaugh and Nickel (2011) concurred, writing that "underlying the purported need for academic community in online learning is the notion that traditional, or face-to-face, courses have inherent elements that will lead to some level of community, whereas online courses do not" (p.165). This suggests that there are inherent elements of the physical environment that foster community; however, opportunities to development a sense of community in an online setting need to be intentional, especially on the part of the faculty and university, to overcome the environmental deficiencies (Overbaugh & Nickel 2011; Rovai, Wighting & Lucking 2004). Terrell, Snyder and Dringus (2009) agreed, recognising that the online doctoral persistence rate is less than desirable, and that a need exists to identify interventions that increase student-to-student and student-to-faculty connectedness and thus foster persistence. Terrell et al. (2009) used the term "connectedness" interchangeably with "community", and asserted that "the more conducive a community is to the support of student goals and needs, the less likely the student is to leave the program prior to graduation" (p.113). Therefore, interventions aimed at fostering community or doctoral connectedness in online programs need to provide students with a place to find support, develop friendships, receive and give encouragement and grow academically. Doctoral students, especially those external to the campus, need to be provided with networking opportunities aimed at connecting them with faculty "supervisors" and learning communities of peers within the university (Erwee, Albion & van der Laan 2013). In addition, they need to be aimed at both the macro-environment and the microenvironment (Golde 2005).

2.4. The Need for Community in the Dissertation Phase of the Doctoral Program
Doctoral programs in the United States usually include three stages: the course work, the comprehensive examination, and the dissertation. The first two stages are designed to prepare students for a successful transformation from autonomous to self-directed learners. In the final stage, the dissertation stage, students develop as self-directed learners, and ultimately, into scholars. The process as a whole poses significant challenges (Ponton 2009), with doctoral students reporting a unique set of challenges specific to the dissertation phase. In a phenomenological study examining factors related to doctoral persistence, many participants reported floundering in the dissertation phase as they struggled to adapt to an environment that was no longer instructor-led with assigned research topics or imposed deadlines (Spaulding & Rockinson-Szapkiw 2012). While loneliness and isolation are identified in the literature throughout the doctoral journey (Lovitts 2001), these experiences intensify during the dissertation phase (Spaulding & Rockinson-Szapkiw 2012). This stage is arguably when students need more student-to-student and student-to-faculty interaction and support than any other, given the associated challenges with transitioning from an autonomous course-taker to a self-directed scholar.

2.5. Technology Integration
Computer-mediated communication (CMC) systems are varied. They include synchronous and asynchronous systems that are text- or video-based and allow for bidirectional and multidirectional communication. For example, social-networking sites such as Facebook and Twitter are asynchronous multidirectional programs with synchronous capabilities for text-based communication (Gunawardena et al. 2009); in contrast, a system such as Skype and FaceTime are synchronous video chat programs.

Mentor (2011) found that connectedness among a small group of graduate students was developed through the use of the most basic bidirectional technology of texting. With technological advancements, building an online learning community using the more advanced multidirectional technologies is a reality, and has the potential to enhance connectedness as online doctoral students and faculty members interact (Lamport & Bartolo 2012; Rovai 2002; Wenger 1998). CMC systems used in the online classroom have been shown to facilitate community and, depending on how closely the medium mimics face-to-face communication, simulate face-to-face interactions among students and faculty members (Boulos, Taylor & Breton 2005; Childress & Braswell 2006; Rockinson-Szapkiw et al. 2010; Sanders et al. 2007). At the doctoral level, Rockinson-Szapkiw (2012) found that introducing an asynchronous, collaborative communication system into the dissertation process increased doctoral candidates' satisfaction and sense of connectedness.

With the increased adoption of CMC tools (Pempek, Yermolayeva & Calvert 2009), researchers have become interested in examining the use of CMC technologies, specifically social-networking technologies, as a means for supporting community and university integration among students outside the classroom (Rockinson-Szapkiw 2012). Heiberger and Harper (2008) and HERI (2007) found positive relationships between undergraduate, residential students' social networking use and university integration. For example, the higher percentage of time a student spent social networking, the more time the student spent engaging in on-campus activities and organisations. Further, HERI (2007) reported that those who used social networking with greater frequency had stronger connections to their on-campus peers offline. These studies have been limited and have primarily focused on residential, undergraduate students. In a qualitative study examining the needs of asynchronous online doctoral students, Grooms (2003) found that doctoral students desired to have occasional interactions with their classmates using synchronous CMC systems. These findings are consistent with those of Boulos, Taylor and Breton (2005), who reported that students requested a delivery approach of 95% asynchronous and 5% synchronous. The respondents desired to occasionally engage in interactions outside the classroom environment with other students and faculty members informally, such as in online town hall meetings and electronic bulletin boards (Grooms 2003). The results were interpreted as a need for connectedness. This finding supports the notion that online doctoral students desire to have more personal exchanges with other students that closely mimic face-to-face interactions and increase a sense of community.

2.6. Summary of the Literature
With high doctoral-student attrition rates having detrimental effects on the student, the institution and society, research examining methods for fostering community, and thus increasing persistence, is necessary. With the growing trend in online doctoral programs across disciplines, especially in the United States (Allen & Seaman 2011), research examining tools for fostering doctoral students' connectedness during the most challenging phase of the process (i.e., the dissertation phase) are essential, especially for online programs, where isolation and loneliness are prominent themes (Rockinson-Szapkiw 2012) and attrition rates are significantly higher (Rovai 2002; Terrell 2005). As students have widely adopted various communications technologies and, consequently, these technologies can potentially become a valuable resource to support their educational communications and collaborations with faculty members, this study examined the use of university- and student-initiated communities hosted via social-

networking technology and their relationship with online doctoral candidates' sense of connectedness with peers and university faculty members.

3. Material and Methods

3.1. Participants

The participants consisted of 132 doctoral candidates enrolled in an online doctor of education program in the Commonwealth of Virginia, USA. Graduates from this program complete 60 credit hours of courses, nine of which they are required to take in residence as week-long intensive courses. Participants in this study were enrolled in a dissertation course between Spring 2012 and Autumn/Fall 2012. Seventy-five participants (56.8%) were using a quantitative methodology for dissertation, and 57 (43.2%) were using a qualitative methodology. The sample consisted of 93 (70.5%) females and 39 (29.5%) males. Twenty-one (15.9%) were African-American, 99 (74 %) were Caucasian, six (4.5%) were Latino and six (4.5%) classified themselves as "other". They ranged in age from 25 to 69, and 111 (84.1%) reported being married. The majority were employed in the field of education as K-12 teachers, K-12 administrators or university faculty members.

This sample size of 132 was sufficient for both statistical and research-design conventions (Cohen 1988; Swanson & Holton 2005). Conventions for a causal-comparative research design suggest a minimum of 20 participants per group (Swanson & Holton 2005); a priori power analysis based on a medium effect size suggested that the sample consist of 128 participants (Cohen 1988).

3.2. Setting

Participants were enrolled in an online prospectus-development course in which they earned three credit hours and were eligible to enroll only after successful completion of the doctoral comprehensive examination. The course was taught via the Internet using the Blackboard[SM] e-learning system and the Microsoft SharePoint system. These systems each have an integrated set of asynchronous application tools that were used to teach the course. The course was one eight-week term, and the aim of the course was for candidates to individually develop a dissertation prospectus. The course was taught by one of six Doctor of Education program faculty members who were considered experts in research methodology (two Caucasian females and four Caucasian males). After successful completion of this course, the students move into an online proposal-development course under the guidance of their dissertation committee.

Nine sections of the course were sampled, and each section consisted of no more than 20 candidates. Each week candidates completed instructional tasks that were designed to either (a) socialise them to the dissertation process or (b) further the conceptualisation and development of their individual dissertation prospectus. Activities and assessments relating to the dissertation process addressed the Institutional Review Board (IRB) process, program-specific dissertation procedures (e.g., securing a chair, submitting committee paperwork, required technologies) and avoiding plagiarism. Assignments that focused on prospectus development included peer reviews, a small-group mock defense and submission of the prospectus for instructor review and feedback. The course is a pass/no-pass course, and all assignments must be completed for students to earn a pass and continue in the dissertation process under the advisement of a dissertation chairperson and two committee members.

When students enter the dissertation process, they are encouraged to join the School of Education Facebook page, which is managed by the School of Education administration. The Facebook page provides information about peer and faculty accomplishments (e.g., publications, presentations and awards), events at the university, updates about the program, tips for the dissertation process and discipline-specific opportunities (e.g., grant opportunities, webinar events and presentation opportunities). Candidates post comments and questions in reply to the university-initiated posts. Candidates are also encouraged to use the technologies of their choice to connect with peers with whom they have formed relationships during classes. Students choose to connect via the phone, e-mail and web technologies such as Skype, Facebook and Twitter.

3.3. Instrument
The primary instrument for this study was the Doctoral Student Connectedness Scale (DSCS) (Terrell, Snyder & Dringus 2009). The instrument has 18 self-report items, such as *I feel that students currently working on their dissertation care about each other*, *I feel that I am encouraged to ask questions to the faculty about the dissertation process* and *I feel connected to other students in the program who are working on their dissertation*. Participants respond to each item on a five-point Likert-type scale: *Strongly agree*, *Agree*, *Neutral*, *Disagree* and *Strongly disagree*. The instrument consists of two subscales connectedness scores, student-to-student and student-to-faculty, that range from 9 to 45. The overall connectedness score ranges from 18 to 90. Higher scores reflect a higher sense of connectedness. The results of a principal-components analysis with oblique rotation confirmed that the two subscales were dimensions of connectedness (Terrell et al. 2009). Cronbach's coefficient alpha for the full connectedness scale was .87 (Terrell et al. 2009). In the present study, Cronbach's coefficient alpha for the full scale and the student-to-student and student-to-faculty subscales were .95, .92 and .92, respectively. For the first analysis, the full-scale score was used. In the second analysis, which focused on student connections, student-to-student connectedness was used.

The DSCS was used with permission and embedded in a faculty-developed online survey that included questions about demographics and online interaction. The independent variables of interaction with the university and peer interaction in the first analysis were measured using the following questions: "Are you currently participating (reading and posting comments and questions) in the School of Education's Facebook page?" and "Do you have a group of peers with whom you interact with on a regular basis (e.g., weekly, monthly, daily) outside of your course work?" Participants answered "yes" or "no" to each question. If participants answered "yes" to the peer-interaction question, they were prompted to answer two additional questions about the frequency and type of interaction. These additional questions served as the independent variables for the second analysis. The question "If you do have a group of peers with whom you interact with on a regular basis, how often do you interact?" measured the frequency of peer interaction. Potential responses included *daily or weekly, monthly, every six months* and *yearly*. The question "If you do have a group of peers with whom you interact with online on a regular basis, how do you interact most often?" measured the main medium candidates used for peer interaction. Potential responses included phone*, e-mail, web-based technology (e-conferencing: Webex, Skype)* and *web-based technology (social networks: Twitter, Facebook)*. There was also an option for *other* and a blank box for further explanation. Twenty-two students chose this option, indicating that they used both Skype and Facebook equally.

3.4. Procedures

The online survey was made available to participants during the final week of the dissertation prospectus development course. The survey was a course requirement, as its primary function was program improvement. The survey data for the present study was accessed as archival data after Institutional Review Board approval was sought and given.

3.5. Research Design and Analysis

As the independent variables were not manipulated and the intent of the research was exploratory, a causal-comparative design was used. Two research questions were examined, and two two-way analyses of variances (ANOVAs) between groups were used to analyse the data. The goal of the first analysis was to determine if doctoral candidates' sense of connectedness (student-to-student and student-to-faculty) differed based on their self-reported interaction with the university-facilitated Facebook page (yes, no) and their self-reported interaction via technology with their peers outside of the classroom (yes, no). The second analysis focused on candidates who reported interacting with their peers outside of the classroom ($n = 92$); the purpose of the analysis was to determine if the frequency of peer interaction (daily/weekly or monthly) and type of medium used for interaction (phone, e-mail or web-based technologies) influenced doctoral candidates' sense of student-to-student connectedness.

Prior to conducting statistical analyses, assumption testing was completed; it revealed no major violations. Boxplots demonstrated no concerns with extreme outliers, and histograms showed that normality was acceptable. The results of Levene's test of equality of error provided evidence that the assumption of homogeneity of variance across groups was tenable. Effect size was calculated using the eta squared (η^2), and Cohen's (1988) conventions were used for interpretation: .01 for a small effect, .06 for a moderate effect, and .14 for a large effect.

4. Results

A two-way between-groups ANOVA was conducted to explore the influence of doctoral candidates' interaction with the university-facilitated Facebook page and interaction with peers on their sense of connectedness with students and faculty members. The interaction effect was not significant, with $F(2, 127) = .83$, $p = .36$. Additionally, the main effect for interaction with the university did not reach statistical significance, with $F(2, 127) = .11$, $p = .75$. Scores for sense of connectedness did not significantly differ for candidates who participated on the university-facilitated Facebook page ($M = 73.71$, $SD = 14.76$, $n = 48$) and candidates who did not ($M = 72.39$, $SD = 14.11$, $n = 83$). However, there was a statistically significant difference for the main effect of interaction with peers, with $F(2, 127) = 9.01$, $p = .003$, eta squared = .07 and observed power = .85. Doctoral candidates who reported using technology to interact with peers outside the classroom ($M = 75.86$, $SD = 13.03$, $n = 92$) had a higher sense of connectedness with their peers than doctoral candidates who did not use technology to interact with peers ($M = 65.82$, $SD = 14.93$, $n = 39$). The effect size was moderate.

An additional two-way between-groups analysis of variance (ANOVA) was conducted to determine if the frequency of interaction and type of medium doctoral candidates used to interact influenced their student-to-student connectedness. The interaction effect

between the type of medium and frequency of interaction was not significant, with $F(2, 88) = 1.38$, $p = .26$. Further, the main effect for frequency of interaction did not reach statistical significance, with $F(2, 88) = .12$, $p = .73$. Scores for sense of connectedness did not significantly differ for candidates who reported interacting on a weekly or daily basis with their peers ($M = 37.73$, $SD = 8.61$, $n = 59$) compared to candidates who reported interacting on a monthly basis with their peers ($M = 36.71$, $SD = 8.08$, $n = 35$). However, there was a statistically significant difference for the main effect of type of medium used for peer interaction, with $F(2, 88) = 3.42$, $p = .04$, eta squared = .07, observed power = .63. As 23 students noted that they frequently used both Skype and Facebook as their primary medium for peer interaction, the web-based technology option was analysed as one variable instead of two as the question had asked. Post-hoc comparisons using Tukey HSD demonstrated that doctoral candidates who used web-based technologies to interact ($M = 41.00$, $SD = 5.90$, $n = 32$) had a higher sense of student-to-student connectedness than doctoral candidates who used the phone ($M = 32.93$, $SD = 10.02$, $n = 14$), $p = .006$, and e-mail ($M = 36.21$, $SD = 5.90$, $n = 48$), $p = .03$. Doctoral candidates who used e-mail to interact did not significantly differ from those who used the phone.

5. Discussion

This study focused on doctoral candidates participating in a United States-based, online doctor of education program engaged in the dissertation process. The purpose of this study was to examine the use of university and student-initiated interactions via social-networking technology and their relationship with online doctoral candidates' sense of connectedness with peers and university faculty members. Findings suggest that candidates who used social-networking technologies to interact with peers outside of the classroom reported a higher sense of connectedness than those who did not interact using these technologies outside of the classroom. Further, candidates who used web-based communication technologies such as Skype, Facebook and Twitter demonstrated a stronger sense of connectedness with their peers than those who chose to interact with peers via the phone or e-mail. The frequency of interaction with peers did not influence the candidates' feeling of connectedness. Given the previously established positive relationship between sense of connectedness and doctoral students' persistence (Terrell 2005), these findings are foundational to stakeholders in the process. Given the relationship between connectedness and persistence (Earl-Novell 2006; Herzig 2002; Hoskins & Goldberg 2005; Ivankova & Stick 2007), online doctoral students committed to completing the process can reduce their risk of attrition by initiating and maintaining community with their peers through interaction using web-based technologies (e.g., Skype and Facebook).

Further, findings suggest that while frequency of interaction does not necessarily influence connectedness, the type of medium for interacting does, with web-based social-networking systems being more effective than phone or email. With this knowledge, it is prudent for online doctoral students attending a program with a three-stage process to foster relationships with their peers during the structured-coursework phase of their doctoral program. Doctoral students should take care to nurture and maintain these supportive relationships through web-based social media systems throughout the largely unstructured dissertation phase of their degree, where connectedness is most needed and essential to persistence (Rockinson-Szapkiw 2012). Faculty members can play a role in this process by providing opportunities to connect and to socialise during courses through collaborative assignments and discussion forums dedicated for social

interactions. For online programs that require several courses in residence, faculty members and program administrators can encourage and foster peer relationships through sponsoring cookouts and other social gatherings outside of the formal classroom.

Faculty members could also consider integrating social-networking communication requirements in their course design. As the findings indicate, 30% (n = 39) of the candidates surveyed in the dissertation phase of their doctoral degree reported that they did not use technology to interact with peers. These candidates also reported lower feelings of connectedness than their peers who interacted using technology. Activities facilitating student-to-student and student-to-faculty interaction using social media *during* the term of the course may serve to foster student-initiated interaction that continues *after* course completion.

While many doctoral programs include coursework, providing opportunities for faculty members to integrate social-networking opportunities into their course design, in countries like Australia and the United Kingdom programs may not include traditional or structured coursework, and students may thus have fewer opportunities to develop relationships and connectedness with their peers. Given the already well-established relationship between connectedness and persistence (Terrell, 2005; Terrell, Snyder & Dringus 2009), social-networking technologies may supply a forum or context for students in such programs to develop supportive peer relationships that in other programs may be initially developed within a classroom, or even within a structured online learning environment. As this present study suggests that candidates in the dissertation process who interacted with peers using social-networking technologies reported a higher sense of connectedness than those who did not interact using these technologies outside of the classroom, it may be of value for students in programs that do not require traditional coursework to seek opportunities to foster relationships with their peers in the dissertation phase or earlier through social-networking technologies. Faculty members overseeing programs without traditional coursework may consider integrating social-networking communication requirements into their programs at strategic intervals (e.g., entrance into the program) and with strategic purposes (e.g., grouped by similar research focus or similar methodology).

The non-significant relationship between student interaction via the university-sponsored Facebook page and sense of connectedness between peers and faculty members may be explained by how the Facebook site is facilitated. The Facebook page referenced in this study is primarily facilitated by one faculty representative in the doctoral program who interacts with students. However, the primary interaction on the site consists of student-to-student interaction in response to a university post. Few doctoral faculty members post or interact with students on the site. Student-to-faculty connectedness could potentially be increased if faculty members interacted on a regular basis with students. Faculty members teaching in online programs may not be readily familiar with computer mediated-communication systems and their utility for fostering connectedness in online learning environments (Rovai 2002; Wenger 1998). Thus, university administrators may need to make greater efforts to increase faculty awareness of how interaction through tools such as social-networking technologies can translate into greater connectedness, and their significant implications for bridging what Tinto (1997) referred to as the "academic-social divide" (p. 610), which is essential for fostering persistence. More faculty training in using and integrating online technologies into courses may also be needed.

6. Limitations

Generalisability is limited, as results are limited to the participants studied within a specific university located in the United States offering an online, education doctoral program. The small number of minority participants also limits application to diverse populations. While the concern of lack of connectedness, disengagement and attrition is one that extends across the boundaries of countries, types of doctoral programs and disciplines (Vekkaila, Pyhältö & Lonka 2013; Wao & Onwuegbuzie 2011), results and related conclusions should be applied with caution, taking these limitations to generalisability into account. This caution is especially important considering that connectedness may be conceptualised differently across countries. Using the Doctoral Student Connectedness Scale (DSCS) (Terrell, Snyder & Dringus 2009) to examine external doctoral students enrolled in an education and business program in Australia, Erwee, Albion and van der Laan (2013) found a three-factor solution of connectedness, instead of the two-factor structure noted in previous studies conducted in the United States. Thus, future studies are needed that examine the influence of online doctoral students' interactions via peer-initiated and university-initiated technology on their sense of connectedness, and that include a balance in social-cultural representation, as well as a focus on international traditional and online programs. Future studies may also further explore the definition and conceptualisation of connectedness across types of programs and countries.

This study used a causal comparative design; thus, the selection threat to validity due to non-equivalent groups is an inherent limitation. This limitation was minimised by examining a homogeneous group based on variables such as demographics, course and degree level; however, the selection threat to validity still existed. Outcomes could be explained by alternative hypotheses resulting from pre-existing group differences. As preferences for interaction and desire for community varies across students, it is possible that students' sense of connectedness was based on preference. Thus, preferences for connection may be a moderating or mediating variable that needs to be considered in future research. Experimental research is also needed to determine a cause-and-effect relationship between web-based interaction and sense of connectedness. Future causal comparative studies could use methods such as matching participants between groups or using statistical controls to further minimise the selection threat to validity. Future research may also consider examining how the different features of Facebook can be used to foster connectedness.

7. Conclusion

Findings from this study revealed that doctoral candidates who reported using technology to interact with peers outside of the classroom had a higher sense of connectedness with their peers than doctoral candidates who did not use technology to interact with peers. Further, doctoral candidates who used web-based technologies to interact had a higher sense of student-to-student connectedness than doctoral candidates who used the phone and e-mail to interact. While previous research on the relationship between social-networking technologies and connectedness has generally focused on undergraduate, residential populations (see Heiberger & Harper 2008; HERI 2007), these findings address a gap in the literature examining the strategic use of social-networking technologies to foster connectedness among online doctoral candidates. This study adds to the emerging knowledge base on online doctoral persistence given the established

role connectedness plays in student integration into the university and the long-documented relationship between student integration and persistence (Lovitts 2001; Tinto 1975; 1993; Wao & Onwuegbuzie 2011).

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