

Article

Cohort-Based Education and Other Factors Related to Student Peer Relationships: A Mixed Methods Social Network Analysis

Rebecca L. Mauldin ^{1,*} , Liza Barros-Lane ², Zachary Tarbet ¹, Kayo Fujimoto ³ and Sarah C. Narendorf ⁴

¹ School of Social Work, The University of Texas at Arlington, 211 S. Cooper, Arlington, TX 76019, USA; zachary.tarbet@mavs.uta.edu

² School of Social Work, University of Houston Downtown, Houston, TX 77002, USA; lanel@uhd.edu

³ Department of Health Promotion & Behavioral Sciences, School of Public Health, The University of Texas Health Science Center at Houston, Houston, TX 77030, USA; kayo.fujimoto@uth.tmc.edu

⁴ Graduate College of Social Work, University of Houston, Houston, TX 77204, USA; sanarendorf@uh.edu

* Correspondence: rebecca.mauldin@uta.edu

Abstract: Graduate students face a variety of stressors that relate to poor academic performance, lower completion rates, and high rates of depressive symptoms, anxiety, and stress. Student peers provide supports for coping with these stressors and succeeding academically. However, graduate students may find it difficult to form relationships with their peers. This mixed method social network analysis (MMSNA) examines graduate student perceptions of their peer relationships and the factors associated with peer friendships in a program that placed students in cohorts for the first semester of a two-year Master of Social Work program. Findings from three student focus groups include four main themes related to the cohort system and the tendency for students to gravitate to others who were similar to them (i.e., homophily). Focus group findings informed model specification for a curved exponential family model of student friendships at the end of the third semester of the program ($N = 70$) that identified correlates of student friendships including statistically significant direct and homophily effects for age, gender, and race/ethnicity. First-semester relationships and shared classes in subsequent semesters also increased the likelihood of friendships in the third semester. Findings emphasize the value of cohorts and a diverse student body for peer relationships.

Keywords: cohort-based learning; graduate student friendship networks; exponential random graph model (ERGM); curved exponential family (CEF) models



Citation: Mauldin, R.L.; Barros-Lane, L.; Tarbet, Z.; Fujimoto, K.; Narendorf, S.C. Cohort-Based Education and Other Factors Related to Student Peer Relationships: A Mixed Methods Social Network Analysis. *Educ. Sci.* **2022**, *12*, 205. <https://doi.org/10.3390/educsci12030205>

Academic Editor: Dominik Froehlich

Received: 17 February 2022

Accepted: 7 March 2022

Published: 13 March 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

During graduate school, students face a variety of stressors such as financial concerns, fraught advising relationships, academic and work pressures, and institutional policies and climate [1–3]. Many graduate students (i.e., Master's or doctoral students) experience high rates of depressive symptoms, anxiety, or school-related stress [4], which has been associated with poorer academic performance [5,6].

Student peers are an important source of support and friendship for graduate students. Students often turn to their classmates to cope with stress, understand academic expectations, and learn course material [7,8]. Graduate students report that peer relationships calmed their anxieties, eased their transition into graduate school, helped them feel connected to their department, and helped them persist in their programs [9–11]. Graduate students rely on their peers for support more frequently than other sources and report that peer support is more valuable to them than other sources of support [12]. Peer relationships may be especially attractive for graduate students because their shared experiences make other students well positioned to understand their unique school-related stressors [10,13].

Despite the various benefits of peer relationships, graduate students may find it difficult to form relationships and friendships among their peers. The demands of graduate school restrict opportunities for socialization and can leave students too tired to participate

in social activities [10,14,15]. Small graduate class sizes, physical isolation from peers (e.g., working in small labs; time spent off campus), or individualistic departmental cultures also stymie peer relationships [8,9].

Because of the benefits of peer support and friendship, graduate programs should seek to facilitate these relationships. Understanding the factors associated with graduate students' peer relationships may help schools develop interventions and programs to nurture their students' social integration with peers. To this end, this mixed method social network analysis (MMSNA) examines graduate student perceptions of their peer relationships and factors associated with their peer friendships.

1.1. Theoretical Framework

Our focus on student friendships is grounded by Tinto's [16,17] Model of Student Persistence which provides a framework for understanding student experiences in higher education, and social network theory, which helps explain the development of social relationships within groups of people. According to Tinto, students who are able to fully integrate socially are more likely to thrive in a college environment [16,17]. Social integration includes the development of meaningful relationships with peers [16–20].

Tinto [18] suggests that both institutional characteristics and student attributes relate to students' social integration. Institutional characteristics include classroom environments such as cohort-based learning [21,22]. Tinto's model does not provide guidance on which variables best operationalize the concept of student attributes [23]; however, previous studies have considered age, sex, and ethnicity [17] and proximity to campus [20,24].

According to social network theory, factors associated with social integration and relationships extend beyond individual and institutional characteristics to include the characteristics and actions of others within a social network. To acknowledge this, we incorporate concepts from social network analysis including a variety of dyadic factors and network structural factors.

Dyadic factors are characteristics of pairs of individuals such as their similarities and proximity [25]. For example, homophily is the tendency for social ties to exist between people who share similar characteristics [26]. Common types of homophily in social networks are based on race, ethnicity, age, and gender, but homophily can also be based on less visible characteristics such as attitudes and beliefs [26,27]. Another dyadic factor, propinquity, is a type of similarity that occurs when individuals occupy the same or similar physical or social spaces, such as living in the same neighborhood or belonging to the same organization. Both homophily and propinquity support the formation and maintenance of social relationships [25,26].

Multiple types of relationships commonly exist between two people, such as classmates who study together and seek each other's advice as friends. These multiplex ties can arise simultaneously or can result from one type of relationship developing from the first. Scholars have viewed this multiplexity as a social phenomenon that reflects strong social bonds between people (see [28] for a review).

The structure of a social network and the social ties within it can influence the dynamics of social relationships between individuals within the network [25]. Perhaps one of the most intuitive examples of this is reciprocity, or the tendency for ties to be reciprocated. For example, people tend to befriend others who consider them friends and will withdraw feelings of friendship when they are not reciprocated [25]. Another important mechanism related to network structure is transitivity. Transitivity occurs in networks when two people who share a common network partner are also connected to each other (i.e., a "friend-of-a-friend is my friend" effect) and manifests as clustering of individuals within a network [25].

Elements from Tinto's model and social network analysis are combined for this study's conceptual framework. This study is based on the premise that graduate students' social integration is related to complex factors including individual attributes, dyadic factors, network structural features, and institutional characteristics.

1.2. Literature on Graduate Student Peer Relationships

There is a small but growing literature on graduate student peer relationships. It includes a variety of literature related to individual attributes [29–31], the institutional characteristic of cohort-based learning [31–34], and social network structural factors associated with students' relationships with one another [29,30].

1.2.1. Individual Attributes Related to Student Peer Relationships

As predicted by Tinto's model, the prior empirical findings identify individual-level attributes including gender, age, and academic achievement as significant factors in student peer relationships.

Gender and Age. In some studies of peer relationships in higher education, gender has been significantly associated with student friendships. However, it is not clear whether being female or male is more socially advantageous. Among STEM Master's students [30] and MBA students [31], male students were more likely than female students to report having peer relationships, yet female students were more popular than male students among engineering undergraduates [35] and STEM Master's students [30]. Additional research is needed to determine how generalizable this pattern is across graduate settings.

There is little, if any, research on the effects of graduate students' age on their peer relationships. There is, however, evidence to suggest that for undergraduates, being younger is associated with greater levels of social integration compared to being older [27,36].

Academic Achievement. Unlike gender and age, academic achievement has consistently been linked to increased social integration for students in higher education [35,37–39]. Although most of the evidence is from studies with undergraduates, results of a study of 75 MBA students in Italy [29] suggest that academic performance may also be an important correlate of peer relationships for graduate students. In this study, grades were positively associated with the likelihood of students reporting they had friendships and being named as friends by other students [29].

1.2.2. Cohort-Based Learning and Student Peer Relationships

Cohort-based learning is an institutional characteristic designed to support students' social integration [40]. In cohort-based learning, educational programs assign students to groups, or cohorts, in which classmates take all of their classes together [40]. Cohorts typically consist of between 10 to 26 students [40] who have structured schedules [41] and high levels of interaction [32]. Cohorts are "low-cost social environments" [42] because students frequently and repeatedly interact and can engage with one another with relative ease.

Although cohort-based learning was initially introduced to higher education in the 1940s, its use became more common in the 1980s and continues to grow in popularity [43]. Cohort-based learning models that can range from closed or pure in which students take all coursework together to open or mixed in which students take core course together as a cohort and then enroll in other courses individually [43]. In the United States, a variety of graduate programs offer cohort-based learning, including social work, education, and business programs (see for example, [44–46]).

Graduates of cohort-based learning in a Master's program have attributed the cohort model with helping them develop camaraderie among their peers and in some cases, lifelong friendships [32]. Cohort membership has been significantly associated with the likelihood of two MBA students becoming close friends, even after controlling for collaborations in classes taken outside the cohort [31]. However, a disadvantage is that cohorts may be insular and limit interactions with non-cohort members [40]. This can be particularly challenging when student dynamics within the cohort are difficult or competitive [33]. Another potential drawback to cohort-based learning is evident when students in open or mixed cohort models are assigned to cohorts for only a portion of their educational experience. In this case, the anticipation of leaving the nurturing environment of the cohort to integrate with another cohort, or into a larger student body, can be anxiety producing for

some students [47]. Doctoral students have reported difficulty dissolving the boundaries of their previous cohort when integrating with other students [34].

1.2.3. Social Network Factors Related to Student Peer Relationships

As suggested by the social network component of our conceptual framework, dyadic and network features are related to the graduate student peer relationships. A systematic review of social mechanisms related to the formation, maintenance, and dissolution of social ties among dyads (i.e., pairs of individuals) outlines strong evidence for the effects of similarity (i.e., homophily), physical and social proximity (i.e., propinquity) and network structural factors such as reciprocity, transitivity, and degree effects (i.e., number of social ties an individual has) [25]. Below, we present literature on these social mechanisms, with a focus on the social networks of students in higher education.

Homophily. Strong evidence that graduate students tend to form relationships with similar peers comes from multivariate social network analyses of graduate student social networks. As in other human social networks [26], homophily based on gender, age, and grades is a consistent finding in student networks [27,29,30,37,38,48]. Qualitative studies emphasize the importance of students of color having relationships with similar peers [49,50]. In spite of this, not all social network studies of students in higher education examine racial or ethnic homophily. However, similarity in race, ethnicity, or nationality has been found to be salient in some Master's students' social networks [29–31,51]. Homophily is important to consider when examining the factors associated with their peer relationships, particularly when investigating the main effects of individual-level attributes such as gender, age, race/ethnicity, and grades.

Propinquity. Proximity in social and physical spaces facilitates relationships among students, such as among Master's students with the same specialization [35] or on the same practicum team [30]. For example, sharing study space and spending time in the same study space increased the likelihood two MBA students would be friends or exchange advice [31]. Classrooms may also be a shared space to cultivate relationships, but the effect of taking classes together is not often considered when examining factors associated with graduate student peer relationships.

Multiplexity. Graduate students can have multiple types of relationships with one another, such as friendships and advice giving [30,31]. Longitudinal social network analyses have shown that having one type of relationship increases the likelihood of creating or maintaining other relationships over time. For example, Lomi et al. [29] found that seeking advice led to the development of friendships among MBA students and that multiplex relationships were more stable over time than one-dimensional relationships. This highlights the importance of considering multiplexity when examining factors associated with graduate student peer relationships.

Network Structure. The final element of our conceptual framework is the expectation that ties within a social network of graduate students will depend on other relationships in the network. Specifically, we suggest that reciprocity (i.e., the tendency for social ties to be reciprocated), transitivity (i.e., shared partners or clustering), and effects related to the number of social ties a person has (i.e., degree effects such as popularity) will relate to graduate student peer relationships. There have been limited inquiries into network structural effects in graduate student peer networks, but evidence exists for each of these effects. Reciprocity and transitivity have been positively associated with the likelihood of social ties between undergraduate and graduate students [27,29,30,37,38]. There is evidence that transitivity effects are amplified the more friends or acquaintances that students have in common [25,52] and that transitivity may be particularly important for students to connect if they do not have classes together [52]. Degree effects have been found in student networks. For example, popular MBA students were likely to attract additional friends [29]. Network structural effects are important to include as control variables when examining other factors associated with social ties [53], but significant network structural effects may also inform potential interventions and programs to enhance students' social integration.

1.3. Gaps in the Knowledge and Current Study

The emerging body of research on the factors associated with graduate student peer relationships suggests that individual attributes, cohort-based learning, and network features are relevant when examining students' social integration. There are few, if any, prospective mixed methods or quantitative studies that simultaneously examine individual-level factors and the impact of cohort membership on graduate students' social networks, particularly when students begin a program in cohorts but subsequently integrate with a larger student body. These types of studies would help educators understand the potentially complex interplay of individual attributes and cohort membership and the longitudinal effects of cohort membership on peer relationships.

It is likely that variations in the types and settings of graduate programs and the diversity within the student body affect students' peer relationships. For example, social work schools emphasize working with diverse populations in their explicit and implicit curricula [54], so social work students may be more likely to form relationships across demographic groupings than students in other settings. It is therefore important to build knowledge of students' social integration in a variety of settings to understand which factors are common across settings.

To fill these gaps, this prospective mixed methods social network analysis (MMSNA) investigates peer relationships in a diverse student body of 70 full-time Master of Social Work (MSW) students who received the first semester of their graduate education within a cohort and then continued their education integrated into the larger student body. The study poses two research questions to examine peer relationships within this context (RQs).

RQ 1 (Qualitative): After graduation or near the end of their programs, what are MSW students' perspectives of their peer relationships during the program and the role of cohort-based education on their peer relationships?

RQ 2 (Qualitative and Quantitative): What individual, institutional (e.g., cohort-based learning), dyadic, and network structural factors are associated with MSW student friendships?

2. Materials and Methods

This study is a sequential mixed methods social network analysis (MMSNA). Social network analysis (SNA) and, in particular, MMSNA, can be a valuable tool for understanding students' social integration related to their peer relationships within the university environment. SNA is an increasingly common method used in educational research and using MMSNA can illuminate the meaning of social relationships and interactions, the role of individual agency in social integration, and other nuances of the social environment by integrating qualitative methods into traditional quantitative SNA techniques [55].

The current study includes survey data collected at the end of the first and third semesters of a two-year full-time Master of Social Work (MSW) program. It also includes focus group data collected in the summer following completion of the full-time program. The focus groups were conducted to follow up on the preliminary findings from the social network surveys. Research participants were full-time, face-to-face students who began the program in the Fall 2014 semester. All study protocols were approved by the University of Houston Committee for the Protection of Human Subjects.

In our sequential design, we began our analysis with the focus group data. These data reflect student perspectives of the cohort-based learning experience they had in their first semester and the peer relationships they had throughout the program. Then, based on qualitative findings, we confirmed the inclusion of theoretical elements in our quantitative model and included any additional factors indicated by the qualitative portion of the study. Although research based on Tinto's model suggests that proximity to campus may affect a student's broad social and academic integration [20,24], our qualitative results suggested that students' proximity to *one another* influenced their peer relationships. As a result, we included geographic proximity of students to one another rather than to campus in our quantitative model.

2.1. Research Setting

This study was conducted at a graduate school of social work in a public university in a large ethnically diverse city in the southern United States. The university was a U.S. Department of Education designated Hispanic Serving Institution. In the fall of 2014, there were approximately 300 MSW students (including full-time, part-time, advanced standing, and regular standing) enrolled at the school. Among MSW programs in the United States, the school was unique in that it offered a one-semester intensive foundation experience rather than the more typical one-year foundation curricular offerings in other universities [56]. For the foundation semester, the school assigned regular standing students to cohorts of 20–30 students within which they took all of their courses. After the foundation semester, students left their cohort and enrolled in classes with the rest of the student body. There were course prerequisites within the program that structured some, but not all, of the course sequencing for the remaining semesters.

2.2. Recruitment and Sample

The 2014 incoming class of MSW students consisted of 74 full-time regular track students (i.e., full-time 2014–2016 students) who were placed in one of three cohorts ranging in size from 24 to 26 students. Prior to the beginning of their first semester, students were recruited into a social network analysis study that was conducted in the Fall 2014 semester (see [51] for details). In 2014, 72 of the 74 full-time students (97.3%) enrolled in the study. By the end of the Fall 2015 semester, 70 of the original study participants remained in the MSW program. These 70 students comprise the sample for the social network analysis component of this research.

In August 2016 after most of the full-time 2014–2016 students had graduated, the research team sent emails inviting full- and part-time students who began the MSW program in the Fall of 2014 to participate in focus groups about their “experiences with peer relationships and the cohort system” in the MSW program. Fourteen current or former students enrolled in one of three focus groups. Most ($n = 12$, 85.7%) of the focus group participants were full-time students who had already graduated from the MSW program at the time the focus groups were conducted.

2.3. Qualitative Data Collection

Three focus groups of four to five participants ($N = 14$) were held in a conference room at the school in August and September 2016. They lasted 55 to 80 min. Three of the authors (L.B, R.L.M., and S.C.N) rotated as facilitator and note taker for the focus groups. Each held a Master of Social Work degree as well as training and experience in group facilitation. Focus participants were provided lunch but did not receive any financial incentive for participation.

During the focus groups, the facilitators used a focus group guide to ask questions and guide the discussion. The questions prompted participants to discuss their impressions with the cohort system (including likes, dislikes, and how it affected the formation of relationships with their peers), their experiences integrating with the larger student body after the first semester, the relationships they had with classmates, and factors that influenced the formation and maintenance of peer relationships. The discussions were recorded on a digital audio recorder and the recordings were transcribed verbatim by a member of the research team.

2.4. Qualitative Data Analysis

The data analysis was conducted by two authors (L.B. and R.L.M.) and a graduate student. The two authors had previously participated in the school’s cohort system as MSW students. The first author (R.L.M.) was in a full-time cohort for the first foundation semester, while the second author (L.B.) remained in one cohort throughout the duration of the three-year part-time program. Because there was potential for these cohort experiences to impact interpretation, multiple discussions were held before and during the analysis

to ensure the accurate reading of the transcripts. Additionally, the initial themes were drawn up by the research team member who had not attended the school or experienced the cohort system.

This was an inductive thematic analysis, which was driven by how the data answered the research questions instead of attempting to use a preexisting theoretical coding matrix to analyze the data [57]. The analysis team read through the focus group interviews several times to familiarize themselves with the text, then one of the team members used quotes from the transcripts to create preliminary themes. The second team member reviewed these preliminary results and finalized the analysis, adding depth, nuance, and ensuring the findings were thoroughly supported by the data. To have peer examination and to bolster the rigor of the study, the second team member and the first author (who had also read the transcripts multiple times) met several times, discussed the findings in detail, and concurred with the final results. The themes were refined using a Google Docs document in order to collaborate easily as a team. Finally, the analysis team kept an audit trail that shows the decisions and steps taken as the themes were conceptualized [57].

2.5. Quantitative Data Collection

Survey data for this study were collected at two separate times, one year apart. Paper-and-pen surveys were administered to groups of students during class time at the end of the fall semesters in the first (November 2014) and second (November and December 2015) years of the program. For students not enrolled in or absent from the class during data collection, a member of the research team emailed participants individually to arrange for survey administration. Participants did not receive any financial incentives for survey completion.

All of the 70 students in the SNA sample completed a survey in the first year of data collection. Sixty-three students (90.0% of the sample) completed the survey in the second year. The seven students who did not complete the survey in the second year were not significantly different from those who did in age, gender, race/ethnicity, or undergraduate grade point average.

School administrators provided archival data from admissions documents and student records for the 70 research participants. This included demographic information, home address of record during the Fall 2015 semester, undergraduate grade point average, and a list of the MSW courses they had completed from Fall 2014 through Fall 2015. The school also provided course enrollments and grades during the MSW program for the 63 students who took the survey in 2015.

2.6. Quantitative Measures

Archival data from school administrators included participants' age (20–57), gender (0 = Male, 1 = Female), race/ethnicity (0 = white, 1 = Black/African American, 2 = Hispanic/Latino, 3 = Other or Unspecified), and first semester cohort assignment. Administrators also provided participants' grade point average (2.78–4.0) from the last 60 semester hours prior to applying for the MSW program. We used incoming grade point average from the admissions documents as our measure for grades rather than grades in the MSW program because the archival data were complete for all 70 participants and the incoming grades were extremely correlated with the third semester Fall 2015 grades ($r = 0.98, p < 0.001$).

Dyadic Variables

In addition to individual-level characteristics, we conceptualized and created several dyadic measures that assessed properties of pairs of students (i.e., dyads) in the sample. For each dyadic variable, we used UCINET 6.665 [58] to construct a 70×70 matrix where the entry in cell x_{ij} indicated the value of the variable for the dyad of student i and student j .

Proximity of Home Addresses. We conceptualized proximity of home address as students living near enough to one another that they could reasonably spend time together outside of class without undue travel time burden. In the city in which the university

is located, travel times for a 10-km drive were commonly 15 to 20 min, but could reach 30–35 min during peak traffic hours. Therefore, we operationalized proximity of home addresses as less than or equal to 10 km between home addresses. Details about how we calculated distance between students' residences [59–61] are presented in Online Supplementary Materials (Supplementary Methods & Materials).

Shared Classes after the First Semester. We used archival data from the school to measure the number of classes each pair of students had taken together in the semesters following the cohort-based foundation semester.

Social Ties. The principal investigator met with current students and graduates of the MSW program as key informants in the summer of 2014 to develop the survey question assessing friendship ties among MSW students. The key informants discussed the nature of friendships and academic ties within the MSW program, suggested language for the social network survey, and reviewed the survey items.

At each data collection point, participants were given a roster listing the names and cohort assignment of the full-time 2014–2016 MSW students. They were instructed to check boxes besides the names of as many or few of the other students on the roster to indicate a friendship or academic tie. The roster also included a checkbox labeled “No one listed below” for students with no friendship or academic ties among the 2014–2016 full-time students and a checkbox labeled “I choose not to answer this question” to distinguish missing data from a lack of ties.

The item to assess friendship read, “I consider this person a personal friend (e.g., socialize outside classroom, discuss personal matters, call and text, have lunch with, would invite to social events).” The item to assess academic ties read, “I have academic discussions with this person (e.g., study together, discuss school and schoolwork, get feedback on assignments; ask questions about homework).” Friendship and academic discussion ties were binary with the value of x_{ij} indicating whether student i reported a friendship or academic tie with student j (0 = No, 1 = Yes).

Multiplex Social Relationships at the end of the First Semester. Multiplex social relationships at the end of Fall 2014 was a dyadic variable that accounted for the existence of friendship and academic ties between two students at the end of the first semester in the program. The value of x_{ij} indicated the number of types of relationships that student i reported having with student j and could range from 0 to 2 (0 = no ties, 1 = either friendship or academic tie, but not both; 2 = both friendship and academic ties). These first semester social ties have been described in detail elsewhere [51]. They existed almost exclusively within the individual cohorts, with very few ties between students from different cohorts.

2.7. Quantitative Data Analysis

Our quantitative data analysis was designed to answer RQ 2: *What are the individual, institutional, dyadic, and network structural factors associated with MSW student friendship?* As a preliminary step, we calculated descriptive statistics (see Table 1 for definitions) for the friendship network using UCINET 6.665 [58] and visualized it with NetDraw 2.166 [62].

Curved Exponential Family (CEF) Models for Correlates of Friendship Ties

We modeled the correlates of students' friendship ties with a type of exponential random graph model (ERGM) called curved exponential family models (CEFs, [63]). These models examine the small, local structures (or structural effects) of ties in a network at the same time as examining characteristics associated with the network members such as demographic or psychosocial attributes [53]. This simultaneous modelling accounts for the potential that the likelihood of a tie in the network may be dependent on the existence of other ties. Additional information about ERGMs and CEFs are presented in the Online Supplementary Materials (Supplementary Methods & Methods).

Table 1. Network statistics used to describe the friendship network of MSW students mid-way through the second year of their graduate program.

Statistic	Definition	Notes
Density	Density is a measure of a network's cohesion and is calculated by dividing the total number of ties that exist in a network by the number of possible ties.	Density can range from 0 to 1 with smaller values reflecting sparser networks and larger values reflecting denser networks.
Centralization	Centralization measures the extent to which the ties in the network are organized around particular actors in the network.	Centralization can range from 0 to 1 with values of 0 indicating an equal distribution of ties in the network and 1 indicating all ties are centered on one actor.
Average distance	Another measure of cohesion that suggests the compactness of the network. Average distance is the mean of the shortest path (i.e., <i>geodesic</i>) between each pair of actors in the network.	
Reciprocity (Arc reciprocity)	The percentage of ties in the network that are reciprocated.	Reciprocity values can range from 0 to 1 with greater values indicating greater levels of reciprocity in the network.
Transitivity	Transitivity indicates the extent of clustering in a network. It occurs in networks when two people who share a common network partner are also connected to each other (i.e., a "friend-of-a-friend is my friend" effect). Specifically, for a group of three actors <i>a</i> , <i>b</i> , and <i>c</i> , where <i>a</i> has a tie to <i>b</i> and <i>b</i> has a tie to <i>c</i> (i.e., a <i>two-path</i> from <i>a</i> to <i>c</i>), transitivity occurs when <i>a</i> also has a tie to <i>c</i> . The value of transitivity in a network is calculated by dividing the number of transitive triads in a network by the number of two-paths.	Transitivity values can range from 0 to 1 with greater values indicating greater levels of transitivity (or clustering) in the network.

Model Specification. We specified the CEF model for friendship ties based on our conceptual framework, findings from the focus groups, and important social mechanisms commonly used in ERGMs [53].

1. **Network structural effects.** Our model included network structural effects of edges (i.e., the propensity for a tie to exist given the rest of the model), reciprocity, transitivity, and the degree effects of popularity spread (i.e., the tendency for a high degree of variation in the popularity of students in the network) and activity spread (i.e., the tendency for a high degree of variation in the number friends reported by students in the network). We also included two-paths, a lower-order structural effect necessary to control for when identifying transitivity effects. If the parameter estimate for two-paths are significant and negative and the parameter estimate for transitivity

is significant and positive, then a tendency toward transitivity is detected in the network and is likely not occurring by chance). Figure 1 provides definitions and visual depictions of these network structural effects.

2. Individual-Level Attributes. We also included the effects for the following individual-level attributes on the likelihood that students would report having friendships (i.e., outgoing tie) or be named by other students as a friend (i.e., incoming tie): age, gender, race/ethnicity, incoming grade point average. In addition, we included the homophily effects for these individual-level attributes.
3. Dyadic and Institutional Factors. We operationalized homophily for the categorical variables of gender, and race/ethnicity as two students having the same value of the variable. For the continuous variables of age and grade point average, homophily was operationalized as the absolute difference between two students' values of the variable, such that dyads with smaller absolute differences on the variable were more homophilous than those with greater absolute differences. The model also included the effects of students being in the same cohort, having multiplex social relationships at the end of the first semester, taking classes together after the cohort experience ended, and students living in proximity to one another (i.e., within 10 km).

Missing Data. Of the 70 students in the network, 12.9% ($n = 9$) did not report their friendship ties and the CEF was fit with missing data for these network members. This is within an acceptable range of missing data for social network analysis [64]. There were no missing data for students' age, gender, race/ethnicity, grade point average, cohort membership, or classes taken.

Model Estimation. We fit the CEF using a Markov Chain Monte Carlo maximum likelihood method in the *ergm* package, version 3.11.0 [65] in the *statnet* suite of packages in R, version 4.0.4. To obtain convergence, the model was estimated in multiple steps in which we started with a basic model consisting only of individual-level dependent variables and then added a few additional dyadic and structural variables into the model at a time.

In doing so, we observed an interesting finding in the model when it did not include multiplex social relationships at the end of the first semester. However, that model did not result in a good fit with this model specification, as p -values for three values of outdegree and one value for edgewise shared partners were less than 0.05 (see Goodness of Fit Plots in Online Supplementary Materials). However, because the fit was approaching the threshold of good fit and the model results provide a useful comparison to our final model with first semester multiplex relationships, we include the results of the preliminary model in Online Supplementary Materials (Table S1).

Goodness of Fit. We assessed goodness of fit by generating the distributions of networks simulated using the parameter estimates. We used a burn-in period of 10,000 networks, randomly sampled 100 simulated networks at intervals of 2000. We compared the distributions of simulated networks to the statistics in the observed friendship network. Results from the final model produced a good fit as defined by $p > 0.05$ for all values of the simulated networks' distributions of indegree, outdegree, edgewise shared partners, and minimum geodesics. For all values except three, p was greater than 0.10. Goodness of fit plots for the final and preliminary models are in the Online Supplementary Materials (Goodness of Fit Plots).

Effect	Description	In the current study	Visual
Node/ego	An actor in a network; the focal node is called <i>ego</i>	MSW student	
Edge	The existence of a relationship between two actors in the network	A friendship tie	
Outgoing tie	Focal actor A (<i>ego</i>) indicates a tie exists with another actor (i.e., <i>ego sends</i> a tie)	Outgoing ties are associated with a student's characteristics	
Incoming tie	Another actor in the network (B) indicates a tie exists with focal actor (i.e., <i>ego receives</i> a tie)	Incoming ties are associated with a student's characteristics	
Homophily	The tendency for ties to exist between actors with similar characteristics	The tendency for friendships to exist between students of the same gender, race, cohort, or who are closer in age, GPA	
Reciprocity	A tie exists from actor A to actor B and from actor B to actor A (i.e., the tie is <i>reciprocated</i>)	Tendency for a student friendships to be reciprocated	
Activity spread	The tendency for some actors to have significantly more outgoing ties than others (i.e., to be more active in the network)	Geometrically weighted outdegree effect for activity spread of friendship	
Popularity spread	The tendency for some actors to have significantly more incoming ties than others (i.e., to be more popular)	Geometrically weighted indegree effect for popularity spread of friendship	
Transitive shared partners (Transitivity)	The tendency for actors who have ties with a shared partner to also have a tie ("friend-of-a-friend is my friend" effect)	Geometrically weighted edgewise shared partners effect for the tendency for transitivity among friends	
Alternating Outgoing two-paths	The tendency for actors who receive ties from the same actor to send ties to another actor in common	Geometrically weighted nonedgewise shared partners effect for the tendency for outgoing two-paths among friends. This lower-order effect is included as a control for the effect of transitivity.	

Figure 1. Network structural effects included in modelling MSW students' friendships. Note. Circular symbols represent a node, or actor, in the network. The focal node is called *ego* and the nodes with which the ego is connected are the *ego's alters*.

3. Results

In this section, we present findings from the focus group data analysis followed by the quantitative findings.

3.1. Qualitative Findings

Students found the cohort system created a sense of safety and was instrumental in their ability to form relationships with both diverse and similar peers. The qualitative themes are: (1) students valued the cohort system creating the environment where multiplex

relationships could develop; (2) the cohort system helped students develop relationships with and gain appreciation for people who were different in background and perspective; (3) students gravitated towards others who were similar across different demographic categories within the cohort; and (4) the cohort system helped create a sense of safety and community.

Theme 1: Students valued having interrelated academic, professional, and friendship relationships and credited the cohort system with fostering an environment where these multiplex ties could develop.

Students reported they developed multiplex relationships with each other while in the cohort system. The type of relationships that students initially developed with each other depended on what was important to them. Academic relationships were often the initial ties that students formed. As one student noted, “Because I really did come into the program, yes, wanting relationships, but I really sought out people that I thought could really enhance my learning, you know, and would be good study partners.” (FG1)

Academic to Professional. It became apparent that what may have started off as an academic relationship would transition into a professional one, partially due to efforts at the university to help facilitate the forming of academic and professional relationships. One participant explained, “when you’re in school you’re told, you know, ‘These are going to be your colleagues, these aren’t just your classmates, these are going to become your colleagues that could go into a profession.’” (FG1) Another participant explained, “I would have said academic relationships were blurred because I think academic and professional for me means almost the same thing.” (FG2)

Academic to Friendship. Participants described how their academic relationships progressed and led to professional relationships or friendships. A participant explained, “we were in a clinical group together in a class, so we had to be the client for each other so it was kind of like that more extended friendship as opposed to just being in class.” (FG1) Another stated:

Because of the academics that were already learned from each other, it fueled our personal relationship and then vice versa, through our personal relationship we learned about how we work as students and how we could help each other even if we’re not in the same group. (FG3)

Similarly another student discussed how as a result of the academic relationships, the cohort system gave them, “the opportunity to foster friendships because you’re with the same people for extended periods of time” (FG2). Another noted, “I have my personal circle which is people I’ve known for the longest time and then the personal circle from the academic side, which I people that I’ve become friends with and they are generally from my cohort.” (FG2)

Friendship to Academic or Professional. In some instances, multiplex relationships developed from friendships. For example, one student said:

I think that personal is always at the heart, always most important because you did need those friends to confide in and rely on when things were tough . . . I don’t think I would have really survived grad school and been able to cultivate other types of relationship—the professional or the academic—um without having kind of those underlying core personal relationships that were so fundamental to my survival in grad school. (FG1)

Valuing Multiplex Ties. Relationships that were multifaceted, involving a combination of personal, professional, or academic dimensions were strong and enduring.

There are people that I gravitated towards professionally and there are people that I gravitated towards personally, but the people that I gravitated towards just personally, I’m not as close to. The people that I gravitated to professionally, I still am. But the people that I gravitated to both, I’m the closest to. (FG1)

I totally will because I've learned that the people I relied on or trusted throughout the cohort system and then developed a friendship with maybe, or even just, outside the cohort system too I would do this, they're going to be a resource and a possible ally out in the field where I can use them as a resource or just even a source of knowledge or connections. And, you know, kind of build it from there. (FG3)

Theme 2: The cohort system helped students develop relationships with and gain appreciation for people who were different in background and perspective.

Students discussed that being in a cohort allowed them to meet people who were different from them in various ways. One participant discussed how the cohort gave exposure to people of dissimilar ethnic backgrounds by saying, "I mean it's not that I would have avoided them, it just offered a new opportunity (for interaction)." (FG2) Another participant said:

There are people that I am absolutely sure I would have never followed up with in conversations if I hadn't seen them multiple times in my classes over and over. Um, just people that aren't necessarily you know, like me or they have their own clique or whatever. (FG2)

Ultimately, the extended time the cohort spent together as well as their activities created an opportunity for engagement and gaining appreciation for each other's differences. As one participant said:

We had lots of group activities within the classroom, within the cohort where we had to split up into different groups than we were normally in and it was forced interaction. But it was really valuable, um, because we would just start to engage and I would learn some things that I don't think I would have normally. (FG2)

Other participants further discussed how they began to develop a sense of closeness and support from people that were different from them, "... Because there were people even, in the cohort, that you get to know and you get close to and you lean on who are different than you" (FG1)

I thought that was really important because I not only made friendships, but I also got to know a lot about other people's perspectives throughout especially the first semester, building that cohort. Um, and the kind of level of intimacy we got to in the classroom within a class period was unexpected and a lot of times profound. (FG2)

The cohort experience also enabled students to gain appreciation for people that they may have initially found to be irritating. The time they spent together allowed them to see below the surface and gain respect for their struggles, because they were able to appreciate their commonality.

So it did feel like there was just this respect for each other that was built. Throughout the first semester by recognizing, 'cause you would be so frustrated with someone who was monopolizing or someone who is this and then you hear something that they say and then you're like, "god, they're just people who are trying to work through their shit." 'Cause we all have our shit and we're all just trying to get through it. And so you do feel this sense of we may not agree and there are people who are irking my nerves to the highest degree ... but today I would call them and ask them for an opinion if I needed it on something that they do because you're taught over that first semester that we're all here just trying to make it. So that respect and that trust to a certain extent. (FG1)

Theme 3: Students gravitated towards others who were similar across different categories within the cohort.

Despite appreciating and learning from the differences among their peers, students recognized that they tended to form relationships with others who were similar to them.

It's not that I disrespect or don't respect my entire cohort's opinions and advice, but because I have these personal relationships that came from the cohort that are much deeper and much more similar, I kind of look to those people a little bit more than I would, um, just any one from the cohort. (FG2)

Students acknowledged this included similarity of race or ethnicity; one shared, "I think that we did gravitate towards people who look and think like us a little bit." (FG1) Other students discussed that the social environment in the cohort system helped them recognize hidden attributes, such as attitudes and values, in their peers and form relationships based on these similarities:

I think there are a handful of people, mostly from my cohort that I talk to on a regular basis. And I think that, again, just comes from similar beliefs and values and interests outside of school and in social work that just kind of because we have the opportunity in our cohort to explore those kind of things we realized how similar we were in different things and enjoyed spending time together and so that kind of developed into a friendship. (FG2)

Work ethic was a hidden characteristic that students commonly identified related to homophily. As a student described, "(a fellow student) became my friend because I realized we had similar work ethics, so we worked well together on projects." (FG3) Another related:

I think that kind of coupled with that, the academic, um, what's the word I'm looking for, just this work ethic, you know, was really important. And so, fortunately, I think that we somehow got all of that, you know. Like we have, we all have this really strong, the 4 of us have a really strong work ethic and we just also happened to have a lot of commonality and enjoy one another. (FG1)

Students looked for a positive return on their investment of time and energy into peer relationships and considered work ethic when determining whether to invest in a relationship.

I think it came down to their competency level and it came down to their work ethic. Because if it was someone that I kind of felt like was just getting by, whenever I was putting a lot into this program, I was putting everything I had into it. I just didn't have the, I didn't feel like I had the time or patience or desire to engage. (FG1)

Living close to one another also facilitated peer relationships. As one participant noted, "It comes back to that geographic, 'cause (specific student) lived very close to me and the extracurricular of like mainly it was going to the gym, like we would always work out." (FG1) Another student elaborated:

You don't have the time to access those other people, maybe to the degree that you would. You know, so I think there's maybe a time limitation more than desire for me. It's like (specific students) lived closer to me. (FG1)

Theme 4: The cohort system helped create a sense of safety and community that was difficult to give up.

Participants discussed how the cohort gave them a sense of community and belonging. As one student put it:

I liked the cohorts. Um, it gave me a sense of belonging. It put me in a smaller group. I'm not very social. You know, I'm not real outgoing so I felt safer in a smaller group of people and getting to know people. (FG3)

Another student described how the cohort was, "instant community, instant camaraderie" and continued to say the cohort also provided, "support, even if it might be a little superficial at first, just on the basis of 'this is our first semester, we all were placed in this same cohort.'" ... (FG2) While some students immediately appreciated the sense of

community and safety that cohorts provided, others were able to appreciate it after they were no longer in the cohort system after the first semester.

At first, when I joined the cohort system I thought it was a little bit limiting because I didn't get to experience as many individuals . . . but I will say now finishing up my degree, when I go into those classes that are open to anybody and I see individuals from my cohort, I gravitate to them, I trust them more, I feel like we've been through stuff together, so it's almost a sense of security. (FG3)

Some students needed a safe environment in order to take the educational risks inherent in graduate education generally, and social work in particular.

I was just kind of reflecting back to even being able to stand up in front of a group and present, I mean I'd been out of school for so many years when I came back to this and um, yeah, I don't think I would have felt comfortable in any of my second semester classes being in front of new people and being able to do that had I not had this kind of primer in a really safe environment with people I felt comfortable with learning how to do group activities or present in front of people. (FG1)

But I do think there was more of a need for personal, personal safety and security and just being completely scared. I mean, I went home the first day of foundation, the first week of foundation or two weeks and cried and was like, "what am I doing? I can't be a social worker! What have I done? This isn't what I am supposed to be doing." I mean, it is, but . . . So you need someone who you feel like they get that. (FG1)

After experiencing the safety they felt in the cohort, students described that it was difficult to separate at the end of the first semester:

So, for the first semester, I think it was great. However, you kind of went into the second semester with the same, um, uneasiness, almost that you might have gone into in the original semester without a cohort system because you got to know those 25 or 30 people really, really well. (FG2).

Similarly, another student said that they felt "like kind of a foreigner" (FG1) after they left their cohort system. In the semesters following the cohort-based foundation, students looked for their fellow cohort members in their classes in order to feel safe and at ease again.

Participants described that their adjustment to no longer being in the cohort (i.e., being *uncohorted*) consisted of them, "trying to find that person that you know in all of your courses." (FG1) Another participant said:

I guess I wasn't necessarily like upset or trying to get in with the other group, but it wasn't, uh, there wasn't the same cohesiveness that we had since we had all been through foundation together. (FG3)

Although it was difficult for some students to uncohort, the sense of safety persisted as cohort members connected with each other in their other courses.

Well, it was a little scary again at first because you were going into classrooms and you didn't know who you were going to see. And I think that I did gravitate toward people that were in my cohort. It gave me somebody to say hi to and then sit with and then you could meet everyone else. So, again, it was kind of like safety. (FG1)

3.2. Quantitative Findings

The sample of 70 full-time 2014–2016 MSW students was overwhelmingly female with an average age of almost 29 years old. The group was ethnically diverse with a plurality of white students, but substantial percentages of Black/African American and Hispanic/Latino(a) students. Table 2 provides details.

Table 2. Sample descriptives of 70 full-time regular standing 2014–2016 MSW students in graduate school of social work in a large, diverse city in the southern United States.

Variable	<i>n</i>	%	<i>M</i>	<i>SD</i>
Gender				
Male	7	10.0		
Female	63	90.0		
Race/Ethnicity				
Black/African American	20	28.6		
Hispanic/Latino	14	20.0		
White	31	44.3		
Other	5	7.1		
Age (20–57)			28.5	9.0
Incoming GPA (2.78–4.0)			3.74	0.27

At the end of the Fall semester of their second year in the program, the fulltime 2014–2016 reported an average of 8.9 friends ($SD = 6.5$) among their fulltime classmates. A small portion of students ($n = 5, 8.2\%$) reported no friends among their fulltime classmates, but an equal number reported 20 or more friends. A visualization of the friendship network is presented in Figure 2.

A large majority (78.3%) of the friendships were between students who had been in the same cohort in the first semester. In contrast, at the end of the first cohort-based semester, 99.5% of the friendships and 99.2% of the academic discussion ties occurred between students in the same cohort.

The density of the network was moderately low (0.112), and the ties that existed were not particularly centralized on a few students (degree centralization = 0.257). On average, students could reach any other student in the network on a path of less than three students (average distance = 2.5, $SD = 0.973$). Over half (55.2%) of the friendships were reciprocal. The level of transitivity in the network was high (0.735), indicating a high level of clustering, or connectedness among friends of friends, in the network.

Curved Exponential Family Model of Friendship Ties Midway through Second Year of Program

Unlike the descriptive statistics of the friendship network above, the results from our final curved exponential family (CEF) model are fully adjusted, assessing the contribution of network structure, individual-level characteristics, and dyadic factors simultaneously. These results are presented in Table 3.

Table 3. Factors associated with friendship ties among full-time Master of Social Work student ($N = 70$) midway through the second year of a 2-year program.

Effect	θ	S.E.	<i>p</i>	
Network structural effects				
Edges	−5.36	1.64	0.001	**
Reciprocity	2.36	0.20	<0.001	***
Popularity spread (<i>gwidegree</i>)	−0.90	0.98	0.359	
(decay parameter)	0.15	0.97	0.876	
Activity spread (<i>gwodegree</i>)	−1.86	0.23	<0.001	***
(decay parameter)	2.21	0.19	<0.001	***
Transitive shared partners (<i>gwesps</i>)	0.43	0.11	<0.001	***
(decay parameter)	0.53	0.21	0.011	*
Two-paths (<i>gwensp</i>)	−0.13	0.01	<0.001	***
(decay parameter)	1.61	0.52	0.002	**
Individual-level factors				

Table 3. Cont.

Effect	θ	S.E.	p	
Age				
outgoing ties	0.02	0.01	0.005	**
incoming ties	0.01	0.01	0.060	
homophily ^a	−0.03	0.01	<0.001	***
Gender (ref = male)				
female—outgoing ties	−0.42	0.18	0.017	*
female—incoming ties	−0.83	0.22	<0.001	***
homophily ^b	0.89	0.18	<0.001	***
Race/ethnicity (ref = White)				
Black/African American—outgoing ties	−0.21	0.11	0.056	
Black/African American—incoming ties	0.46	0.14	0.002	**
Hispanic/Latino(a)—outgoing ties	0.20	0.10	0.044	*
Hispanic/Latino(a)—incoming ties	0.14	0.13	0.298	
Other—outgoing ties	0.13	0.19	0.489	
Other—incoming ties	0.24	0.22	0.269	
race/ethnicity homophily ^b	0.39	0.09	<0.001	***
Grade point average (GPA)				
outgoing ties	0.37	0.26	0.143	
incoming ties	0.25	0.31	0.417	
homophily ^a	−0.36	0.31	0.251	
Dyadic and institutional factors				
Same cohort in first semester	−0.21	0.16	0.192	
Shared classes after first semester (0–11)	0.80	0.14	<0.001	***
Proximity of home address proximity (within 10 km)	0.09	0.15	0.525	
Multiplexity, types of ties at end of 1st semester (0–2)	1.35	0.16	<0.001	***
AIC	1907			
BIC	2098			

Note. ^a Homophily is operationalized as absolute difference in value and is indicated by a significant negative parameter estimate; ^b Homophily is operationalized as same value of categorical variable and is indicated by a significant positive parameter estimate; gwdegree = geometrically weighted indegree; gwodegree = geometrically weighted outdegree; gwesp = geometrically weighted edgewise-shared partners; gwensp = geometrically weighted non-edgewise-shared partners; AIC = Akaike information criterion; BIC = Bayesian information criterion. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. There was a significant tendency toward reciprocity ($p < 0.001$) and transitivity ($p < 0.001$) in the friendship network. The significant negative parameter for activity spread ($p < 0.001$) indicates that students with many friends were unlikely to add additional friends to their personal networks, given all other considerations in the model. Homophily was significant along many dimensions. There was a tendency for friendships between students who were similar in age ($p < 0.001$), the same gender, ($p < 0.001$), or the same race/ethnicity ($p < 0.001$). In contrast, we found no evidence for homophily based on grade point average.

Friendships were more likely to be reported by older students ($p < 0.01$) and male students ($p < 0.001$) than by their counterparts. Male students were also more likely than female students to be named by other students as a friend ($p < 0.05$). Hispanic/Latino(a) students ($p < 0.05$) were more likely to report friendships, and Black/African American students were more likely to be named as friends ($p < 0.01$) than white students were.

Previously established relationships were also important for friendships at the midpoint of the second year of the program, particularly multiplex relationships. The more types of relationships a student reported having with a peer at the end of the first semester (e.g., friendship and academic ties compared to only a friendship), the greater the likelihood the student would report a friendship tie in the second year with that peer ($p < 0.001$). Having taken classes together after the cohort experience ended at the end of the first semester was also salient. The more classes a pair of students shared, the more likely they would have a friendship tie ($p < 0.001$).

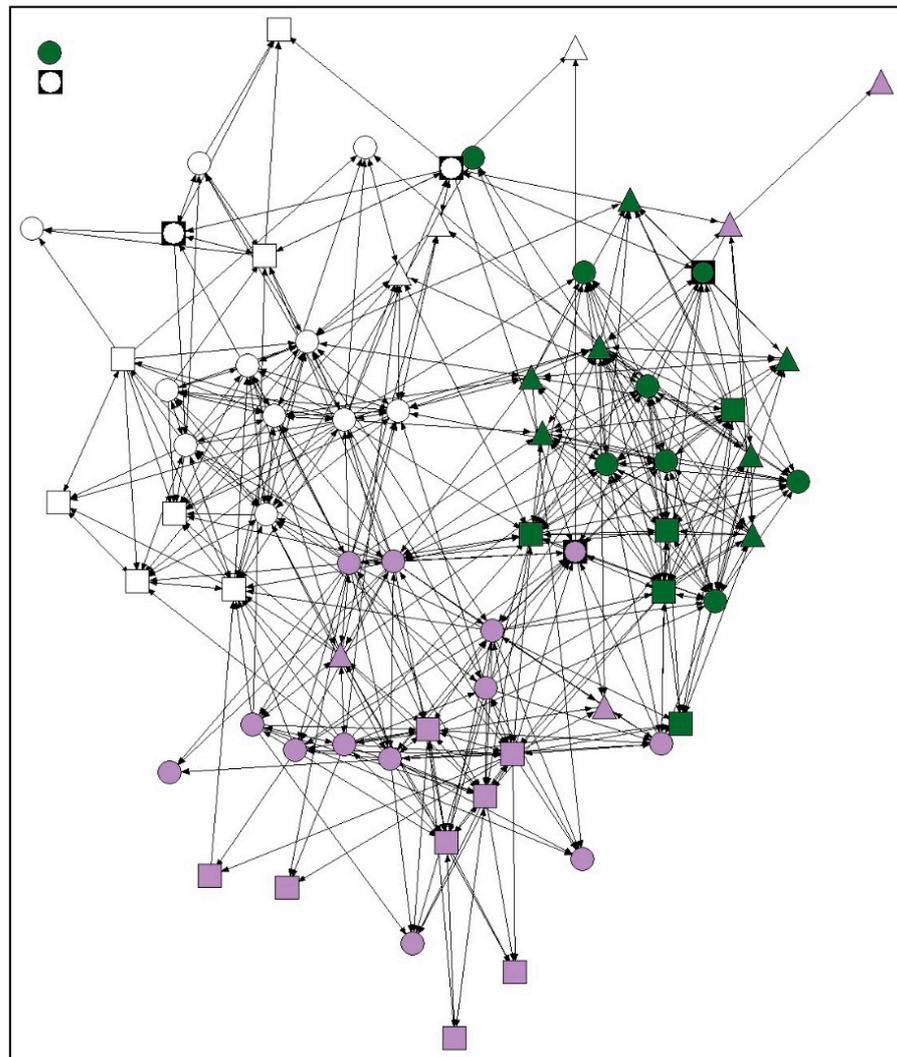


Figure 2. Friendship network of second-year full-time MSW students ($N = 70$) with color-coding to indicate cohort membership in first semester of the program. Note. Polygons indicate a student, lines indicate a friendship ties; arrowheads indicate the direction of the friendship tie; the color of the polygon indicate cohort assignment for the first semester of the program. This network visualization was created using Netdraw 2.166 network visualization software [62] with a spring embedding algorithm with Gower scaling (own source).

The contrast between the preliminary and final model provides nuance for understanding the significance of cohort membership on student friendships. In the preliminary model that did not include multiplex relationships at the end of the first semester, being in the same cohort during the first semester was a highly significant predictor ($p < 0.001$) of being friends mid-way through the second year of the program (See Table S1 in the Online Supplementary Materials). Taking classes together after the cohort experience was not associated with subsequent friendships.

However, in the fully adjusted final model that included multiplex relationships at the end of the first semester, shared cohort membership was no longer a significant predictor of friendships mid-way through the second year of the program. Instead, having more classes together after the first semester ($p < 0.001$) and having at least one type of relationship at the end of the first semester ($p < 0.001$) were significant predictors of later friendships.

4. Discussion

This mixed methods social network analysis (MMSNA) blends the quantitative strengths of a prospective social network analysis with rich insights from focus groups with graduate students. It adds to the current knowledge of graduate students' social integration with findings from a diverse group of students who experienced one semester of cohort-based learning before joining a larger student body for an additional year of study. Our multivariate analysis simultaneously explored individual-level, institutional, and network structure factors that were theoretically based or supported by the qualitative portion of the study. The focus group findings provide a nuanced understanding of the students' perceptions of the formation of different types of peer relationships within the context of their cohort experiences.

4.1. Individual-Level Factors Associated with MSW Student Friendships

In our final, fully adjusted model of friendships midway through the second year in the program, gender, age, and race were individual-level factors that were significantly associated with the likelihood of friendship ties. Unlike other studies that have found female students to be more popular than male students [30,35], we found that male students were more likely to be named by their peers as friends. In addition, being older was associated with an increased likelihood of reporting friendships. This contrasts with studies of undergraduates that have found that younger students are more socially integrated [27,36]. Hispanic/Latino(a) students were more likely to report having friendships and Black/African American students were significantly more popular than white students. It is possible that the moderately high level of racial and ethnic diversity in the student body (20% Hispanic/Latino(a) and 29% Black/African American) created an environment that was supportive of social integration for Hispanic/Latino(a) and Black/African American students.

We did not find that students with higher levels of academic performance were more socially integrated as has been reported among undergraduates [35,37–39] and MBA students [29]. This could be related to the emphasis on non-academic skills and knowledge (e.g., interpersonal communication, advocacy, human relationships) in social work training, making academic performance less important in selecting friends. It is noteworthy that in the focus groups, students reported that work ethic was an important factor in selecting friends. However, grade point average was not a significant correlate of friendship ties. It is likely that the work ethic students identified was unrelated to grades, but to other professional competencies, or was a reflection of selection bias in which the most motivated students volunteered for the focus groups.

4.2. Homophily

In our conceptual framework, we acknowledged that friendships are not only influenced by an individual's attributes, but also by how the attributes of both individuals in the potential friendship relate (i.e., dyadic factors such as similarities or differences). We therefore explored a variety of homophily effects.

Our qualitative analysis found that students gravitated towards others who were similar across a variety of categories. This was supported in the quantitative analysis, which found significant homophily effects for friendship based on age, gender, and race/ethnicity. Homophily based on these demographic groupings is common in human relationships [26] and often found in student social networks [27,29,30,37,38,48,51]. Even though focus groups reported being drawn to people that were similar, they also discussed that the high level of peer interaction that occurred within their cohort gave them the opportunity to expand their relationships to include students they initially felt were different from them. Previous scholarship has identified low-cost social environments [42], such as cohorts, which involve regular interactions can facilitate social connections and reduce homophily [42,66,67]. This mechanism may explain the focus group findings; nonetheless in our quantitative results, after controlling for relationships formed in the first cohort-based semester, homophily across demographic categories was still significant.

Students also reported that similarity in attributes such as values and attitudes was important in their friendship selection. Values and attitudes are considered “non-visible attributes” by de Klepper et al. [27] who argue that homophily based on non-visible attributes operates differently from that based on visible attributes. In the initial stages of friendship development, homophily based on visible attributes is more likely because it takes time and exposure to recognize non-visible attributes in another. The first semester cohort, as a low-cost social environment, provided students the opportunity to witness non-visible attributes in their peers. In spite of this, we did not find significant homophily based on grade point average. As mentioned above, this could be because academic performance was not a good proxy for work ethic in the context of social work professional education. It is important to note that this finding is in a multivariate analysis in which reciprocity and transitivity effects were significant. The tendency for friendships to be reciprocated and clustered could have suppressed the effect of grade-based homophily.

4.3. The Association between Cohort Membership and MSW Student Friendships

It is clear from the focus groups that the students attributed the building of meaningful relationships to supportive peer interactions in the cohort. They reported gravitating toward their cohort classmates after the first cohort-based semester when they joined the larger student body. Our preliminary quantitative model, which did not account for the relationships formed during the cohort experience, supports this qualitative finding by finding cohort membership to be a significant predictor of friendships in the second year. However, in the fully adjusted quantitative model that controlled for the relationships that existed at the end of the first semester, cohort membership was not a significant predictor of subsequent friendships.

The juxtaposition of the two models elucidates the role of the cohort environment on subsequent friendships. Although in the fully adjusted final model first-semester cohort membership itself was not associated with the friendship ties in the second year, the relationships they had formed predominantly within those cohorts were significantly predictive of friendships midway through the second year of the program. We interpret this to mean that the highly interactive environment of the cohort helped students know their peers well and make informed choices regarding compatibility. Even though they may have gravitated toward their cohort classmates later in the program for a sense of comfort and familiarity, familiarity alone did not translate into friendship.

4.4. Implications for School Administrators

Our findings suggest that one semester in cohort-based learning may be sufficient for students to form enduring and multiplex peer relationships. Programs should consider variations of the cohort model that encourage academic connections and give enough time and space for other relationships to build. Because of the importance of peer social ties in creating a sense of emotional and physical safety for participating in a graduate program, and the value of friendships and professional connections with each other, graduate program administrators should strive to create opportunities for students to make connections across different relationship domains. For example, conventional program features such as student professional organizations or networking events are indicated. Additionally, off-campus events, shared meals, or coffee or cocktail social hours are another way to allow students to develop a sense of comfort around each other outside of the classroom environment. Ultimately, hearing from students in their respective programs will be the best way to help develop relationships among themselves. Therefore, administrators should consider surveying students for a better understanding of how their efforts to increase connections are being received and to gain ideas about the best ways to build relationships within their student body.

Administrators should commit to fostering a diverse student body. As the qualitative data revealed, students gained insight from the perspectives of classmates that were unlike them. This helped them learn to value the contributions of people with diverse

perspectives and to surround themselves with those who could contribute in this way to their professional and personal lives. Additionally, in this study, Hispanic/Latino(a) and Black/African American students tended to be popular and socially integrated. Having a diverse student population may mitigate the social isolation that minority students often experience. Administrators should consider the ways they can improve peer connectivity for students of color such as using cohort-based learning, which was effective in the presence of a relatively large percentage of students of color.

4.5. Limitations and Future Directions

In spite of the strengths of this study, there are important limitations to consider. First, the research setting is a diverse social work school in a sprawling urban center and our results are unlikely to generalize to other contexts. Similarly, the setting has unique jurisdictional or institutional characteristics that do not represent other universities or programs. We also note limitations in our quantitative data, which we collected prior to the focus groups. We assessed academic performance using incoming grade point averages. There are likely more appropriate construct and measures to assess relevant values and attitudes (e.g., work ethic, professionalism) among MSW students. School administrators provided home addresses as of December of the second year of the program. If students had moved earlier, this date may not have reflected their residences when they were forming relationships. In addition, students may have provided the school with a permanent address (e.g., parents' address) rather than their residence. Lastly, we acknowledge that the students who participated in the focus group likely did not reflect the entire student body. Because we did not collect demographic data on the focus group participants, we cannot compare the race, ethnicity, gender, and age of the participants to the full-time students in our quantitative sample. The focus group participants agreed to return to the school after graduation to discuss their experiences and may have been more socially integrated than the students who chose not to participate in the focus groups. We recommend future research be conducted in a variety of settings to understand which factors related to students' social integration differ by context. Additional research is also needed to assess the effects of non-visible attributes, particularly those that are relevant to the field of study.

5. Conclusions

Graduate programs have the opportunity to create environments that support students' personal and academic development. In addition to high quality educational training, previous literature shows that social connections are crucial to student success. While graduate programs may be limited in the kind of social interactions that take place outside of the classroom, they are able to design programs for maximal social connection. This study showed that while not perfect, the cohort system facilitated making friendships among similar and dissimilar people, and that these friendships endured over time. Additionally, this study showed that a diversity across age, gender, and ethnicity in the student body may provide an environment in which students from marginalized communities may experience robust social integration. More research is needed to explore other program designs or variations of the cohort system that are supportive of social connections.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/educsci12030205/s1>, Supplemental Methods & Materials; Figure S1, Goodness of fit plot for indegree distribution, preliminary model; Figure S2, Goodness of fit plot for outdegree distribution, preliminary model; Figure S3, Goodness of fit plot for edge-wise shared partners distribution, preliminary model; Figure S4, Goodness of fit plot for minimum geodesic distribution, preliminary model; Figure S5, Goodness of fit plot for indegree distribution, final model; Figure S6, Goodness of fit plot for outdegree distribution, final model; Figure S7, Goodness of fit plot for edge-wise shared partners distribution, final model; Figure S8, Goodness of fit plot for minimum geodesic distance distribution, final model; and Table S1, Preliminary curved exponential family

(CEF) model results of factors associated with friendship ties among full-time Master of Social Work student ($N = 70$) midway through the second year of a 2-year program.

Author Contributions: Conceptualization, R.L.M., L.B.-L. and S.C.N.; Data curation, R.L.M.; Formal analysis, R.L.M., L.B.-L. and Z.T.; Investigation, R.L.M., L.B.-L. and S.C.N.; Methodology, R.L.M., L.B.-L., Z.T., K.F. and S.C.N.; Project administration, R.L.M.; Supervision, S.C.N.; Visualization, R.L.M.; Writing—original draft, R.L.M., L.B.-L. and Z.T.; Writing—review & editing, R.L.M., L.B.-L., Z.T., K.F. and S.C.N. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Committees for the Protection of Human Subjects of the University of Houston (protocol code 14445-01, 13 October 2015).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The quantitative data presented in this study are openly available in the Social Networks for Social Good dataverse at <https://dataverse.tdl.org/dataset.xhtml?persistentId=doi:10.18738/T8/5ELWBV> (accessed on 8 July 2021). The distance matrix and qualitative data presented in this study may be available on request from the corresponding author. The qualitative data are not publicly available due to privacy concerns. The raw data of home addresses of research participants are not available due to ethical and privacy concerns.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Bekkouche, N.S.; Schmid, R.F.; Carliner, S. “Simmering Pressure”: How Systemic Stress Impacts Graduate Student Mental Health. *Perform. Improv. Q.* **2021**, *547–572*. [CrossRef]
2. Charles, S.T.; Karnaze, M.M.; Leslie, F.M. Positive factors related to graduate student mental health. *J. Am. Coll. Health* **2021**, *1–9*. [CrossRef] [PubMed]
3. Smith, E.; Brooks, Z. Graduate Student Mental Health. 2015. Available online: http://nagps.org/wordpress/wp-content/uploads/2015/06/NAGPS_Institute_mental_health_survey_report_2015.pdf (accessed on 28 July 2021).
4. Levecque, K.; Anseel, F.; De Beuckelaer, A.; Van der Heyden, J.; Gisle, L. Work organization and mental health problems in PhD students. *Res. Policy* **2017**, *46*, 868–879. [CrossRef]
5. Kernan, W.; Bogart, J.; Wheat, M.E. Health-related barriers to learning among graduate students. *Health Educ.* **2011**, *111*, 425–445. [CrossRef]
6. Wyatt, T.; Oswalt, S.B. Comparing Mental Health Issues Among Undergraduate and Graduate Students. *Am. J. Health Educ.* **2013**, *44*, 96–107. [CrossRef]
7. El-Ghoroury, N.H.; Galper, D.I.; Sawaqdeh, A.; Bufka, L.F. Stress, coping, and barriers to wellness among psychology graduate students. *Train. Educ. Prof. Psychol.* **2012**, *6*, 122–134. [CrossRef]
8. Menzies, J.; Baron, R. International postgraduate student transition experiences: The importance of student societies and friends. *Innov. Educ. Teach. Int.* **2013**, *51*, 84–94. [CrossRef]
9. Golde, C.M. The Role of the Department and Discipline in Doctoral Student Attrition: Lessons from Four Departments. *J. High. Educ.* **2005**, *76*, 669–700. [CrossRef]
10. McPherson, C.; Punch, S.; Graham, E. Transitions from Undergraduate to Taught Postgraduate Study: Emotion, Integration and Belonging. *J. Perspect. Appl. Acad. Pract.* **2017**, *5*, 42–50. [CrossRef]
11. Moriarty, J.; Manthorpe, J.; Chauhan, B.; Jones, G.; Wenman, H.; Hussein, S. ‘Hanging on a Little Thin Line’: Barriers to Progression and Retention in Social Work Education. *Soc. Work Educ.* **2009**, *28*, 363–379. [CrossRef]
12. Tompkins, K.A.; Brecht, K.; Tucker, B.; Neander, L.L.; Swift, J.K. Who matters most? The contribution of faculty, student-peers, and outside support in predicting graduate student satisfaction. *Train. Educ. Prof. Psychol.* **2016**, *10*, 102–108. [CrossRef]
13. Chui, H.; Ziemer, K.S.; Palma, B.; Hill, C.E. Peer relationships in counseling psychology training. *Couns. Psychol. Q.* **2014**, *27*, 127–153. [CrossRef]
14. Barreira, P.; Basilico, M.; Bolotnyy, V. *Graduate Student Mental Health: Lessons from American Economics Departments*; Harvard University: Cambridge, MA, USA, 2018; Available online: https://scholar.harvard.edu/sites/scholar.harvard.edu/files/bolotnyy/files/bbb_mentalhealth_paper.pdf (accessed on 1 August 2021).
15. Evans, T.M.; Bira, L.; Gastelum, J.B.; Weiss, L.T.; Vanderford, N.L. Evidence for a mental health crisis in graduate education. *Nat. Biotechnol.* **2018**, *36*, 282–284. [CrossRef] [PubMed]
16. Tinto, V. Dropout from Higher Education: A Theoretical Synthesis of Recent Research. *Rev. Educ. Res.* **1975**, *45*, 89–125. [CrossRef]
17. Tinto, V. *Leaving College: Rethinking the Causes and Cures of Student Attrition*, 2nd ed.; University of Chicago Press: Chicago, IL, USA, 1993.

18. Tinto, V. Universities as Learning Organizations. *About Campus*. **1997**, *1*, 2–4. [CrossRef]
19. Chrysikos, A.; Ahmed, E.; Ward, R. Analysis of Tinto's student integration theory in first-year undergraduate computing students of a UK higher education institution. *Int. J. Comp. Educ. Dev.* **2017**, *19*, 97–121. [CrossRef]
20. Pascarella, E.T.; Chapman, D.W. A multiinstitutional, path analytic validation of Tinto's model of college withdrawal. *Am. Educ. Res. J.* **1983**, *20*, 87–102. [CrossRef]
21. Beaudin, B.; Roth, R.; Greenwood, J.; Boudreau, L. Science cohort model: Expanding the pipeline for science majors. *J. First-Year Exp. Stud. Transit.* **2002**, *14*, 105–132.
22. Rüegg, S.T. Comparing Cohort Model and Non-Cohort Model Program Design as a Mechanism for Increasing Retention and Degree Completion. Ph.D. Thesis, Northcentral University, La Jolla, CA, USA, 2019.
23. Nicoletti, M.d.C. Revisiting the Tinto's theoretical dropout model. *High. Educ. Stud.* **2019**, *9*, 52–64. [CrossRef]
24. Sweet, R. Student dropout in distance education: An application of Tinto's model. *Distance Educ.* **1986**, *7*, 201–213. [CrossRef]
25. Rivera, M.T.; Soderstrom, S.B.; Uzzi, B. Dynamics of Dyads in Social Networks: Assortative, Relational, and Proximity Mechanisms. *Annu. Rev. Sociol.* **2010**, *36*, 91–115. [CrossRef]
26. McPherson, M.; Smith-Lovin, L.; Cook, J.M. Birds of a Feather: Homophily in Social Networks. *Annu. Rev. Sociol.* **2001**, *27*, 415–444. [CrossRef]
27. De Klepper, M.; Sleenbos, E.; van de Bunt, G.; Agneessens, F. Similarity in friendship networks: Selection or influence? The effect of constraining contexts and non-visible individual attributes. *Soc. Netw.* **2010**, *32*, 82–90. [CrossRef]
28. Skvoretz, J.; Agneessens, F. Reciprocity, Multiplexity, and Exchange: Measures. *Qual. Quant.* **2007**, *41*, 341–357. [CrossRef]
29. Lomi, A.; Sniijders, T.A.; Steglich, C.E.; Torló, V.J. Why are some more peer than others? Evidence from a longitudinal study of social networks and individual academic performance. *Soc. Sci. Res.* **2011**, *40*, 1506–1520. [CrossRef]
30. Tyagi, A.; Gomez-Zara, D.; Contractor, N.S. How do friendship and advice ties emerge? A case study of graduate student social networks. In Proceedings of the 2020 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM), virtually online, 7–10 December 2020; pp. 578–585.
31. Zhou, Y.; Hua, Y. The role of shared study space in shaping graduate students' social networks. *J. Facil. Manag.* **2021**, *19*, 92–110. [CrossRef]
32. Degeneffe, C.E.; Grenawalt, T.A.; Kesselmayer, R.F. Relationship Building in Cohort-Based Instruction: Implications for Rehabilitation Counselor Pedagogy and Professional Development. *Rehabil. Res. Policy Educ.* **2021**, *35*, 18–32. [CrossRef]
33. Sathe, R.S. Using the Cohort Model in Accounting Education. *Account. Educ.* **2009**, *18*, 33–49. [CrossRef]
34. Swayze, S.; Jakeman, R.C. Student Perceptions of Communication, Connectedness, and Learning in a Merged Cohort Course. *J. Contin. High. Educ.* **2014**, *62*, 102–111. [CrossRef]
35. Stadtfeld, C.; Vörös, A.; Elmer, T.; Boda, Z.; Raabe, I.J. Integration in emerging social networks explains academic failure and success. *Proc. Natl. Acad. Sci. USA* **2018**, *116*, 792–797. [CrossRef]
36. Rubin, M.; Wright, C.L. Time and money explain social class differences in students' social integration at university. *Stud. High. Educ.* **2017**, *42*, 315–330. [CrossRef]
37. Brouwer, J.; Engels, M.C. The role of prosocial attitudes and academic achievement in peer networks in higher education. *Eur. J. Psychol. Educ.* **2021**, *1*–18. [CrossRef]
38. Brouwer, J.; Flache, A.; Jansen, E.; Hofman, A.; Steglich, C. Emergent achievement segregation in freshmen learning community networks. *High. Educ.* **2017**, *76*, 483–500. [CrossRef]
39. Noyens, D.; Donche, V.; Coertjens, L.; Van Daal, T.; Van Petegem, P. The directional links between students' academic motivation and social integration during the first year of higher education. *Eur. J. Psychol. Educ.* **2018**, *34*, 67–86. [CrossRef]
40. Lei, S.; Gorelick, D.; Short, K.; Smallwood, L.; Wright-Porter, K. Academic cohorts: Benefits and drawbacks of being a member of a community of learners. *Education* **2011**, *131*, 497–504. Available online: <https://go.gale.com/ps/i.do?p=AONE&u=googlescholar&id=GALE%20textbar%7BA253740208&v=2.1&it=r&sid=AONE&asid=63457512> (accessed on 8 July 2021).
41. Maher, M.A. What Really Happens in Cohorts. *SAGE J.* **2004**, *9*, 18–23. [CrossRef]
42. Leszczensky, L.; Pink, S. Ethnic segregation of friendship networks in school: Testing a rational-choice argument of differences in ethnic homophily between classroom- and grade-level networks. *Soc. Netw.* **2015**, *42*, 18–26. [CrossRef]
43. McCarthy, J.; Trenga, M.E.; Weiner, B. The Cohort Model with Graduate Student Learners: Faculty-Student Perspectives. *Adult Learn.* **2005**, *16*, 22–25. [CrossRef]
44. Loyola University Maryland School of Education. Available online: <https://www.loyola.edu/school-education/academics/cohorts> (accessed on 2 March 2022).
45. USC Marshall School of Business. Available online: <https://www.marshall.usc.edu/programs/mba-programs/online-mba/what-are-benefits-cohort-based-online-mba-program> (accessed on 2 March 2022).
46. UTA School of Social Work. Available online: <https://www.uta.edu/academics/schools-colleges/social-work/programs/msw/cohort> (accessed on 2 March 2022).
47. Maher, M.A. The Evolving Meaning and Influence of Cohort Membership. *Innov. High. Educ.* **2005**, *30*, 195–211. [CrossRef]
48. Godley, J. Preference or propinquity? The relative contribution of selection and opportunity to friendship homophily in college. *Connections* **2008**, *1*, 65–80.
49. Apugo, D.L. "We All We Got": Considering Peer Relationships as Multi-Purpose Sustainability Outlets Among Millennial Black Women Graduate Students Attending Majority White Urban Universities. *Urban Rev.* **2017**, *49*, 347–367. [CrossRef]

50. Kim, H.Y. International graduate students' difficulties: Graduate classes as a community of practices. *Teach. High. Educ.* **2011**, *16*, 281–292. [[CrossRef](#)]
51. Mauldin, R.L.; Narendorf, S.C.; Mollhagen, A. Relationships among Diverse Students in a Cohort-Based MSW Program: A Social Network Analysis. *J. Soc. Work Educ.* **2017**, *53*, 684–698. [[CrossRef](#)]
52. Kossinets, G.; Watts, D.J. Empirical Analysis of an Evolving Social Network. *Science* **2006**, *311*, 88–90. [[CrossRef](#)] [[PubMed](#)]
53. Robins, G.; Pattison, P.; Kalish, Y.; Lusher, D. An introduction to exponential random graph (p^*) models for social networks. *Soc. Netw.* **2007**, *29*, 173–191. [[CrossRef](#)]
54. CSWE Commission on Accreditation. EPAS Handbook. 2005. Available online: <https://www.cswe.org/accreditation/accreditation-process/2015-epas/S> (accessed on 27 September 2021).
55. Froehlich, D.; Rehm, M.; Rienties, B. Reviewing Mixed Methods Approaches Using Social Network Analysis for Learning and Education. In *Educational Networking*; Pena-Ayala, A., Ed.; Springer: Cham, Switzerland, 2020; pp. 43–75.
56. Colby, I.C. Rethinking the MSW Curriculum. *J. Soc. Work Educ.* **2013**, *49*, 4–15. [[CrossRef](#)]
57. Braun, V.; Clarke, V. Using thematic analysis in psychology. *Qual. Res. Psychol.* **2006**, *3*, 77–101. [[CrossRef](#)]
58. Borgatti, S.P.; Everett, M.G.; Freeman, L.C. *Ucinet 6 for Windows: Software for Social Network Analysis*; Analytic Technologies: Lexington, KY, USA, 2002.
59. OpenStreetMap Contributors. Planet Dump [Data File from “planet-200921.osm.pbf”]. 2020. Available online: <https://www.openstreetmap.org> (accessed on 1 October 2020).
60. QGIS Development Team. QGIS (Version 3.16). Open Source Geospatial Foundation Project. 2020. Available online: <https://qgis.org/en/site/> (accessed on 1 October 2020).
61. Raffler, C. QNEAT3 (Version 3). 2018. Available online: <https://root676.github.io/> (accessed on 1 October 2020).
62. Borgatti, S.P. *NetDraw Software for Network Visualization*; Analytic Technologies: Lexington, KY, USA, 2002.
63. Hunter, D.R. Curved exponential family models for social networks. *Soc. Netw.* **2007**, *29*, 216–230. [[CrossRef](#)]
64. Kossinets, G. Effects of missing data in social networks. *Soc. Netw.* **2006**, *28*, 247–268. [[CrossRef](#)]
65. Handcock, M.S.; Hunter, D.R.; Butts, C.T.; Goodreau, S.M.; Krivitsky, P.N.; Morris, M. *ergm: Fit, Simulate and Diagnose Exponential-Family Models for Networks*. The Statnet Project (<http://www.statnet.org>), 2018. Available online: <https://CRAN.R-project.org/package=ergm> (accessed on 8 July 2021).
66. Valente, T.W.; Fujimoto, K.; Unger, J.B.; Soto, D.W.; Meeker, D. Variations in network boundary and type: A study of adolescent peer influences. *Soc. Networks* **2013**, *35*, 309–316. [[CrossRef](#)]
67. Windzio, M.; Bicer, E. Are we just friends? Immigrant integration into high- and low-cost social networks. *Ration. Soc.* **2013**, *25*, 123–145. [[CrossRef](#)]