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How to cite:

Rienties, Bart and Nolan, Eimear-Marie (2014). Understanding friendship and learning networks of international and host students using longitudinal Social Network Analysis. *International Journal of Intercultural Relations*, 41 pp. 165–180.

For guidance on citations see [FAQs](#).

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Version: Accepted Manuscript

Link(s) to article on publisher's website:

<http://dx.doi.org/doi:10.1016/j.ijintrel.2013.12.003>

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Understanding friendship and learning networks of international and host students using longitudinal Social Network Analysis

Abstract:

While the number of international students travelling abroad for higher education constantly increases, it has been recognised among educators that international students have difficulty adjusting to their host educational environment. Past research indicates that international students' personal ties with other international, home and host students can influence their cross-cultural adjustment to their new environment. Drawing from cross-cultural, educational science and social network research, we conducted a longitudinal study using dynamic social network analyses into how 485 international and 107 host students build learning and work relationships at both Bachelor and Post-Graduate level.

Results indicate that students from different cultural backgrounds develop dissimilar co-national and international friendships and learning relationships over time. Additionally, in contrast to previous findings our MRQAP and multiple regression analyses indicate that social interactions among international and host students did not become more intertwined over time. However, active (mixed) group activities (temporarily) increase cross-cultural interaction, indicating that institutions can play an active role in improving cross-cultural adjustment.

1. Introduction

As an increasing number of students are opting to study abroad ([Gu, Schweisfurth, & Day, 2009](#); [Rienties & Tempelaar, 2013](#); [Russell, Rosenthal, & Thomson, 2010](#)), it is important to understand how international students learn and interact with each other and host-national students. Successful adjustment to the various aspects of a host

culture (i.e., work, general living, and social interaction) and interaction with other international and host students have been linked to positive outcomes such as increased task performance, satisfaction, and reduced intent to quit prematurely ([Rienties, Beausaert, Grohnert, Niemantsverdriet, & Kommers, 2012](#); [Rienties & Tempelaar, 2013](#); [Russell et al., 2010](#); [Zhou, Jindal-Snape, Topping, & Todman, 2008](#)).

A large body of research on internationalisation has focussed on determining how individual characteristics, such as academic integration ([Rienties et al., 2012](#); [Zepke & Leach, 2005](#)) or psychological and socio-cultural factors ([Ward, Bochner, & Furnham, 2001](#); [Ward, Okura, Kennedy, & Kojima, 1998](#)) influence international students' adjustment and learning to the host-institution. However, a limited number of studies (e.g., [Hendrickson, Rosen, & Aune, 2011](#); [Rienties, Hernandez Nanclares, Jindal-Snape, & Alcott, 2013](#)) have focussed on how social (learning) relations of international and host-national students influence students' ability to interact both in- and outside the classroom. A common assumption held by many teachers is that some groups of international students tend to stick together and seem hesitant to interact with host students. The degree to which students are able to develop friendship, working and learning relations influences their ability to cope with the complex demands of higher education ([Furnham & Alibhai, 1985](#); [Hendrickson et al., 2011](#); [Rienties et al., 2012](#); [Rienties, Heliot, & Jindal-Snape, 2013](#); [Rienties, Hernandez Nanclares, et al., 2013](#)).

Recently, several researchers ([Hendrickson et al., 2011](#); [Neri & Ville, 2008](#); [Rienties, Heliot, et al., 2013](#); [Rienties, Hernandez Nanclares, et al., 2013](#)) have adopted a methodological approach called Social Network Analysis (SNA) to measure, visualise and predict how international and host students develop social

interactions. SNA can be considered as a wide-ranging strategy utilised to explore and predict social structures while uncovering the existence of social positions of (sub)groups within a network ([Borgatti, Mehra, Brass, & Labianca, 2009](#); [Curşeu, Janssen, & Raab, 2012](#); [Katz, Lazer, Arrow, & Contractor, 2004](#)).

For example, research by [Hendrickson et al. \(2011\)](#) on social friendship networks of 84 international students at the University of Hawaii found that having more relations with host students was positively correlated with satisfaction and connectivity. Our own research ([Rienties, Heliot, et al., 2013](#); [Rienties, Hernandez Nanclares, et al., 2013](#)) in two post-graduate business modules in the UK indicates that students at the start of the modules primarily established friendships with students from similar cultural backgrounds. However, we noticed an increase in cross-cultural friendship and learning links over time when students were randomised into small-groups and “forced” to work together on a range of group tasks. Nonetheless, substantial social segregation in friendship, learning and working networks of international and host students remained present for some groups of international students ([Montgomery & McDowell, 2009](#); [Neri & Ville, 2008](#); [Rienties, Hernandez Nanclares, et al., 2013](#)), in particular for international students with a large cultural distance relative to host students, such as Confucian Asian students.

According to a recent literature study by [Volet and Jones \(2012, pp. 255-256\)](#), “[c]hange in international and local students’ engagement in intercultural interactions over a period of time has attracted limited empirical attention... Intervention studies aimed at enhancing intercultural engagement among local and international students tend to be small scale, descriptive, and lacking methodological rigor”. Therefore, we will adopt a dynamic longitudinal social network analyses study ([SNA: Rienties, Hernandez Nanclares, et al., 2013](#)), whereby we compare the social network

developments of international and host students at ten different time intervals across five modules during a Bachelor and Post-Graduate business programme. Within the academic year 2011-2012, 247 students across three modules participated in a pre-post test design (i.e., start and end of each module) after one and three months, after 12 and 15 months, and 30 and 33 months during their Bachelor programme. Furthermore, 345 Post-Graduate students participated in a pre-post test design after one and three months, and seven and nine months.

In this study, we explore how international students over time build, develop and maintain friendship, learning and working relations with co-national, multi-national and/or host-national students. Three fields of literature that have been historically separated are drawn upon, namely cross-cultural expatriate literature ([Black, 1988](#); [Black, Mendenhall, & Oddou, 1991](#); [Selmer & Leung, 2003](#)), educational science ([Gu et al., 2009](#); [Volet & Jones, 2012](#); [Ward et al., 1998](#)), and research in social network science ([Curşeu et al., 2012](#); [Furnham & Alibhai, 1985](#); [Krackhardt & Stern, 1988](#); [Neri & Ville, 2008](#)). Although we acknowledge that the reasons and drivers for “going abroad” for sojourners and expatriates may vary, we anticipate that combining the two separate research fields with recent insights in social network theory can provide a new perspective on the development of friendship and learning links of international students.

2. Theoretical framework

2.1 Findings from expatriate literature

[Black \(1988\)](#) presents three facets of adjustment when looking at expatriate assignments: interaction adjustment, work adjustment, and general adjustment.

Interaction Adjustment refers to the degree of interaction an expatriate has with host-nationals and the comfort they feel interacting with supervisors, peers and

subordinates in the host culture ([Black & Stephens, 1989](#)). [Black et al. \(1991\)](#) articulate that interaction adjustment is the most difficult dimension of adjustment, as differences in mental maps and rules (perceptions, beliefs and values) become evident when expatriates interact with host-nationals. Different cultures generally have certain norms that guide the proper functioning of individuals within the society. As a result of these differences, expatriates can initially experience conflict and misunderstandings in the host culture with host-nationals. Social learning theory suggests that individuals learn appropriate behaviours through interaction and observation of host-nationals during the adjustment process ([Black et al., 1991](#); [Caligiuri, 2000](#)).

Work Adjustment is conceptualised as the degree of adjustment an individual has about the job, responsibilities and working conditions in the host-country ([Black, 1988](#); [Black & Stephens, 1989](#)). [Hechanova, Beehr, and Christiansen \(2003\)](#) meta-analysis of antecedents and consequences of expatriate adjustment found that interaction with host-nationals was positively correlated with work adjustment. We anticipate that host-nationals can supply the international students with important information about the education system and the behaviours and practices that are expected from them within the host culture, thus aiding their overall adjustment.

General adjustment (sometimes called environmental or non-social adjustment) refers to the extent to which expatriates are able to adapt to the main environmental and physical aspects of the new culture. It can be defined as the degree of comfort and familiarity individuals have with the general living conditions of the host-country. This includes non-work factors like food, housing and culture ([Black & Stephens, 1989](#)). International students will not only have to make sense of the academic learning environment and facilities, but also the foreign culture. This may

include a different political and monetary system, different language, norms, values and behaviours to that of their home culture. [Hechanova et al. \(2003\)](#) and [Bhaskar-Shrinivas, Harrison, Shaffer, and Luk \(2004\)](#) meta-analyses of antecedents and consequences of expatriate adjustment found that interpersonal skills and relational skills were correlated with general adjustment.

2.2 Cross-cultural adjustment and transitional literature in higher education

A large number of studies have addressed cross-cultural adjustment, transition, adaptation or persistence of students in higher education in general ([Zepke & Leach, 2005](#)), and of international students in particular ([Rienties et al., 2012](#); [Russell et al., 2010](#); [Zhou et al., 2008](#)). However, according to [Volet and Jones \(2012, p. 246\)](#) most adaptation studies “show limited theorizing on the bilateral and reciprocal nature of adaptation and few conceptualisations of individuals as actors with a capacity to regulate their participation in challenging social environments”.

The social life within and outside the academic environment can strongly influence how international and host students interact, work and learn together. Having a sufficient number of friends from the same culture as well as the host culture ([Bochner, McLeod, & Lin, 1977](#); [Montgomery & McDowell, 2009](#)), sharing accommodation with other students ([Ward et al., 1998](#)), being member of a study association, student fraternity or joining a sports club can influence general and interaction adjustment, overall well-being and finally increase academic performance ([Rienties et al., 2012](#); [Russell et al., 2010](#)). When international students arrive at the host country, according to [Geeraert, Demoulin, and Demes \(2014, p. 3\)](#) “close contact with co-nationals may be very welcome and have the effect of reducing stress and providing a sense of adjustment. Over time ... extensive contact with co-nationals may be at the detriment of cultural learning and adjustment”.

In student-centred learning environments students from different cultural backgrounds are “forced” to work together, which allows them to learn from different perspectives ([Rienties, Hernandez Nancloares, et al., 2013](#)). If over time multi-national groups develop a climate of trust and become more cohesive ([Decuyper, Dochy, & Van den Bossche, 2010](#)), group members are likely to provide peer-group members with information regarding socializing and living in the host culture, in addition to introducing them to the study environment. Unless international students have family or friends already living in the host culture ([Rienties et al., 2012](#); [Zhou et al., 2008](#)), they are likely to turn to their group members to attain the information they require about the host culture. The group members may very well be the initial points of contact for the new student. Group members can aid the international students general, interaction and work adjustment by answering questions, providing guidance and explaining local norms and behaviours of the host culture.

However, previous research has shown that establishing friendship and working relations with host students is difficult for international students, due to language issues ([Montgomery & McDowell, 2009](#); [Rienties et al., 2012](#)), perceived discrimination ([Russell et al., 2010](#)), and the fact that most host students already have well-established friendship networks ([Hendrickson et al., 2011](#); [Rienties et al., 2012](#)). Furthermore, according to [Peacock and Harrison \(2009, p. 494\)](#) amongst British (host) students there was a “perceived threat that an international student could bring the marks of the group down through his or her lack of language ability, lack of knowledge of the United Kingdom or understanding of British pedagogy”.

Successful interaction with host students generally occurs over time as it is a complex and dynamic process ([Volet & Jones, 2012](#); [Zhou et al., 2008](#)). [Selmer and Leung \(2003\)](#) found a positive relationship between time spent in the host culture and

work adjustment. [Gregersen and Black \(1990\)](#) found that time since arrival in the host country positively correlated with adjustment to interact with host- nationals. This is supported by [Kashima and Loh \(2006\)](#) study of one hundred Asian international students' acculturation to Australia, which also found that time spent in the host culture and the more interaction students had with host- nationals (local ties) contributed positively towards psychological adjustment.

However, recent research ([Summers & Volet, 2008](#); [Ujitani & Volet, 2008](#); [Volet & Jones, 2012](#); [Zhou et al., 2008](#)) has found that international students' adjustment is a complex and continuously evolving process. [Gu et al. \(2009\)](#) indicate that students are generally overwhelmed and experience an 'initial shock' upon arrival to the host culture, this reduces in time as they become adjusted to the new environment. In a longitudinal study of 162 Belgium high school exchange students, [Geeraert et al. \(2014\)](#) found that while at the beginning close contact with co-nationals was not related to adjustment or stress, over time students who failed to make friendships with host students experienced higher levels of stress. In a longitudinal study of 233 students' appraisals of mixed group work enrolled in a first, second and third year of business, [Summers and Volet \(2008\)](#) found that students over time became significantly more negative about mixed group work. Additionally, the assumed positive time development in terms of more positive appraisals of mixed groups in second and third year was not supported ([Summers & Volet, 2008](#)). [Kimmel and Volet \(2010\)](#) suggest from the result of their study that creating a sense of cohort among international and host students could facilitate intercultural interactions as a result of increased familiarity and acquaintance.

Although these studies provide important insights into the dynamics and complex adjustment and interaction processes of international and host students,

except for [Summers and Volet \(2008\)](#), [Gu et al. \(2009\)](#), and [Geeraert et al. \(2014\)](#) to the best of our knowledge no study has measured the longitudinal adjustment processes beyond the short time span of one year. Furthermore, none of these studies have measured the actual social networks of host and international students and how these social networks develop over time.

2.3. Literature on Social Networks of international and host students

In the last ten years, an increasing number of researchers have used social network analyses to understand how students ([Curşeu et al., 2012](#); [Hommes et al., 2012](#); [Katz et al., 2004](#)) and teachers ([Daly, Moolenaar, Bolivar, & Burke, 2010](#); [De Laat, Lally, Lipponen, & Simons, 2007](#); [Rienties, Tempelaar, Giesbers, Segers, & Gijsselaers, 2013](#)) develop friendship, learning and working relations. A social network consists of set of nodes (i.e., students) and the relations (or ties) between these nodes ([Wassermann & Faust, 1994](#)). In social network theory, the focus of analysis is on measuring and understanding the social interactions between entities (e.g., individuals, teams, schools), rather than focussing on individual behaviour ([Katz et al., 2004](#)). A general assumption of social network theory is that people's behaviour is best predicted by the web of relationships in which they are embedded. Although historically studies in education have paid limited attention to the structure of students' social relations ([Hommes et al., 2012](#)), [Rienties, Hernandez Nanclares, Hommes, and Veermans \(2014\)](#) argue that recently students' social networks are increasingly studied in order to understand how (international and host) students learn formally and informally from each other.

Most social network studies in education use social capital theory to explain how individuals develop and maintain formal and informal learning relations ([Katz et al., 2004](#); [Neri & Ville, 2008](#)). Social capital can be defined as “resources embedded

in a social structure which are accessed and/or mobilized in purposive action” ([Lin, 2001, p. 12](#)). These embedded resources can facilitate information flows between students, which consequently reduces the transaction costs when sharing knowledge, such as sharing of materials, summaries, or ideas. Furthermore, social ties may be conceived as certification of social credentials, as it reflects a student’s accessibility to resources through social networks and relations, thus his or her social capital ([Lin, 2001](#)). In addition, social networks provide substantial psycho-social support ([Hommes et al., 2012](#); [Hotta & Ting-Toomey, 2013](#)), a sense of belonging ([Daly et al., 2010](#); [De Laat et al., 2007](#)), and reinforces identity and recognition ([Lin, 2001](#)). Recent research indicates that SNA provides robust and accurate depictions of actual learning processes and social networks ([Curşeu et al., 2012](#); [Hommes et al., 2012](#); [Katz et al., 2004](#)). More importantly, two recent studies in medical science and information science highlight that social networks are the key determinant for learning and academic performance ([Gašević, Zouaq, & Janzen, 2013](#); [Hommes et al., 2012](#)).

Four studies have become available that have applied concepts of SNA to understand how international and host students develop friendship and learning relations ([Hendrickson et al., 2011](#); [Neri & Ville, 2008](#); [Rienties, Heliot, et al., 2013](#); [Rienties, Hernandez Nanclares, et al., 2013](#)). In recent research by [Hendrickson et al. \(2011\)](#) on social friendship networks of 84 international students at the University of Hawaii, having more relations with host students was positively correlated with satisfaction and connectivity. Multi-national friendships are often built because international students share a similar experience and are open to learn from other cultures ([Hendrickson et al., 2011](#); [Montgomery & McDowell, 2009](#)). In a study amongst 173 international students at an Australian university ([Neri & Ville, 2008](#)),

39% of participants reported interacting mainly with co-national students, while 45% predominately interacted with multi-national students. While a minority of students developed relations with host students, according to [Neri and Ville \(2008, p. 1535\)](#) “[m]ost social capital investments by international students occurred via on campus interactions with other international students, predominantly from the same country of origin”.

In line with the above findings, two recent case-studies ([Rienties, Hernandez Nanclares, et al., 2013](#)) amongst 59 undergraduate economics students in Spain and 69 post-graduate business students in the UK indicated a strong segregation across host, co-national and multi-national friendships and learning relations at the beginning of the module. In the Spanish “Limited Erasmus Program” case-study ([Rienties, Hernandez Nanclares, et al., 2013](#)), seven Erasmus students initially developed friendships almost exclusively amongst Erasmus students, while the 50 Spanish (host) students were interacting primarily with their co-national friends. In the UK “International Classroom” case-study ([Rienties, Hernandez Nanclares, et al., 2013](#)), the vast majority of students were from Confucian Asian countries, who principally interacted with themselves before the start of the module. A variety of students from various nationalities had developed an “international classroom” together with host students. Similarly, a relatively clear segregation of initial friendships along cultural backgrounds was present at the start of the module of 207 post-graduate students ([Rienties, Heliot, et al., 2013](#)), whereby Confucian Asian students developed strong co-national friendships, while “other” international students and host-students were positioned around the Confucian Asian network.

Therefore, our first two hypotheses test whether the social friendship, learning and working networks at the beginning of the five modules were different between

host and international students. As indicated by several SNA researchers ([Hommes et al., 2012](#); [Katz et al., 2004](#); [Wassermann & Faust, 1994](#)), the question-stem of a SNA questionnaire has a substantial influence on the types of social networks a researcher can explore. According to [Hommes et al. \(2012, p. 747\)](#), friendships “explore passive information diffusion” between students, while working and learning networks explore with whom students are formally and informally communicating about task-related activities ([Rienties, Hernandez Nanclares, et al., 2014](#)). It may be conceptually important to distinguish working from learning networks. For example, students working together in small groups of five could indicate that they have all worked together, but not learned anything from any of the group members. Alternatively, they may have worked primarily with students outside their formal group but also learned from members within their group. If we indeed find that international students initially built different networks, in line with recent findings ([Hendrickson et al., 2011](#); [Neri & Ville, 2008](#); [Rienties, Heliot, et al., 2013](#); [Rienties, Hernandez Nanclares, et al., 2013](#)) we would like to test whether these international student networks are built on the same cultural backgrounds (i.e., co-nationality) or not (i.e., multi-nationality), as illustrated in H3-H4.

H1: The social friendship networks of international students are different from those of host students at the start of the five modules.

H2: The social learning and working networks of international students are different from those of host students at the start of the five modules.

H3: Friendship networks at the start of the five modules are built on the same cultural background.

H4: Learning and working networks at the start of the five modules are built on the same cultural background.

In line with longitudinal adjustment literature ([Geeraert et al., 2014](#); [Gu et al., 2009](#); [Summers & Volet, 2008](#); [Ward et al., 1998](#)), the expectation is that international students over time will be able to develop successful social relationships with co-national, multi-national and host students. In particular in a three year undergraduate Bachelor programme, we expect that undergraduate students will be able to develop extensive cross-cultural friendship, learning and working relations as they spend considerable time in class together (H5-H6).

H5: Over time, the social friendship networks of undergraduate students become more integrated irrespective of cultural backgrounds.

H6: Over time, the social learning and working networks of undergraduate students become more integrated irrespective of cultural backgrounds.

On the one hand, given the relative short duration of Post-Graduate programmes one might expect that most students will primarily stick to their co-national relations, considering the limited incentive to develop cross-cultural relations and time constraints of the programmes. On the other hand, qualitative interviews amongst five post-graduate students highlighted that international students did make a conscious effort to build friendship and learning relations even if they were studying together only for one year ([Rienties, Heliot, et al., 2013](#)). Some of these friendships were along co-national lines, while others were pro-actively looking for new

perspectives from students from different nationalities. Therefore, H7-H8 test whether social networks of post-graduate students become more integrated.

H7: Over time, the social friendship networks of postgraduate students become more integrated irrespective of cultural backgrounds.

H8: Over time, the social learning and working networks of postgraduate students become more integrated irrespective of cultural backgrounds.

Finally, as also indicated in section 2.2, collaborative learning may create opportunities to learn from different cultural and individual perspectives ([Montgomery, 2009](#); [Rienties, Hernandez Nanclares, et al., 2013](#)). Preliminary findings in one study ([Rienties, Hernandez Nanclares, et al., 2013](#)) indicate that implementing student-centred learning with authentic group work allowed both international and host students to develop more multi-national learning relations over time. Despite friendship and learning relations at the start of the module being primarily related to co-nationality, after eleven weeks the primary predictor of learning relations was the group division.

In contrast, a follow-up mixed method study consisting of 207 post-graduate students ([Rienties, Heliot, et al., 2013](#)) indicated that learning ties after 11 weeks were marginally predicted by the group division. A substantial segregation between Confucian Asian, European international and UK students remained present. Given that both studies investigated social relations at different stages in the curriculum, this study builds on these initial findings by taking a longitudinal perspective of social network developments across five modules. In line with recommendations of [Volet and Jones \(2012\)](#) to actively intervene in the classroom to facilitate cross-cultural

interactions, the teachers of each of the five modules actively tried to encourage cross-cultural interaction by using a range of group-work activities. Therefore, our final hypothesis is:

H9: Due to group work assignments, after completing a module students developed more integrated social networks.

3. Methods

3.1 Participants and setting

Based upon the findings from the first initial study ([Rienties, Hernandez Nanclares, et al., 2013](#)), a range of teachers from different disciplines at a university in the south of the UK became interested in understanding their students' friendship, learning and working relations. This study focused on data gathered within the context at a business school. Data were collected for each year within the undergraduate programme in the academic years 2011-2012, similar in design as [Summers and Volet \(2008\)](#). A new aspect is that we also collected data for each semester in a post-graduate programme.

As indicated in Table 1, a culturally diverse mix of students was present across the five modules, whereby 107 (18%) host students and 484 (82%) international students participated in one of five modules. For one student, no nationality data was made available. International students from 58 nationalities were present, primarily from Confucian Asian and Eastern European countries. This sample composition is fairly representative for business programmes in the UK ([Higher Education Statistics Agency, 2012](#)). 64% of participants were female, and the average age was 23.54 (SD = 4.21).

Given that visualising the interaction patterns amongst 592 students from 59 different countries would be extremely difficult to interpret from a longitudinal as well as from a social network perspective ([Rienties, Hernandez Nanclares, et al., 2013](#)), we clustered the nationalities according to the GLOBE study. [House, Hanges, Javidan, Dorfman, and Gupta \(2004\)](#) identified nine cultural dimensions by investigating the relation between culture and leadership styles, and created ten clusters of world cultures transcending national boundaries.

→ Insert Table 1 about here

3.2 Measuring friendship and learning networks

247 undergraduate students across three modules participated in a pre-post test design after four and twelve weeks (UG1, n = 54), after 12 and 15 months (UG2, n = 112), and 30 and 33 months during their Bachelor programme (UG3, n = 81). Furthermore, 345 post-graduate participants in a pre-post test design after four and twelve weeks (PG1, n = 207) and seven and nine months during two post-graduate modules (PG2, n = 138). For ascertaining how international and host students learned together at the start and end of each of the five modules, we employed a method developed within the field of Social Network Analyses ([Borgatti et al., 2009](#)). The evolutions of the social friendship, learning and working networks were analysed as follows.

First, pre-existing friendship, learning and working relations were measured by using “closed-network” analyses ([Krackhardt & Stern, 1988](#); [Rienties, Hernandez Nanclares, et al., 2013](#)). A list with names of all the students in their respective module was provided, as is commonly done in SNA ([Curşeu et al., 2012](#)). 261 students answered the Social Network question stems “I am a friend of ...”, “I have learned a lot from ...”, and “I have worked a lot with ...” in a check-box manner after

four weeks in UG1 and PG1, as most students did not have any social relations at the start of their programme. For 331 students in UG2, UG3 and PGS2, this was measured at day 1. Students who were “checked” were coded with 1, while not-checked students were coded with 0.

Second, in UG1 and PG1, students were randomised in groups by the teachers, so students from different nationalities were randomly assigned to groups. In contrast, in UG2 and PG2 students were allowed to self-select their group members. In UG3 students from different parts of the network were merged together in groups by the teacher based upon the initial friendship network, thereby creating culturally diverse groups while ensuring that in each group of students would know at least one or two group members. Third, we again measured the three social networks at the end of the module after eleven weeks (i.e., post-test). For the two measurement periods, an average response rate across the five modules of 83% and 83% was established.

3.3 Data analysis

As data were collected in the same academic year, each of the 592 students only participated once in pre-post data collection process. As a first of five steps, graphical analyses using Netdraw of the two*three social networks were conducted in order to identify the overall social network structure and identify possible patterns of sub-group development in each of the five modules, as recommended by [Rienties, Hernandez Nanclares, et al. \(2013\)](#). As a second step, for each module five matrixes (i.e., co-nationality, GLOBE, Chinese, group division, gender) were constructed, a procedure similar to creating a dummy-variable for each category in “classical” statistical analyses ([Rienties, Hernandez Nanclares, et al., 2013](#)). Given that there were 248 Chinese students, and [Montgomery \(2009\)](#) found that some students had a prejudice against working with Chinese students, we constructed a Chinese matrix.

Finally, a group division matrix was constructed in order to control for the influence of the group division on the developments of the social networks over time.

As a third step, we determined the position of each student within their GLOBE geo-cultural region (intra) relative to students from different GLOBE geo-cultural regions (inter) in the three social networks using the External – Internal index ([Krackhardt & Stern, 1988](#); [Rienties, Hernandez Nanclares, et al., 2014](#)). Basically, the E-I index takes the number of ties of members within the same GLOBE cluster to students outside the GLOBE clusters, subtracts the number of ties to members within the cluster, and divides this by the total number of ties. The resulting index ranges from ‘-1’ (all ties are only with own GLOBE cluster) to ‘+1’ (all ties are to students outside the GLOBE cluster). As not for all the 10 GLOBE geo-cultural regions sufficient data were available for each time measurement, we merged Anglo-Saxon, Latin European, Nordic European, Germanic European, and Eastern European into one category entitled “Western international students”. Latin American, Sub-Saharan African, Middle East and Southern Asian students were merged into “Non-Western international students”. As sufficient Confucian Asian and UK students were present, these categories were kept.

As a fourth step, multiple regression quadratic assignment procedures ([MRQAP: Rienties, Heliot, et al., 2013](#)) were used to test whether gender, group-structures or the three proxies for cultural backgrounds (co-nationality, GLOBE, Chinese network) amongst (international and host) students predicted social friendship, learning and working networks using 2000 random permutations for each of the five modules. MRQAP tests are permutation tests for multiple linear regression model coefficients for data organized in square matrices of relatedness of friendship and learning, and the interpretation of the standardised betas is similar to OLS

regression analyses ([Krackhardt, 1988](#); [Rienties, Hernandez Nanclares, et al., 2013](#)). Data were analysed on a network level using UCINET version 6.445. As not all readers may be familiar with MRQAP regressions, as a fifth and final step we conducted “classical” multiple linear regressions with the complete dataset in SPSS 19.

4. Results

Separate Chi-square analyses and ANOVAs were conducted in order to determine whether respondents differed from non-respondents in terms of age, gender, nationality, and GLOBE. No significant differences were found in any of these demographics. However, a significant difference was found in Grade Point Average, which was higher for respondents ($F_{M1} (1, 529) = 22.583, p <.01, \eta^2 = .04$; $F_{M2} (1, 529) = 10.694, p <.01, \eta^2 = .02$), but small in effect size. Given that we measured (perceived) social network relations across each of the five modules, when a participant did not respond to a SNA questionnaire, there were still on average 83% of his/her class-members who indicated whether (or not) they had a friendship, learning or working relationship with this (non-responding) participant ([Borgatti et al., 2009](#); [Rienties, Heliot, et al., 2013](#)). Therefore, we argue that the respondents at the two time intervals provide an adequate representation of the actual samples in the five modules.

4.1 Social friendship networks across the five modules

In order to illustrate the power of SNA in understanding how friendship networks of international and host students developed across the five modules, Figure 1a – 1j are presented using Netdraw. First of all, these Figures illustrate whom students considered as their friends in the pre-post measurement of each of the five modules.

The colour and shape of the nodes (see also Table 1) represent the respective GLOBE cluster of each node (i.e., student). Please note that Netdraw positions nodes at random across the X- and Y-axis based upon the (perceived) social interactions between students, whereby students who share similar connections are positioned more closely together. Being on the left of a friendship graph is not necessarily better or worse than being on the right, top or bottom, but students with similar friendship connections are positioned closer together.

→ Insert Figure 1a-1j about here

Three trends can be identified across these ten social friendship network graphs. First, some students were on the outer fringe of the friendship network and were not well-connected to other learners, while other students were more central in the friendship network, indicating more (reciprocal) friendships. Second, in all ten graphs a relatively clear segregation between Confucian Asian and other international and host students was visible. Most Confucian Asian students were positioned closely together on the left of the friendship network, indicating that they primarily built friendships with co-national students, as found by previous studies ([Rienties, Heliot, et al., 2013](#); [Rienties, Hernandez Nanclares, et al., 2013](#)). Similarly, most UK students were situated on the right or bottom right and built, developed and maintained friendship relations with co-national students, while “other” international students built a combination of multi-national friendships. Nonetheless, the majority of students maintained several cross-cultural friendships, as in all ten graphs no isolated “islands” of subgroups of GLOBE students were visible. While initially in the undergraduate programme students seemed to mix well irrespective of cultural

backgrounds, over time Confucian Asian and UK students seemed to maintain less direct friendship links, and “other” international students seemed to increasingly form a bridge function between Confucian Asian and UK students.

Third, even though students seemed to build friendships based upon their cultural backgrounds, each graph indicated a far from linear relation between the position in the network and their respective GLOBE culture. In each of the ten SNA graphs, there were students who built substantial multi-national friendships and/or who were positioned relatively far away from their “own” GLOBE cluster. This is visible for several Confucian Asian, UK, and other international students at the different measurements, indicating that some students were actively looking for cross-cultural rather than co-national friendships, as found by previous research ([Hendrickson et al., 2011](#); [Rienties, Heliot, et al., 2013](#); [Volet & Jones, 2012](#)). These three trends were also visible in the learning and working networks (not illustrated).

4.2 Similarity of social networks of international and host students

Given that the above social network visualisations are complex and difficult to interpret on eye-sight only, as a next step we calculated the number of (cross-cultural) friendships for each participant. In Figure 2, the average friendships across the four cultural clusters over the ten time measurements are illustrated. In the UG1 module, students had on average 12.40 (SD = 4.97) friends after four weeks. After three months the average number of friends increased to 14.37 (SD = 5.41). Friendships continued to increase in UG2 to on average 16.80 (SD = 9.21), followed by a rapid decline in friendships in UG3 to 8.57 (SD = 6.55). A possible explanation for this decline is that more than half of students in their third year went on placement, thereby leading to two UG3 cohorts (one who did not go on placement, one who came back after one year of placement), who were not necessarily friends (before). In the

post-graduate programme, the number of friends after four weeks was only 3.47 (SD= 2.90), which steadily increased to 19.11 (SD = 8.91) at the end of PG2. For each of the 10 time measurements, using ANOVAs we compared whether the number of friends was different according to the four cultural clusters. Only during PG1 a significant difference in number of friends was found across the four cultures ($F_{PG1, 1} (3, 203) = 4.476, p < .01, \eta^2 = .06$), primarily due to a lower number of friends amongst UK students.

→ Insert Figure 2 about here

In order to determine whether social friendship networks were primarily focussed on the same co-national culture, or on cross-cultural relations, External-Internal index scores were calculated for the four cultural clusters (as well as co-nationalities and GLOBE, not illustrated). First of all, as illustrated in Table 2 only Confucian Asian students had a negative E-I index for both time measurements, indicating that most Confucian Asian had more friends from the same culture than from different cultures. While the results indicate that cultural backgrounds play an important role in friendship building, we acknowledge that the Confusion Asian sample in our study was larger than other groups, thus it is possible that the result are also dependent on the size of the Confusion Asian community, as was previously found by [Ward and Masgoret \(2004\)](#). Second, as indicated by the large standard deviations, a large spread of cross-cultural friendships was present, indicating that within each cluster there were students who primarily were friends with students from different cultures, while at the same time there were students who primarily developed friendships only with the same cultural background. Finally, a significant

increase in the E-I index was found ($t = 2.758$, $p < .01$, $d = .07$) over time using a paired sample t-test, whereby host and Confucian Asian students became significantly more externally focussed in their friendships over time. Similar significant effects were found for learning networks ($t = 4.524$, $p < .01$, $d = .13$) over time and working networks ($t = 2.157$, $p < .05$, $d = .07$) when looking at the entire sample, though again with a small effect size.

➔ Insert Table 2 about here...

However, the above Table 2 takes only an aggregate perspective of friendship development across the five modules. As illustrated in Figure 3, the E-I Index scores for each of the four cultural clusters followed more dynamic and complex patterns. First, UK friendships fluctuated around the (culturally neutral) 0 mark during the under-graduate programme and the first measurement in the post-graduate programme, but peaked towards strong multi-national friendships at the end of the post-graduate programme. This latter increase may be a result of the low number of host students in this PG2 module. Western international friendships seemed to follow a U-shaped curve, whereby initially many cross-cultural relations were developed, followed by a period of equal internal and external relations, ending with a strong external focus.

➔ Insert Figure 3 about here

Non-Western students had the highest amount of cross-cultural relations, with the exception during the first semester of the post-graduate programme. Finally,

Confucian Asian friendships were primarily inward focussed with an increasing trend towards internal relations over time. A notable exception was during the final months of the UG3 module, where the E-I index was $-.25$ ($SD = .67$). A MANOVA, with the four cultural clusters and five modules for friendship E-I index at the pre-post measurements confirmed the results and a significant effect for the four cultures ($\text{Lambda}(6, 568) = 56.766, p < .01$) and five modules ($\text{Lambda}(8, 566) = 8.753, p < .01$) was found. Separate MANOVAs for pre- and post-test and separate ANOVAs for each of the ten time measurements (not illustrated) indicated strong significant differences across the four clusters at each time measurement. In other words, we find support for H1 & H3 that friendships of international and host students are different at the start of the module.

In Figure 4, the E-I indexes of the friendship, learning and working networks for the UK and Confucian Asian students are illustrated. The three social network patterns followed a similar trend, although Confucian Asian students had slightly less negative E-I scores for learning than for friendship networks, indicating that they were more inclined to maintain cross-cultural learning relations than friendship relations. Separate MANOVA analyses with all four cultural clusters and five modules learning E-I index at the pre-post measurements confirmed the results and a significant effect for the four cultures ($\text{Lambda}(6, 568) = 21.356, p < .01$) and five modules ($\text{Lambda}(8, 566) = 5.432, p < .01$) was found. Similar effects were found for work-relations for the four cultures ($\text{Lambda}(6, 568) = 37.261, p < .01$) and five modules ($\text{Lambda}(8, 566) = 13.362, p < .01$), confirming H2 & H4.

→ Insert Figure 4 about here

4.3 Regression modelling

4.3.1. MRQAP Regression modelling using UCINET

In order to identify the magnitude of the cultural matrixes on friendship, learning and working networks across the five modules, we used multiple regression quadratic assignment procedures taking into consideration gender, group division, and the three proxies of cultural background (co-nationality, GLOBE, and Chinese network), as illustrated in Table 3. In Model 1, using multiple regression quadratic assignment procedures (MRQAP) in order to estimate which of the five matrices had the strongest influence on our dependent variable, friendship ties after four weeks were significantly predicted by the initial group division ($\beta = .190$; $p < .01$), followed by the same GLOBE cluster ($\beta = .136$; $p < .01$) and the Chinese network ($\beta = .107$; $p < .01$), whereby β represent standardised betas. This indicates that the initial group division students were randomly put into was the best predictor for friendship formation after four weeks, followed by same GLOBE network and whether students were Chinese or not. In Model 2 at the end of UG1, both group division and GLOBE standardised betas increased in size, indicating that friendships over time were more strongly related to which group a student was enrolled into and whether students were from the same GLOBE culture. As indicated in Table 4 and Table 5, the learning and working networks for UG1 were (again) predicted by group divisions and cultural backgrounds (though now with co-nationality and Chinese networks). In other words, although group divisions were the primary predictor for friendship, learning and working networks across the pre- and post-test in UG1, similarity of cultural backgrounds also predicted (to a smaller degree) the social networks.

→ Insert Table 3-5 about here

For UG2, a similar trend was found, whereby the group division was a strong predictor for all three social friendship, learning and working networks at day 1 of the module, as students were allowed to self-select their members. At the same time, the cultural proxies were significant predictors for all three social networks across the pre- and post-test, while the same gender was also a significant predictor for these three networks. Over time, the betas for group division increased for all three social networks.

For UG3 (whereby the teacher mixed students from different parts of the friendship network in groups), although the initial group division was a significant (but relatively smaller) predictor for all three social networks at the beginning of the module, the cultural proxies for same cultural background were a more prominent predictor for the three social networks. At the end of the UG3, group divisions were the primarily predictor for the three networks, while the some of the cultural background proxies remained significant, but their betas dropped substantially in size. In other words, although students preferred to work and learn together over time based upon the same cultural background, in particular for the Chinese network, group divisions became increasingly important in explaining how the social networks developed.

For PG1, the initial group division (where students were randomised) did not predict any of the three social networks. Friendships, learning and working relations after four weeks were primarily predicted by similarity in cultural backgrounds. After three months, cultural backgrounds remained the primary predictor for the three social networks, with a small effect of group divisions. A possible explanation for these findings is that due to the large cohort of 207 students and no formal group

assessments, creating sufficient momentum for groups to cross cultural boundaries may have been relatively limited ([Rienties, Heliot, et al., 2013](#)).

For PG2, the group division was the main predictor for the three social networks. Over time, the group division became an even larger predictor, whereby cultural differences were no longer significant predictors for the learning network, and only one cultural proxy (i.e., the Chinese network) predicted the friendship and working network.

In sum, of the 30 possible predictors for the three social networks across the ten time measurements, 26 times the Chinese network proxy was a significant predictor ($M_{\beta\text{Chinese}} = .078$, $SD_{\beta\text{Chinese}} = .035$), followed by 14 times the same co-nationality proxy ($M_{\beta\text{Co-nat}} = .034$, $SD_{\beta\text{Co-nat}} = .041$), and 9 times the GLOBE proxy ($M_{\beta\text{GLOBE}} = .043$, $SD_{\beta\text{GLOBE}} = .051$). In contrast to H5-H8, the cultural proxies remained significant predictors for the social friendship, learning and working networks at the end of the module. In particular in friendship relations, cultural backgrounds were a constant and significant predictor, while cultural backgrounds were relatively less likely to influence in the learning networks across the five modules. However, our findings give substantial support for H9 that teachers can actively encourage cross-cultural interactions in- and outside the classroom. 27 times the group division significantly predicted the three social networks ($M_{\beta} = .250$, $SD_{\beta} = .179$), whereby the Betas on average were three times as large as the proxies for cultural background, indicating that working together in groups is a powerful bridge between different cultures.

4.3.2. Linear regression modelling

Finally, in Table 6 the linear regression analysis results of all 590 students on the E-I indexes of the three social networks during pre- and post-measurement are illustrated,

whereby Confucian Asian students were used as the cultural reference group and PG1 as the module reference group in SPSS. There seems to be mixed support whether Bachelor students over time became more externally focussed in their social networks, as the standardised betas were largest for UG1, while for UG2 no significant relations were found, and for UG3 only the post-test had significant betas (though smaller in size than UG1). However, UK national, Non-Western and in particular Western international students were significantly more externally oriented towards cross-cultural friendships, learning and working relations (in comparison to the reference group of Confucian Asian students). In other words, mixed support is provided to H5-H8, whereby host and international students who were not from Confucian Asia developed more external relations over time, while Confucian Asian students developed a more internal focus over time. In Table 7, the confirmed and rejected hypotheses are illustrated.

→ Insert Table 6 & 7 about here.

5. Discussion

Understanding how individuals interact, create and maintain social ties and learn from one another in a host culture has been a focal point of enquiry in both general adjustment and educational literature in the last thirty years ([Gu et al., 2009](#); [Russell et al., 2010](#); [Summers & Volet, 2008](#); [Volet & Jones, 2012](#); [Ward et al., 2001](#)). The UK along with many other “western” countries has experienced substantial increases in the numbers of international students entering higher education ([Gu et al., 2009](#); [Higher Education Statistics Agency, 2012](#)). Expatriate adjustment literature ([Bhaskar-Shrinivas et al., 2004](#); [Black et al., 1991](#); [Hechanova et al., 2003](#)) highlights many positive effects (reduction of uncertainty which facilitates adjustment, increased

levels of performance) of intercultural interaction between expatriates and host-nationals.

Creating and fostering intercultural interaction within higher education settings can prepare students for the international workforce they will be entering ([Ledwith & Seymour, 2001](#)). However, recently several researchers ([Peacock & Harrison, 2009](#); [Rienties, Heliot, et al., 2013](#); [Rienties, Hernandez Nanclares, et al., 2013](#); [Ujitani & Volet, 2008](#); [Volet & Jones, 2012](#)) have found that international and host students actually develop and maintain minimal cross-cultural interaction. Thus, it is becoming more vital than ever for educators to be aware and understand that the interaction processes between co-nationals, host-nationals and multi-national students do not “automatically” lead to a cross-cultural learning climate.

A first important finding is that students’ actual social networks over time did not necessarily become more integrated. It is clear from our results that (international and host) students’ social learning, friendship networks and working networks in the five modules were built on the same cultural background. Being consistent with past research ([Summers & Volet, 2008](#); [Ward et al., 1998](#)) we expected that the various cultures within the Bachelor programme would become more intertwined over time. Our findings, however, did not support this assumption, whereby we found an increased degree of segregation between (Confucian) international and host students at the end of their study in the Bachelor degree.

The majority of Confucian Asians and UK students seemed to mix well initially in the UG1, but over a three-year period our results indicated that there was decline in social interactions between these two cultures. One possible explanation for this is that at the start of the programme the majority of students did not know each other. Several introductory sessions were held within the first few weeks of the

semester for students to form relationships with one another, while the teacher in UG1 pro-actively created randomised cross-cultural groups who worked intensively together on a range of authentic group tasks. So friendships made within these exercises were perhaps reflected in the results after three months.

A possible explanation for the segregation of culturally diverse groups over time could be that international students find it difficult to create sustainable friendships and working relationship with host students in the new environment as suggested by research ([Black, 1988](#); [Montgomery & McDowell, 2009](#); [Rienties et al., 2012](#)). GLOBE's cultures indicate that Confucian Asians share few similarities with Western cultures, which may explain why we found fewer interactions between Western cultures and Confucian Asian cultures, this could be a 'them versus us scenario'.

Students created co-national groups which can positively reduce uncertainty, thus creating a sense of belonging/ fitting in. Being part of a co-national group in a foreign culture can initially aid students' coping strategies as they are surrounded by people who share common beliefs, values and social norms who can help them cope with their diverse setting. Consequently we believe that such social ties are attractive to international students as they reduce uncertainty and culture shock. However, (Confucian Asians) students who primarily rely on co-national friendships within a host environment may be reducing their likelihood of successful cross-cultural adjustment ([Geeraert et al., 2014](#); [Kim, 2001](#)). If Confucian Asians students are not interacting with UK students, it can be expected that they are not receiving valuable information that could increase their general, work and interaction adjustment in the host educational setting. Therefore, in line with [Kim \(2001\)](#) we also propose from our

findings that co-national friendship over a period of time plays a role in hindering intercultural interactions among Confucian Asian students.

A second important finding of the present study was that ‘other’ (Western and non-Western students not from Confucian Asia or UK) students seemed to bridge a gap between the Confucian Asians and the UK students at undergraduate levels of study. Looking at the demographic makeup (Table 1), the majority of students were from Confucian Asia and the UK. It is possible that ‘other’ students were unable to create a similar home-culture group, as their cultural backgrounds were under-represented within the class ([Kim, 2001](#); [Zhou et al., 2008](#)). Therefore, international students with relatively few co-national students might have been “forced” to be more open to socially interact with other cultures over time, allowing them to actively engage and interact with international students in their class, and share similar experiences ([Hendrickson et al., 2011](#); [Montgomery & McDowell, 2009](#)). This research has brought to light the importance of these ‘other’ students in acting as a bridge between both prominent cultures. It would be interesting to identify if these “other” international students have increased levels of adjustment, cultural sensitivity, cultural intelligence, and task performance based on the fact they might have benefited from interacting with multinational and host students.

A third (and in our opinion most) important finding is that institutions can effectively intervene in the classroom to encourage cross-cultural relations to develop and maintain over time. In four out of five modules, the primary predictor of how students build friendships, learning and working networks was the group division, which on average had three times larger impact than the cultural proxies. As illustrated by UG1, UG3 and PG2 modules, when students were randomised in groups and worked on authentic group tasks and assessments, students developed strong

cross-cultural friendships and learning links within their groups over time. In contrast, in PG1 where international and host students were randomised in groups without a clear constructive alignment of learning outcomes, tasks and assessments, students primarily learned with co-national students outside the formal group structure. Similarly, in UG2 where students were allowed to self-select their group members, most students maintained similar friendship relations over time, rather than developing new (cross-cultural) friendships relations as in UG1, UG3 and PG2. In an experimental study, [Rienties, Alcott, and Jindal-Snape \(2014\)](#) found in the random condition international and host students maintained significantly more cross-cultural learning in comparison to students in the self-selection condition.

In answering some of the future research questions addressed by [Volet and Jones \(2012\)](#), our findings give food for thought on how teachers and institutions in general should design their modules, group selection methods and programmes. More research is required to understand the optimum balance of instructional design to encourage cross-cultural learning. However, our findings do illustrate an important point often ignored in internationalisation literature, namely that institutions can pro-actively encourage cross-cultural learning within modules if students work in cross-cultural groups on authentic and assessed group tasks for a sustained period of time.

5.1 Limitations

While every effort was made to reduce limitations within this study, some limitations do exist. First, our dynamic social network analysis of friendship, learning and working networks were self-report instruments, thus students' desirable social behaviour could have influenced the results to some degree. Despite this, SNA technique is proven to be a valid and robust measurement of social networks and

learning outcomes ([Borgatti et al., 2009](#); [Curşeu et al., 2012](#); [Hommes et al., 2012](#); [Katz et al., 2004](#)) and no response bias in terms of cultural backgrounds was found.

Second, like [Summers and Volet \(2008\)](#) in taking a longitudinal approach to this research we did not follow the same undergraduate students from their entry to year one straight through to their final year. In the near future, we intend to keep following the students who successfully developed cross-cultural relations in UG1. Nonetheless, given that we used pre-post-test designs for all five modules, a consistent trend for Confucian Asian and UK students was found over time, and our R-square adjusted and MRQAP modelling exercises indicate substantial fit.

A third limitation is the exclusive focus on advanced quantitative statistical techniques, whereby the underlying reasons why some host and international students developed substantial cross-cultural relations while others primarily developed co-national relations need further unpacking. Preliminary triangulation analyses by [Rienties, Heliot, et al. \(2013\)](#) indicate that students who bridge different cultural networks primarily develop these links with students with similar mindsets and similar academic performance.

Lastly, we would like to highlight that when investigating social networks the results may not only be influenced by the mix of cultures but also by the relative size of each culture within the classroom. For example, [Ward and Masgoret \(2004\)](#) conducted a national study of international students in New Zealand and found that Chinese students spent more time with their counterparts than they did with ‘other’ students. They indicated that this result could have been influenced by the size of the Chinese community.

5.2 Practical implications and future research

To meet the growing demands that increased levels of globalisation has bestowed upon higher education institutions in relation to international students, it is vital that there is an understanding of social networks of international and host students. By creating an understanding the interaction among the cohort of students, it is possible to suggest ways to enhance interaction among culturally diverse students, thus enhancing interaction beyond such a minimal level within University campuses that we experience at present.

It is clear that both host and international students have to adjust not only to academic life, but also to their new cultural environment. The differences between cultures along with possible disparity of educational practices in this host environment are likely to be stressful. Supplying international students with information regarding the host culture and other major cultures in their class may reduce their needs to form sub-cultures of their own. Some international students are doing this to reduce their uncertainties, therefore if educators can facilitate their cultural learning and awareness they may become less inclined to isolate themselves from other culture as their uncertainties have been reduced as we have seen with Confucian Asians mostly in our study.

Coupled with the above it is important to look at the context of expatriation among students. It is documented that the reason a person chooses to leave their home culture influences their overall adjustment. Within this study it is important to note that the push-pull factors of international students may influence their adjustment and the development of social networks in the host culture. [Mazzarol and Soutar \(2002\)](#) present a push-pull model of international education flows and note that several factors can influence the demand of international education. For example, students may travel abroad to study for life experience and adventure, others may want to go to

a certain University as it is a leading institution in a particular area, or others may study abroad due to family advice and guidance. While this study did not include questions associated with push-pull factors of international student migration, we suggest that future research should consider and investigate these factors.

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Table 1 Descriptive statistics of cultural backgrounds and labelling in SNA

Cluster	#students	Countries (samples, and ordered by relevancy)*	UG	UG	UG	PG	PG	Shape/colour in Social Network figures
			1	2	3	1	2	
<i>UK host students</i>	107	UK (107)	16	43	22	17	9	White circle
<i>Anglo-Saxon</i>	9	USA (5)				3	6	Black circle
<i>Latin Europe</i>	20	Italy (6), Portugal (5)	1	5	4	5	5	Pink square
<i>Nordic Europe</i>	2		1	1				Orange plus
<i>Germanic Europe</i>	11	Germany (7)	3	1	3	2	2	Grey up triangle
<i>Eastern Europe</i>	72	Russia (19), Greece (12), Romania (11), Cyprus (10), Bulgaria (5)	6	22	14	16	14	Green box
<i>Latin America</i>	3				1	2		Yellow down triangle
<i>Sub-Saharan Africa</i>	9				4	5		Light blue circle
<i>Middle East</i>	10					7	3	Purple rounded
<i>Southern Asia</i>	43	India (18), Thailand (17), Malaysia (3), Iran (2), Indonesia, Pakistan		2	2	28	11	Red circle in box
<i>Confucian Asia</i>	305	China (248), Taiwan (15), Hong Kong (14), South-Korea (13), Japan (5), Vietnam (5).	27	38	31	122	87	Blue diamond
<i>Total</i>			54	112	81	207	137	

* Note: only countries with at least 5 co-national students are illustrated. UG1 = undergraduate year 1 semester 1, UG2= undergraduate year 2, semester 1, UG3 = undergraduate year 3, semester 2, PG1 = postgraduate, semester 1, PG1 = postgraduate, semester 2.

Table 2 E-I index for friendships across four clusters (pre vs. post-test)

	Pre-test		Post-test		t-test	Cohen D-value
	M	SD	M	SD		
UK	0.01	0.59	0.13	0.52	3.635**	0.21
Western International	0.12	0.49	0.10	0.51	-0.441	
Non-Western International	0.23	0.54	0.25	0.51	0.424	
Confucian Asian	-0.60	0.42	-0.55	0.44	1.973*	0.11

* p < .05, ** p < .01

Table 3. MRQAP regression analyses of social friendship networks and cultural differences (standardised beta coefficients)

	Model 1 Friendship UG1 (1)	Model 2 Friendship UG1 (3)	Model 3 Friendship UG2 (12)	Model 4 Friendship UG2 (15)	Model 5 Friendship UG3 (30)	Model 6 Friendship UG3 (33)	Model 7 Friendship PG1 (1)	Model 8 Friendship PG1 (3)	Model 9 Friendship PG2 (7)	Model 10 Friendship PG2 (9)
1. Gender	.046*	.016	.057**	.036*	-.009	-.009	.020**	.025**	.024	.003
2. Group division	.190**	.277**	.232**	.244**	.065**	.263**	.003	.032**	.300**	.350**
3. Co-nationality	.068	.060	.001	-.044	.065*	.020	.057**	.051**	.051	-.017
4. GLOBE network	.136**	.172**	.173**	.179**	.115**	.046	.024	.015	-.019	.038
5. Chinese network	.107**	.105**	.111**	.084**	.126**	.129**	.059**	.083**	.119**	.169**
R-Squared adjusted	.09	.14	.12	.11	.06	.10	.02	.02	.15	.16

* p < .05, ** p < .01

Table 4. MRQAP regression analyses of social learning networks and cultural differences (standardised beta coefficients)

	Model 1 Learn UG1 (1)	Model 2 Learn UG1 (3)	Model 3 Learn UG2 (12)	Model 4 Learn UG2 (15)	Model 5 Learn UG3 (30)	Model 6 Learn UG3 (33)	Model 7 Learn PG1 (1)	Model 8 Learn PG1 (3)	Model 9 Learn PG2 (7)	Model 10 Learn PG2 (9)
1. Gender	.030	.017	.032*	.040**	-.006	-.002	.006	.009	.022	.012
2. Group division	.202**	.259**	.248**	.321**	.074**	.310**	.000	.028**	.443**	.516**
3. Co-nationality	.093**	-.007	.037	.040*	.079**	.026	.031*	.037**	.050	.031
4. GLOBE network	.013	.018	.088**	.031	.026	-.008	.010	.007	.055	.003
5. Chinese network	.056*	.108**	.031	.014	.129**	.107**	.046**	.038**	.071*	.030
R-Squared adjusted	.06	.08	.08	.11	.04	.11	.01	.01	.23	.28

* p < .05, ** p < .01

Table 5. MRQAP regression analyses of social working networks and cultural differences (standardised beta coefficients)

	Model 1 Work UG1 (1)	Model 2 Work UG1 (3)	Model 3 Work UG2 (12)	Model 4 Work UG2 (15)	Model 5 Work UG3 (30)	Model 6 Work UG3 (33)	Model 7 Work PG1 (1)	Model 8 Work PG1 (3)	Model 9 Work PG2 (7)	Model 10 Work PG2 (9)
1. Gender	.020	.03	.071**	.035**	.023	.015	.011	.010*	-.032	.0105
2. Group division	.354**	.524**	.275**	.399**	.082**	.457**	-.007	.062**	.348**	.643**
3. Co-nationality	.097**	.086**	.039	-.008	.054*	.066**	.050**	.043**	-.087	-.020
4. GLOBE network	.000	-.015	.095**	.059**	.066**	.009	.02	.008	-.084	.003
5. Chinese network	.031	.042*	.063**	.046**	.098**	.047**	.042**	.045**	.148**	.057*
R-Squared adjusted	.14	.29	.11	.17	.04	.22	.01	.01	.17	.43

* p < .05, ** p < .01

Table 6 Linear regression analyses of E-I indexes of three social networks, gender, and cultural differences

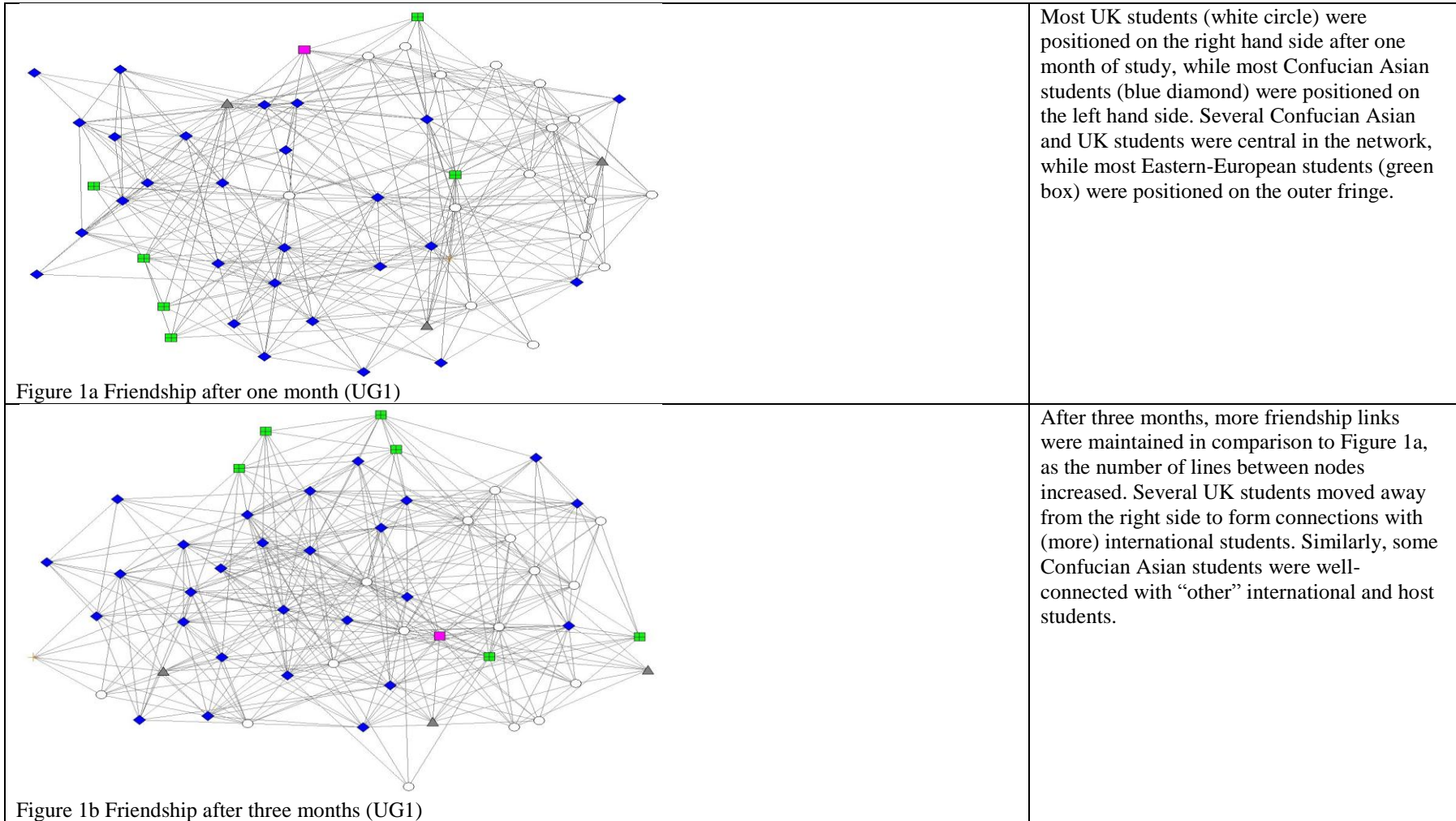
	Model 1 Friend (Pre)	Model 2 Friend (Post)	Model 3 Learn (Pre)	Model 4 Learn (Post)	Model 5 Work (Pre)	Model 6 Work (Post)
1. Gender	.017	.040	.002	.001	.049	.063
2. UK national	.404**	.447**	.252**	.239**	.276**	.320**
3. Western International	.464**	.423**	.338**	.324**	.337**	.376**
4. Non-Western	.448**	.430**	.291**	.313**	.372**	.430**
5. UG1	.151**	.135**	.158**	.231**	.275**	.252**
6. UG2	.008	-.037	-.028	.053	.014	.049
7. UG3	.050	.115**	.093*	.156**	.072	.166**
8. PG2	.203**	.129**	.072	.177**	.363**	.183**
R-Squared adjusted	.39	.38	.18	.22	.34	.35

* p < .05, ** p < .01. Note that Confucian Asian students were the reference group for culture, while PG1 was the reference group in terms of timing.

Table 7 Confirmed and rejected hypotheses

H	Dependent Variable(s)	Confirmed/rejected
1	The social friendship networks of international students are different from those of host students at the start of the five modules.	Confirmed, most students built relations based upon similarity of cultural backgrounds (in particular amongst Confucian Asian students)
2	The social learning and working networks of international students are different from those of host students at the start of the five modules	Confirmed
3	Friendship networks at the start of the five modules are built on the same cultural background	Confirmed
4	Learning and working networks at the start of the five modules are built on the same cultural background	Confirmed
5	Over time, the social friendship networks of undergraduate students become more integrated irrespective of cultural backgrounds	Partially confirmed. UK but in particular (non-Confucian Asian) international students develop more external cross-cultural relations at the post-test of the five modules, but Confucian Asian students develop more inward relations over time.
6	Over time, the social learning and working networks of undergraduate students become more integrated irrespective of cultural backgrounds	Partially confirmed, similar effects as H5.
7	Over time, the social friendship networks of postgraduate students become more integrated irrespective of cultural backgrounds	Partially confirmed, similar effects as H5. Most international and host students develop substantial cross-cultural relations, even if their study lasts only for one year.
8	Over time, the social learning and working networks of postgraduate students become more integrated irrespective of cultural backgrounds	Partially confirmed, similar effects as H7.
9	Due to active group work assignments, after completing a module students developed more integrated social networks	Confirmed. Group divisions are three times more important in predicting friendship, learning and working relations than cultural backgrounds at the end of the module

Figure 1a-1j Friendship networks across five modules



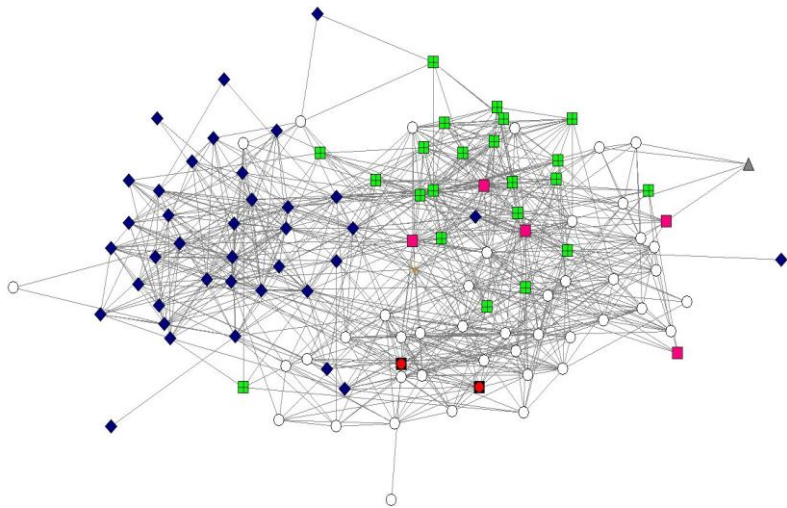


Figure 1c Friendship after 12 months (UG2)

After twelve months, in UG2 module again most Confucian Asian students were positioned as a distinct subgroup on the left, while Eastern European students were mostly positioned on the top right of the social friendship network. The majority of UK students were positioned on the right and bottom of Figure 1c. A mix of Western and non-Western international students were scattered across the network.

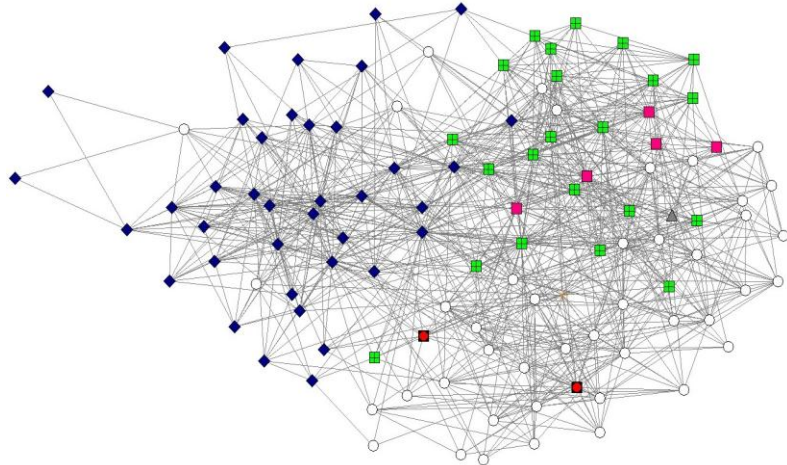


Figure 1d Friendship after 15 months (UG2)

After 15 months, the number of friendship links between students increased, but the overall positioning of the three largest cultural groups (UK, Confucian Asian, Eastern European) in the social friendship network remained relatively stable. Latin European students (pink square) were also positioned on the right of Figure 1d.

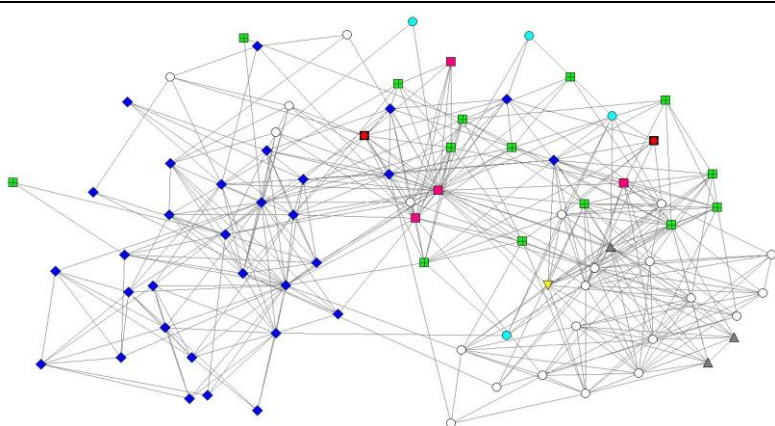


Figure 1e Friendship after 30 months (UG3)

In UG3 module after 30 months again most Confucian Asian students were positioned as a distinct subgroup on the left, while UK students were positioned on the right bottom, but with several UK students positioned on the top of the left graph. The “other” international students seemed to form a bridge on the top of Figure 1e between the Confucian Asian and UK students.

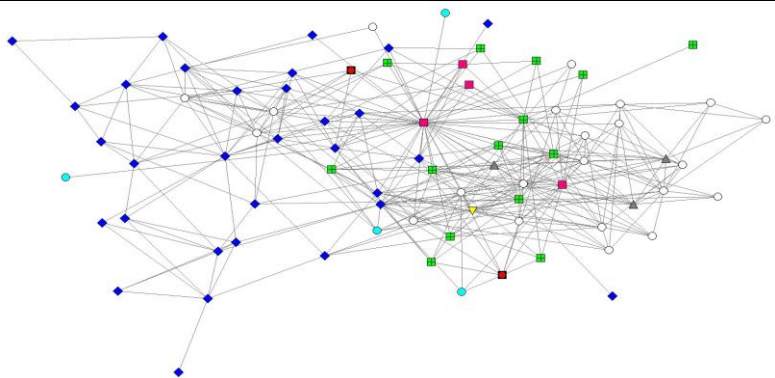


Figure 1f Friendship after 33 months (UG3)

After 33 months, the other international students were mostly positioned in the centre of the network, with several UK students on the right and middle of the friendship network. Most Confucian Asian students were positioned on the left, but several students became central participants in the friendship network.

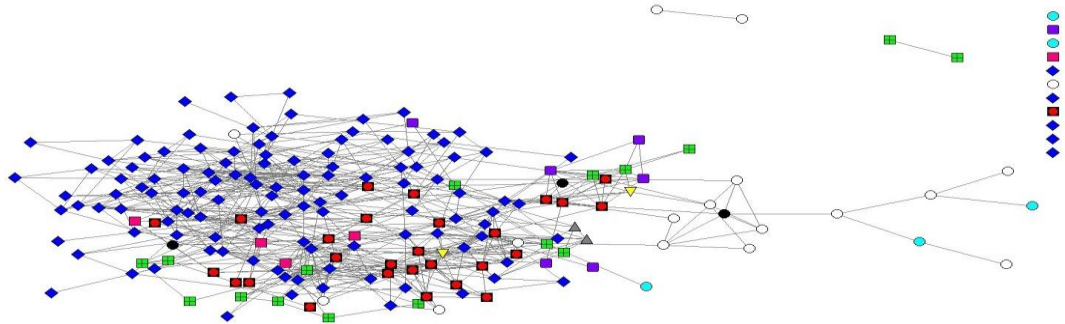


Figure 1g Friendship after one month (PG1)

After one month, 11 post-graduate students did not establish any friendship within PG1 module. A large cohort of Confucian Asian students was present, who were primarily situated on the left of Figure 1g. Most UK students were positioned on the right and primarily interacted amongst co-national students. Except for Southern Asian students (red circle in box), most other (international and host) students were positioned on the outer fringe of the network.

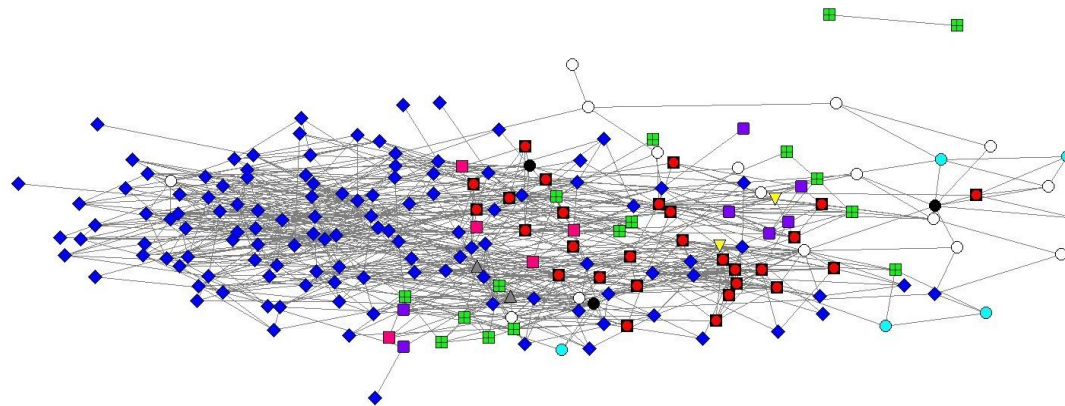


Figure 1h Friendship after three months (PG1)

After three months, substantially more friendship links were generated, but most students remained in the same part of the friendship network. Southern Asian students and other international students seemed to provide a bridge between Confucian Asian and UK students.

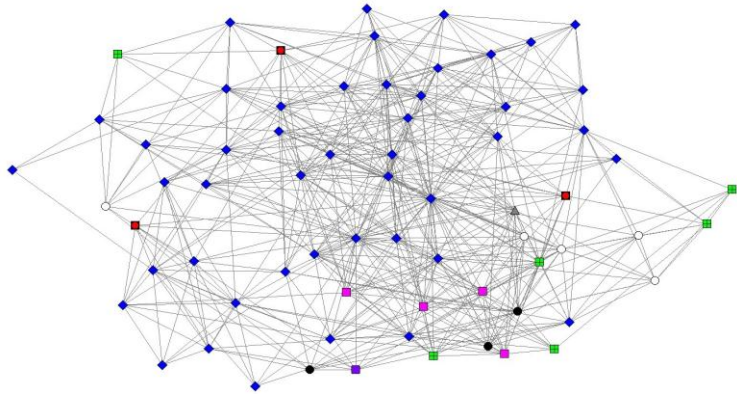


Figure 1i Friendship after seven months (PG2)

After seven months, most non-Confucian Asian and host post-graduate students were situated on the outer fringe on right. In comparison to the other graphs, the number of host students was limited ($N=4$).

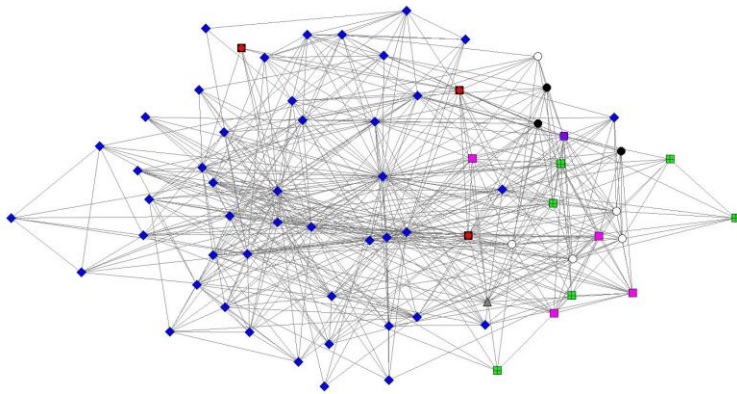


Figure 1j Friendship after nine months (PG2)

After nine months, most Confucian Asian students were situated in the centre and left of Figure 1j. Host and other international post-graduate students were positioned on the outer fringe of the network.

Figure 2 Friendships across the five modules (months in brackets)

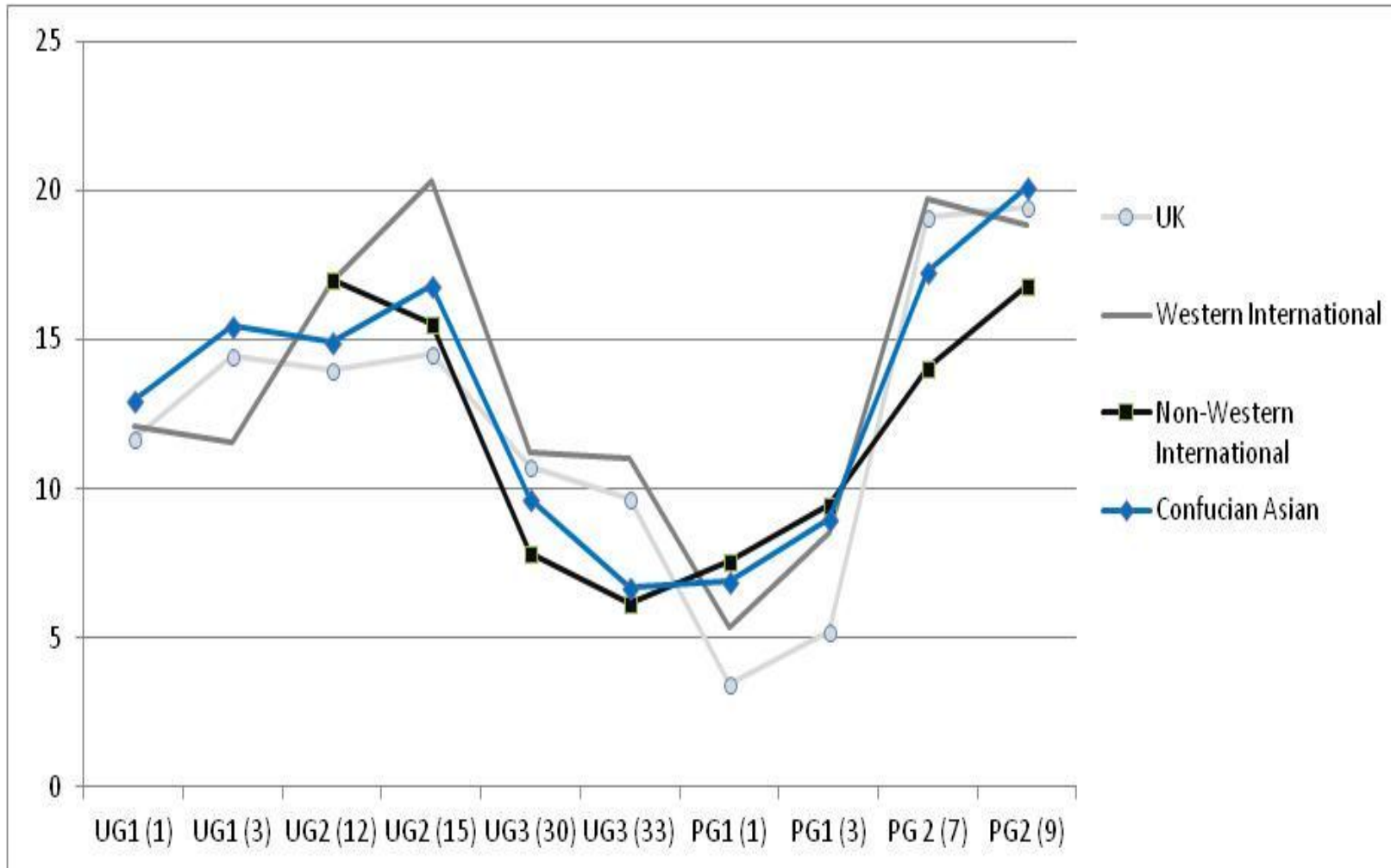


Figure 3 External Internal Index of friendships across the five modules

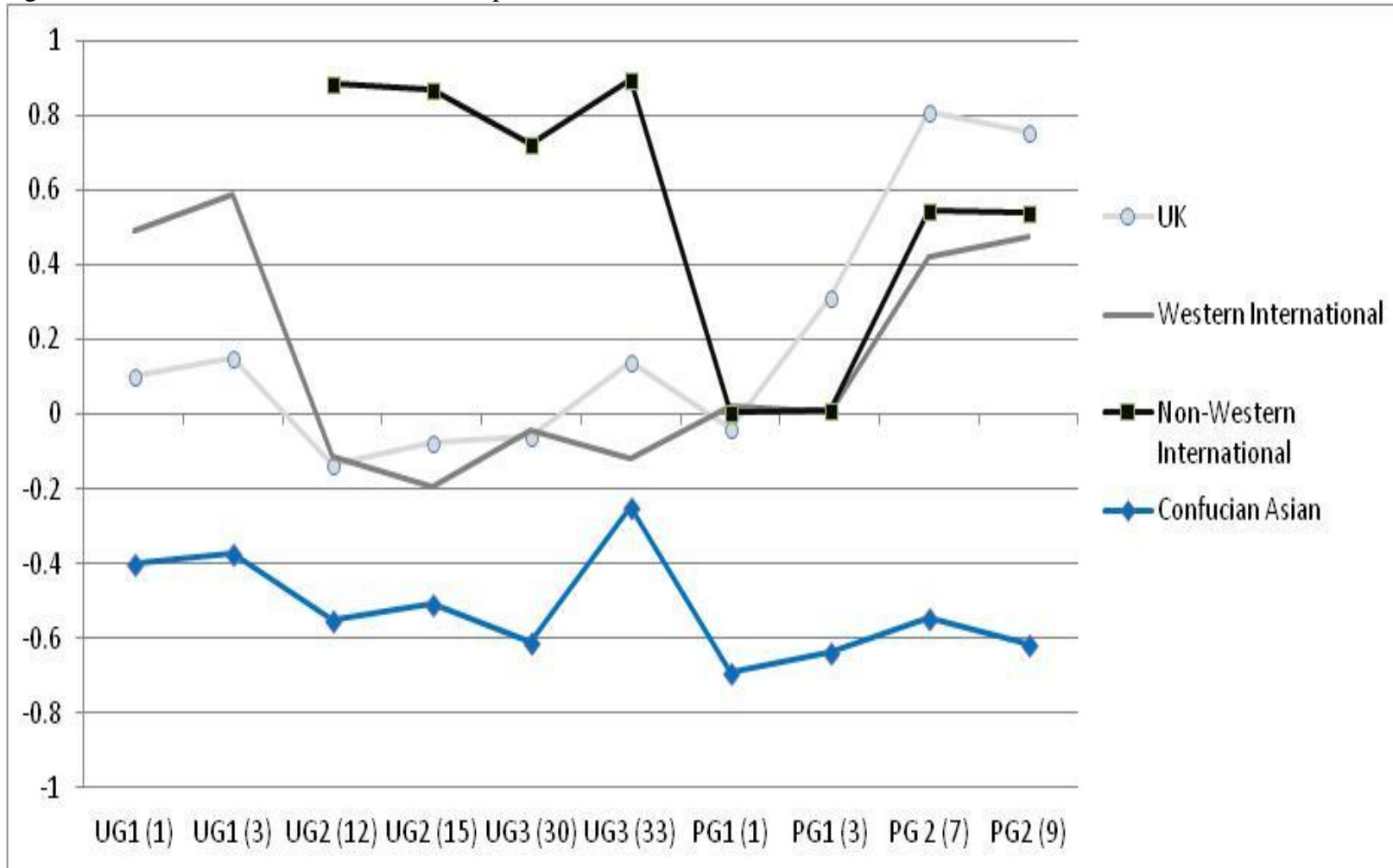


Figure 4 Social networks of UK and Confucian Asian students across the five modules

