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Social Supports in HE: A Social Network Analysis (SNA) approach to understanding learning experience

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Abstract

In this study, we combined social network analysis methods with mixed methods approaches to examine social roles and network patterns in social network data gathered from one complete class group of learners in a higher education setting. We investigated the strength of social ties to examine the support networks of this learner sub-group, with a particular comparison between mature learners and other learners, and female and male learners. We also interrogated the meaning of online social relationships, the social strength of online ties and the relation between the existence of a tie to the expectations that the associated individuals have about the implied relationship. We used these analyses to draw inferences about support networks on which these learners rely, considering how learners in an educational setting access (or not) the supports which they require. We also considered whether successful access to such supports is influenced by a learner's position in the social structure and whether accessing such supports is considered by the learners themselves to have a significant impact on their experience in HE. A central methodology included the use of a clustering algorithm to carry out a role analysis that categorised the learners into groups, according to the structure of their support networks. Our study considered both age and gender as defining characteristics and discovered social isolation within the network but also social integrators, that is, individuals, or networks of individuals, who are key to functioning support networks. We hope that the findings of this study will help in the understanding of the role of social supports and provide insights into the learner experience in HE.

Keywords: Social network analysis; social support networks; mature students; gender in education; learner experience.

Introduction

If our aim is to understand people's behavior rather than simply to record it, we want to know about primary groups, neighborhoods, organizations, social circles, and communities; about interaction, communication, role expectations, and social control. (Barton 1968, as reported in Freeman, 2004)

Humans are social beings who create networks of interaction that control our engagement with the world. These social supports are fundamental for social integration and emotional well-being. In higher education, there is a diversity of qualitatively different support networks available to learners and understanding these networks is key to understanding the student learning experience. This paper considered the role played by face-to-face social supports and online networks in the learner experience. There has been a generational shift in the way that people balance needs for privacy against the supports that can be obtained from dissemination and discussion of personal matters with a wide community, or network, of online connections. In the context of the modern world in which social networking is more and more supported by online platforms, we hypothesised that support networks have further diversified due to the extent to which individuals have access to, and are comfortable with, the use of these tools. One category along which we expected to observe a clear distinction in support networks was between mature learners and those who enter HE directly from second-level, so-called 'direct entry learners'. Another characteristic which we hypothesised would be impactful was gender.

What can SNA methods tell us about learner experience?

The role of social supports in educational contexts has been shown to have a strong impact on student learning: for example, Davidson and Major (2014) investigated the use of collaborative groups in learning – that is, small groups of learners who meet regularly to discuss matters associated with their academic goals and progress, with and without teacher participation. These learning groups are established to increase understanding and develop transferable skills but often have greater significance for students, providing emotional and other supports (Johnson, Johnson & Smith, 2006; Johnson, Johnson & Holubec, 2008; Johnson, Johnson & Smith, 2014).

Two principles in the field of SNA are useful with regard to understanding how learners build and/or maintain social networks. Firstly, there is the concept of *homophily* in social networks, i.e. the principle that contacts between similar people occur at a higher rate than among dissimilar people, which McPherson, Smith-Lovin and Cook (2001, p.21) describe simply as “similarity breeds connection”. In practice, this means that if two individuals share a common focus, it is more likely that they will share joint activities with each other than two individuals who do not have that focus in common. This principle of homophily would suggest that the *connectedness* of learners is a key determinant of their educational success.

Secondly, *focus theory* suggests that aspects of the social environment can be seen as *foci* around which individuals organise their social relations and activities, whether in family units, learning environments or other social interactions. Feld (1981), using focus theory, distinguished between some foci, such as families (in which all individuals associated with the focus will have ties to each other) and other foci (such as city neighbourhoods) in which not every individual is tied to every other individual. Feld also suggested that when two individuals are tied, they will tend to develop new foci around which they organise their common activities. From this perspective, Feld emerges with a model of community organisation as sets of intersecting *social circles*.

By uniting educational perspectives on collaborative learning with SNA analysis of connections and relationships, it is possible to bring meaningful insights to the complexities of connections between individual learners and within a group of learners: “this theoretical and methodological approach [SNA] differs from conventional approaches used in educational research, which often views individuals as mere collections of attributes” (Carolan, 2014, p.51).

This perspective allowed us to hypothesise that collaborative learning groups (which, from an SNA perspective, could be termed *foci*) were ‘implicitly’ available to members of strong support networks (which we defined as, strong support ties which are formed between classmates) providing fora to support learning. On the other hand, we also hypothesised that students who remain socially excluded from such networks may not have access to such collaborative support groups (or foci) because they have not developed sufficient social ties. The result is that some students who are less able to form social ties may find it increasingly difficult to overcome the barrier of establishing themselves in the emerging support networks and that this may have negative impacts on their learning motivation, engagement and success.

Rationale

Since the global banking crisis of 2008, reduced government spending in educational infrastructure and human resources has had a profoundly negative effect in education in Europe. Recent figures show that Ireland's 3.4% contribution of GDP to education is the fourth lowest in the OECD (OECD, 2020a). In addition, rising unemployment levels in the last decade have increased the numbers of those entering education in the hope of increased competitiveness in the labour market and this has in part contributed to the growth in student numbers which is predicted to continue and place increased demands on the higher education sector (HEA, 2018). Lastly, the HE sector has been massively affected by the pandemic restrictions imposed in 2020 and is also facing an unpredictable post-COVID-19 landscape with possible ill effects on learner experience (OECD, 2020b).

The impact of these crises on teaching and learning in HE included: reduced staff levels and bigger class sizes (generally), hiring freezes (Latvia, Ireland, and Italy); redundancies (Hungary, the UK; and

Austria); salary freezes (Estonia); salary reductions (Greece, Ireland, Spain, Portugal and Latvia); cutbacks in the provision of support infrastructure and services, including libraries, counselling and other supports (Ireland) and reduced up-keep of capital property (Austria and Poland) (EUA, 2011). All such outcomes have had negative impacts on the quality of teaching and learning provided in the sector.

The more recent pandemic restrictions have meant that most HE learning was moved to an emergency remote platform with the commensurate difficulties that brought for teachers and learners:

initial challenges centred on access to broadband and IT equipment and support, the technological skills-base of teachers, learners (and for younger learners, parents) and the difficulties of teaching certain disciplinary-specific skills in lieu of face-to-face contact e.g. practical skills training for nurses and veterinary nurses. Delivery of content, feedback and assessment all now needed to be, at least, re-considered, if not completely re-designed for the remote and online environment. As lockdown continued...other challenges were being identified with regard to teacher stress and burn-out and student motivation and engagement (Brereton, 2020, p.2).

Therefore, while “the economic crisis has been a wake-up call, forcing us to focus on issues that really matter...education” (DES, 2011, p.1), it is also true that at a time of severe economic downturn, increased massification and a global health crisis, a concurrent European-wide agenda to modernise higher education and enhance teaching and learning is underway: “every institution should develop and implement a strategy for the support and on-going improvement of the quality of teaching and learning, devoting the necessary level of human and financial resources to the task, and integrating this priority in its overall mission, giving teaching due parity with research” (EC, 2013, p.3).

It is therefore essential that any consideration of the learner experience must take place in the light of these on-going changes.

Social Network Analysis

Since the pioneering work of social science researchers such as Linton (in the 1930s), Moreno (in the 1940s and 50s) and White (in the 1960s and 70s) ¹, the concept of a social network has long been a rich field, examining communities in terms of their social links and the configurations of social relationships which are “interwoven with meaning” (Fuhse, 2009, p.1). Extracting such *social meaning* from data in the form of a network of social links has broadened to become the field known

¹ Freeman (2004) provides an excellent review of the developments in the field, delivered in an engaging narrative style. This work is dedicated to Moreno and White.

as social network analysis (SNA) which examines networks to “uncover the social relations that [link] individuals and groups together, the structure of those relations, and how relations and their structures influence (or are influenced by) social behavior, attitudes, beliefs and knowledge” (Prell, 2012, p. 1).

SNA focuses on individuals in a social structure, often referred to as *actors* and, in particular, on the relationships between those actors. Categorising actors and groups of actors according to their patterns of social connections can yield insights into the functioning of the structure as a whole. While the *dyad*, the relationship between two actors, is the fundamental unit through which the network is composed, *triadic* structures (mutual relationships between three actors) are often taken as indicators of a strong social structure. Often, it is insightful to examine a particular actor and focus on those individuals to whom they are connected, referred to as the *alters* and to examine patterns in the network of connections between actors and alters, the so-called *ego network*. SNA research also considers features of the network, such as its size and the density of links, in subgroups or in the entire network (Prell, 2012).

Another facet of SNA research measures the quality or strength of a social network. Vaux (1988) used the network size as a measure of strength to distinguish different types of supports which the network requires and suggested that not all types are necessarily provided in every network. In addition, Freeman and Ruan (1997) considered the need for different support types due to the multi-relational nature of the ego-network giving rise to multiple kinds of social ties and role relations.

Social Network Analysis in Educational Research

The coupling of social relationships to networks, too, is heavily laden with meaning. The symbolic construction of persons is one instance of this coupling. Another instance is the application of social categories (like race or gender), which both map and structure social networks. [This] offers an agenda for research on this meaning structure of social networks. (Fuhse, 2009, p.51).

SNA can provide numerous valuable insights in the field of education (and especially, the sociology of education), in ways which allow for nuanced consideration of meaning construction in social relations. We can apply this in educational contexts, in particular in relation to the social structures of learners, to identify the quality and strength of a network of learners.

SNA can also allow a valuable consideration of the role played by gender within learners’ social networks and its impact on learner experience; for example, Ullrich, Borau and Stepanyan (2010) found gender differences in the formation and usage of social networks while Psylla, Sapiezynski, Mones, and Lehmann (2017, p.1), who considered the interactions (face-to-face and online) of 800 university students found “robust deviations that include multiple facets of social interactions, suggesting the existence of inherent behavioural differences”.

Arguably, the key development which makes social network analysis approaches relevant in the field of education and especially, the sociology of education is that “relationships shape a person's behavior and/or attitudes beyond the influence of his or her own individual characteristics”, thereby providing valuable insights into the relationships and supports surrounding each learner in an educational context (Carolan, 2014, p. 6).

Moreover, social network analysis can provide useful and innovative insights into possible digital enhancements in learning. For example, Saqr and Alamro (2019) made use of SNA to study learner interactions in technology-enhanced learning and in online Problem Based Learning (PBL), in particular. In this way, the authors were able “to study students’ positions in information exchange networks, communicational activities and interactions, broaden their understanding of the process of PBL, evaluate the significance of each participant role and learn how interactions can affect academic performance” (Saqr & Alamro, 2019, p.1). In examining the role and impact of support networks on student learning (Keane, de la Varre, Irvin, & Hannum, 2008), the digital divide was also explored and the extent to which digital literacy can improve learner success identified. It was shown that the provision of technology training can lower the drop-out rate as learners who are technologically-enabled make better use of supports in the learning environment.

Social Support Networks in Educational Research

Research has also investigated how differences in social support are related to differences in the characteristics (such as gender and age) of the support receiver; for example, Moore (1990) found differences between the importance of role relationships between networks comprising women or men. Fuhse (2009, p.51) described the “coupling of social relationships to networks...such as the application of social categories (like race or gender)...[as] heavily laden with meaning”. This study considered whether different learner groups, defined by their characteristic attributes (such as gender or age), have different levels of access and usage of social support networks in order to consider the learner experience in a ‘meaningful’ way.

In light of the on-going challenges and changes in the HE sector, this meaningful consideration should examine the social supports for all learners, but in particular, those learners in under-represented learner groups who may be most in need of them, including mature students (those defined as 23 years and older), the percentage of which is only 15%, falling short of the participation target set for this cohort (HEA, 2018)².

² A recent sectoral report also pointed out the challenges to such learners arising from poor communication of information on specific supports to students, with better consistency needed in the dissemination of information to these learners (HEA, 2018).

Methodology

Study Design

A computational social science methodology can provide “an opportunity to integrate traditionally disparate approaches within sociology and...a foundation for transforming sociology in the 21st century” (Brent, 1993, p.1). Specifically, we used a mixed methods explanatory sequential design, enhanced with social network analysis techniques. Data was gathered by means of qualitative and quantitative tools, including focus groups, semi-structured interviews and a survey which was analysed using computational methods. This three-way process facilitated triangulation of the data and enhanced the validity of the study.

The focus groups and interviews provided rich insights into the learner experience (Creswell & Plano Clark, 2011). The survey provided the raw data of learner networks and the social network analysis mapped the network data as computational (SNA) tools were used to better understand this social phenomenon (Hox, 2017).

Employing computational sociological mixed methods allowed us to best achieve the aim of the study i.e. to uncover the social support systems upon which learners rely and which they believe to be important to their success as learners. This follows best practice when working to uncover deeper levels of ‘school culture’:

In order to probe beneath the surface of the school’s culture, to examine the less overt aspects of the school’s culture(s) and subcultures, it is important to combine quantitative and qualitative methodologies for data collection. A mixed methodology will be used for the empirical data collection, using numerical and verbal data, in order to gather rounded, reliable data. A survey approach will be used to gain an overall picture, and a more fine-grained analysis will be achieved through individual and group interviews and focus groups (Cohen, Manion & Morrison, 2007, p. 115).

The use of a qualitative methodology in the initial phase allowed us to examine the ‘reality’ of the learner experience as “qualitative research is not just about applying a different set of tools to gain knowledge, but rather, involves a fundamental shift in the approach to research, and description of reality” (Kielmann, Cataldo & Seeley, 2012, p. 5). This methodology also worked to engage the participants in thematic generation grounded in human experience (Sandelowski, 2004). The use of a quantitative methodology in the next phase facilitated “identifying and defining elements and discovering ways in which their relationships can be expressed” (Cohen et al., 2007, p. 57).

The development of the survey needed careful consideration, as an accurate elicitation of social network data was required. The survey was devised to elicit and categorise different types of social supports and asked respondents to list those members of their face-to-face social networks who they would expect to provide these categories of support. In this way, the survey gathered a set of social connections between learners in the group, as well as from the learners to a small group of non-learners who could provide support.

We also investigated how much of their online social networks respondents were willing to share and investigated if their perceptions of which alters were most supportive was well-correlated with their communication patterns to these alters. SNA was conducted of the resultant networks to extract roles and identify key individuals.

SNA Methodology

As stated previously, in order to further understand the learner experience, this study also used social network analysis techniques to uncover the ego-networks of a class group. We considered if social networking is used differently by different learners and whether different usages impact on the quality of the learner experience.

We focused on a single class group of final year learners in a business programme in Dundalk Institute of Technology (DkIT) whom we surveyed to collect a set of social connections (or networks) between the learners in the class, as well as from the class group to a small group of external figures who could provide support. The links that we asked students to nominate corresponded to different types of social ties. A ‘friendship’ link, for example, corresponded to the typically mutual, peer-level, social tie, for which we asked learners to indicate a strength, on a 5-point scale. Note that respondents completed the questionnaire separately, so that the data gathered was each respondent’s perception of the connection and it is interesting to see how this perception differed between the actors on either end of the social link. We also gathered links that would be expected *a-priori* to be asymmetric, asking respondents to nominate those among the group whose opinions they valued, or who they would approach when seeking support.

Given such networks, the tools of SNA could be applied in order to gain some insight into the cohort as a whole. In particular, we focused on two types of analysis. The first was concerned with the identification of sub-groups of nodes who have a higher density of within-group connections than connections to others outside the groups. This is a typical characteristic of a *community*. Many social networks are composed of cohesive communities bound by weak ties (Granovetter, 1973, 1982) and such a structural composition has implications, for instance, on how information flows through the network, which can ultimately impact on feelings of exclusion or inclusion. Being a member of a

cohesive community, with strong social ties and access to information and support, can be important to successful learning, while, in contrast, being excluded from such a group may result in alienation.

Since the late 1990s, many computational approaches have been developed to extract the community structure of social networks. In this work, we exploited methods based on *modularity maximisation* (Newman, 2003, 2006). Given a partitioning of a network into sub-groups, *modularity* measures how cohesive sub-groups are. The modularity of a partition of the network is a number between -0.5 and 1.0. High values of modularity (i.e. positive values, close to 1.0) correspond to highly cohesive sub-groups, where the majority of links connect members of the same sub-group and there are relatively few between-group links. In a social network, it is common to find a partition into sub-groups with modularity in the range 0.2 to 0.5. Negative values of modularity, or values close to 0.0, indicate that the partition does not correspond to a set of communities. Given a network, a modularity maximisation algorithm (which we refer to as the MM algorithm) automatically finds a partition whose modularity is close to the highest possible among all possible partitions of the network. On the other hand, given any partition of the network, we can compute its modularity and use that value to assess how cohesive the partition is. For instance, in our analysis, we examined a partition induced by considering the gender of the respondents, such that all female respondents were in one sub-group and all male respondents were in the other. The modularity of this partition provided a quantitative assessment of the extent to which social ties were determined by gender.

Secondly, we used SNA measures of node *centrality* or importance (Freeman & Ruan, 1977). Tens of such centrality measures have been proposed in SNA research and each ranks the nodes in the network according to different notions of importance. Some measures, for example, evaluate the importance of a node as a connector, such that the node's importance is as a conduit through which different members of the network can gain access to each other. Other measures evaluate the nodes' importance as *authorities*, members of the network that others would approach as a source of information or support. We focused on such measures of authority and, in particular, we exploited a Link Analysis Ranking measure called *Page-Rank*, in which the authority of a node is measured recursively, as a weighted average of the authoritativeness of the nodes that connect to it. This measure was particularly useful in the analysis of the networks where a tie links nodes to an individual whose opinion is respected. Nodes with high authority value in these networks corresponded to the influencers or authority figures in the network.

We ranked all nodes in the network according to their authority value, such that the node of lowest authority got rank 1 and the node of highest authority got rank N, where N is the total number of nodes in the network. Given such a ranking, it was then interesting to examine the average rank of different sub-groups in the network. For instance, we examined the average rank of the female respondents to understand how authority is related to gender, or at the average rank of mature

learners, to understand whether this cohort was perceived differently to other learners in the class group.

Data Collection

The Sample

Data was gathered from a whole class group of 26 final year learners in a business programme in DkIT in order to elicit the composition of their relationships and use of support networks. The homogenous sample (all students from the same class, year and programme group) comprised fifteen females and eleven males, five of whom were mature learners (age 23 or over, whose access to HE had not been by direct entry from secondary level). All class-members were invited to participate in the study and all selected to do so. This involvement took the form of participation in either one or two focus groups (1 comprising 14 self-selecting individuals, the other comprising 5 self-selecting mature learners), self-selection to participate in semi-structured interviews (2 direct entry students and 3 mature students) and a whole class participation in completing a survey. Ethical approval was granted by the DkIT School of Business and Humanities Research Ethics Group, as per normal research ethics guidelines.

The Pilot Study

A pilot study was carried out which comprised two focus groups; one with a mix of self-selecting learners from the class group and one comprising mature learners only. In addition, five semi-structured interviews were carried out, comprising a mix of direct-entry and mature learners. This pilot study was useful in identifying themes or issues of relevance to the study. While there was an overlap in many themes in the whole class group, the themes or issues which were considered of most relevance to the mature learners included: integration (*connectedness*) within the class group and the larger group of learners in DkIT; isolation from the class group and the larger group of learners in DkIT; gender and age differences in technological enablement; and difficulties in accessing social supports. The participants also identified Facebook as their most commonly used social networking tool. In identifying the ‘participants’ definitions of the situation, noting patterns, themes, categories and regularities’, we aimed to ensure the validity of the research (Cohen et al., 2007, p.184).

Focus Groups and Interviews

In total, five learners, two male - one direct entry and one mature learner (over 23) - and three female - two direct entry and one mature - self-selected to participate in semi-structured interviews. We found that student apprehension and social isolation were strongly correlated in the mature learner group while student confidence and integration were correlated in the direct entry learners. Central to

this integration was the direct entry learners' physical participation in campus activities, allied to their strong participation in online support communities. The mature students' focus group echoed these results with participants describing their lack of knowledge of online communities in addition to their expressed apprehensions in joining such communities even if they had knowledge of them. Participants in the mature student focus group repeatedly referred to themselves as '*old*' or '*older than the others*' with one participant even referring to herself as '*an aul' one like me [who] wouldn't have much in common with the young ones in the class*'. This sense of exclusion and isolation was not in evidence in the one participant in the mature learners' focus group who was a current member of the '*Mature Students' Society*' who felt that this was a '*great way to hear about stuff going on*' and '*a good meeting spot*'. It would appear that a lack of information on 'age-appropriate groups' was, at least in part, a contributor to the feelings of isolation and negative experiences felt by some mature learners in higher education.

The Survey

Incorporating emerging themes from the earlier phases of data gathering, a survey was devised which asked learners to indicate (by placing ticks in a matrix provided):

- Social links with their classmates and with a set of institutional social support providers;
- Links to those whose opinions they valued and would consult with regard to a number of specific issues, i.e. personal issues; learning and college issues ; social and cultural issues ; political issues; career and work issues;
- Those individuals among their classmates who they felt were influential in the group;
- Those individuals among their classmates who were part of their face-to-face networks and any who were part of their online social network.

Analysis of network data

During the survey stage, each participant completed an individual matrix in answer to seven survey questions and this data was then compiled into one complete matrix which included all the quantitative data gathered. Then, using a clustering algorithm to map the network and a Link Analysis Ranking method to compute authoritativeness (whereby an authority value was ascribed to an individual in proportion to the number of authoritative people who valued the individual's opinion), SNA methods were applied to the data gathered from the survey. This allowed consideration of the 'meanings' within these social networks, the ways they provided connections for learners in the network and the possible impacts of these networks on the learning environment of the participants.

When we considered the communities which the data described, we were able to analyse whether distinct support structures existed within the network. Using the principles of homophily, we also

considered whether relationships of learners with similar interests were evident and if so, what impacts, if any, these connections had upon the learning environment in general. We also examined whether individuals in the network were particularly influential in providing support to the general group and whether certain individuals or groups were isolated from the rest of the social network. Lastly, we considered these questions in relation to natural clusters in the learner group, formed according to similarities such as gender or age – in particular, regarding any possible cluster within the sub-group of mature learners.

Results

Each survey respondent was given a list of their classmates along with seven figures (external to the class) and asked to either place a tick or a rating on a 5-point scale against each person for whom they had the social tie indicated by the corresponding question. Aggregating all the rows allowed a matrix to be created for each question, such as that shown in Figure 1, associated with the question that asked respondents to nominate their friendship links. Each matrix therefore, showed the ties between classmates. In the case of friendship, each blue rectangle in the raw data contained a rating, where 5 meant strong friendship and 1 meant weak friendship. For other questions, we simply asked respondents to indicate the tie.

By re-ordering the list of respondents, the pattern of responses in the matrix changes, even though the data has not been modified. Such a reordering allowed us to visualise sub-groups of the respondents and see the extent to which they form a cohesive cluster, indicated by many ties between them and fewer ties to other figures outside the class group: for example, reordering the matrix of Figure 1, so that females are listed before males, leads to the matrix of Figure 2. The females in the class (R1, R6, R9, R16, R18, R25, R12, R13, R19, R23, R3, R5, R8, R22,R10), are listed first, allowing us to immediately see that female-to-female links are more prominent than female-to-male. To aid viewing of the links, a colouring was applied so that female-to-female links are shown in orange and male-to-male links are shown in white, while between gender links are shown in red. The number of links in each matrix was shown under the *nz* label.

The full networks gathered for each of the other six questions are shown in Figure 3. In each of these networks, the node labelled ‘E’ corresponds to any of the seven external people who were listed on the questionnaire.

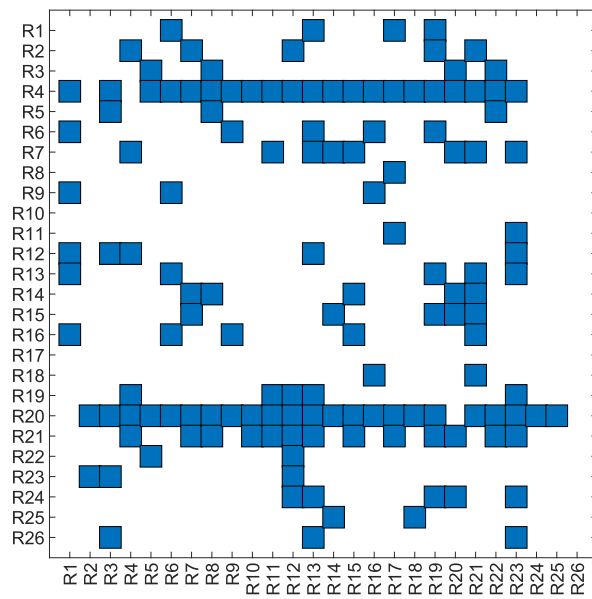


Figure 1 Matrix of Responses obtained for each question

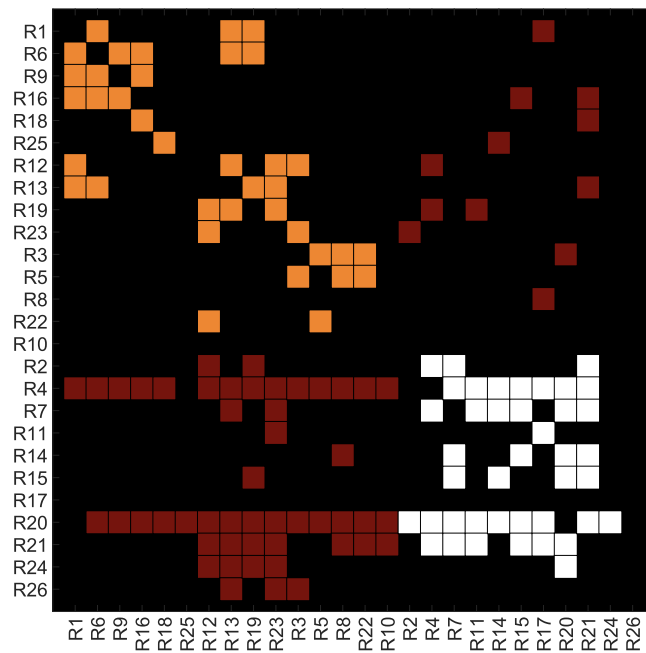


Figure 2 Friendship responses reordered by gender.

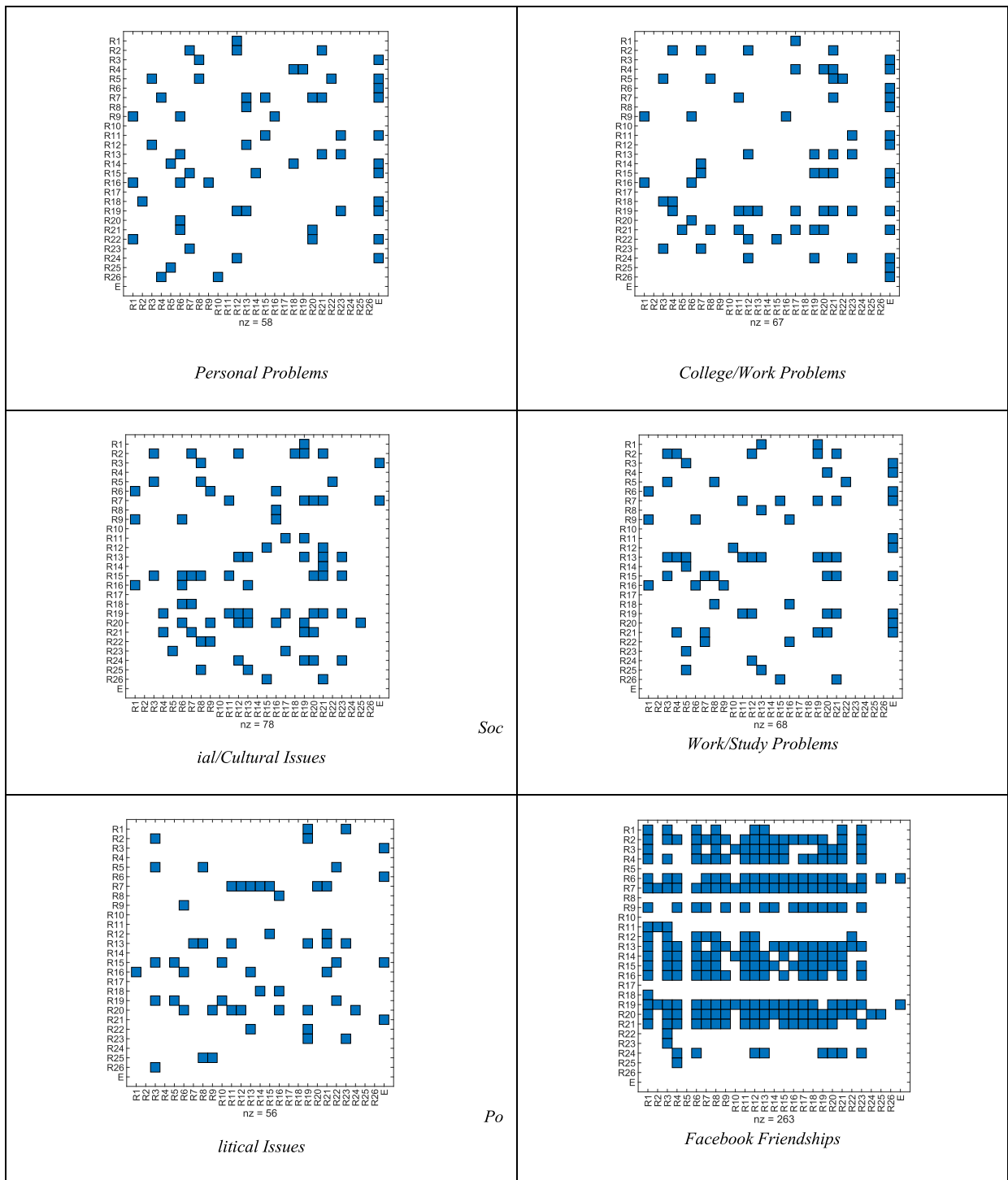


Figure 3 Social Networks Gathered Through the Questionnaire

Gender

The collected data was considered from a gender perspective. In total, there were 15 females and 11 males in the class. The clustering or community-finding algorithm found *cluster nodes* in the social network graph where there were a high number of friendship links between nodes in the cluster, in comparison with links from the cluster to other clusters. One natural clustering of the nodes was according to gender. Figure 4 shows the friendship network drawn such that all females were grouped into one cluster and all males into another. Furthermore, a community-finding algorithm focused just on female-to-female friendships detected three distinct sub-clusters within the female cluster but did not detect any further subdivision of the male cluster.

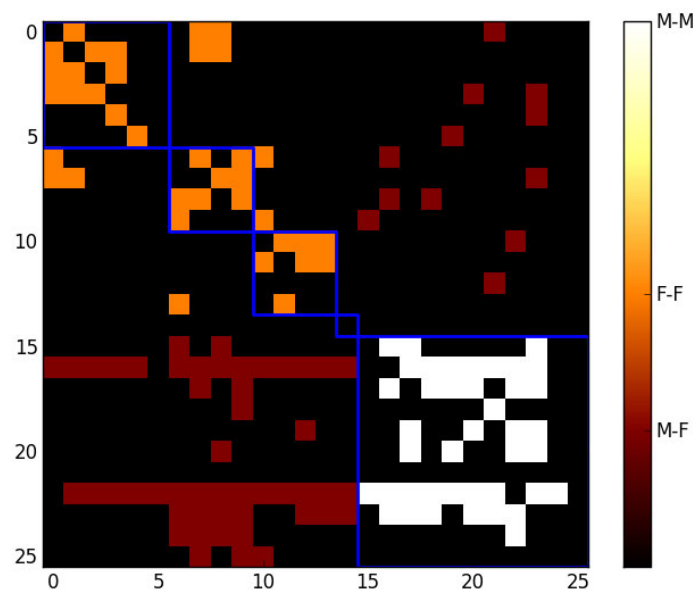


Figure 4 Friendship graph with clustering by gender. Female-to-female links are shown in orange, male-to-male in white and male-female and female-male links in red.

The modularity of the clustering by gender was 0.22. The MM algorithm yielded a set of maximally cohesive clusters with a modularity of 0.27. The result of the algorithm is shown in Figure 5.

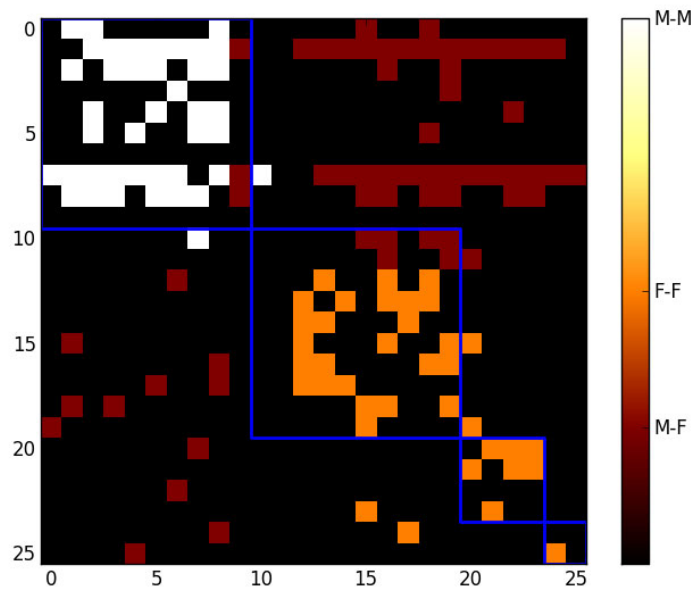


Figure 5 Friendship graph with clustering by maximum modularity.

It is interesting to see that this ‘best’ clustering, from a modularity point-of-view, which was calculated without taking any attributes of the nodes into account but just considering the pattern of friendship links, produced clusters that fall largely on gender lines. Two males were placed in a female dominated community because they have more friendship links to females than males but otherwise all males appear in a single cluster.

Other general observations regarding gender

We would expect friendship links to be mutual. In fact, only 24% of links were reciprocated overall. Male-to-male reciprocation was significantly higher, at 46% while female-to-female reciprocation was 37%. Only 8% of male to female links were reciprocated i.e. of all friendship links identified by a male to a female, only 8% of these were identified by the female back to the male. In contrast, 33% of friendships identified by a female to a male were reciprocated. The mean strength of the links overall was 2.7. Male to female links were higher than this overall average, at 2.9, while female to male were lower at 2.5. Female to female friendships had an average strength of 2.8, while the male-to-male average was 2.7. It is also worth noting that only 17% of possible female-to-female links existed, while 37% of possible male-to-male links existed.

One might conclude that females were more selective in their friendships, particularly when those friendships were to the opposite gender. See the summary in Figure 6.

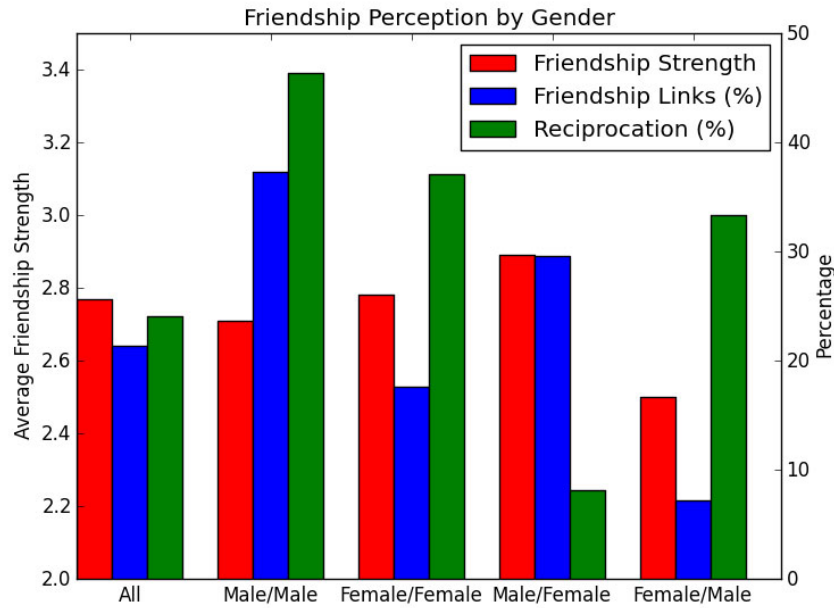


Figure 6 Friendship by Gender Summary

Pathways

Similarity to the gender analysis above, we looked at the friendship network with respect to the pathway taken to enter the programme. We identified three pathways: *mature* students (represented as 'M'), over 23 years of age on joining the programme who had come back into education; learners who took a direct route of joining the programme at the end of their second level education; and *Post-Leaving Cert* (represented as 'PLC') who completed a course after second level to help them achieve the necessary entry requirements to this programme.

The friendship network, ordered to display clusters according to pathway, is shown in Figure 4. It was notable that the within-cluster links were few in comparison to between-cluster links. This was confirmed by computing the modularity of the clustering, which evaluates to -0.04. The data showed that pathway was not a good predictor of friendship.

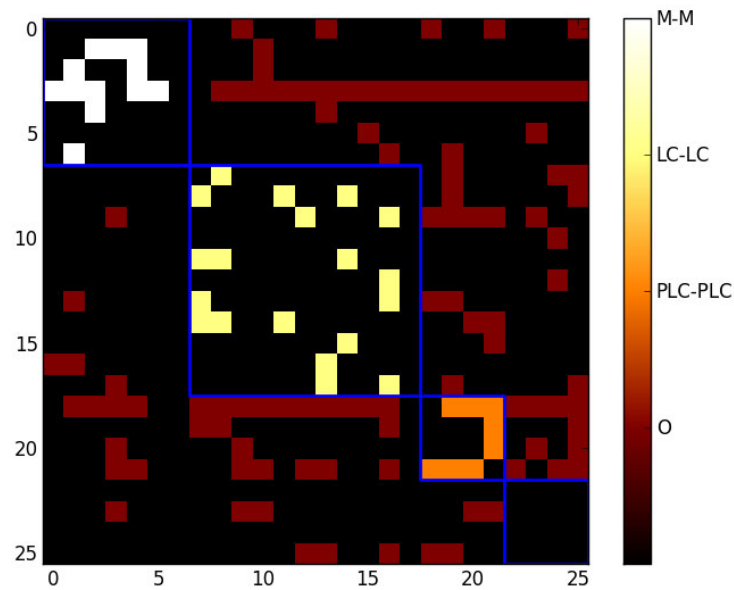


Figure 7 Friendship graph with clustering by pathway.

Examining the mature learners in particular, we noted that mature learners ticked 22% of the possible friendship links to the rest of the network (the non-mature learners) and rated these friendships with an average strength of 3.1. On the other hand, non-mature students only ticked 9.7% of the possible friendship links to mature students and gave these an average strength of 2.2.

These figures can be compared with an average strength of 3.4 given to friendship links between direct entry learners and an average strength of 2.1 given to friendship links between M students. We concluded that mature students *perceived* their connections to the rest of the class to be stronger than they were, according to their non-mature classmates. This suggests that a level of isolation existed that mature students were not fully aware of. This may result from the group of mature students not seeing themselves as a cohesive group and rating their friendships to the rest of the class more strongly on average than their friendships to each other. The asymmetry of perceived friendship might be accounted for by the age difference between the two groups though this was not substantiated in the study and could form the basis of further studies.

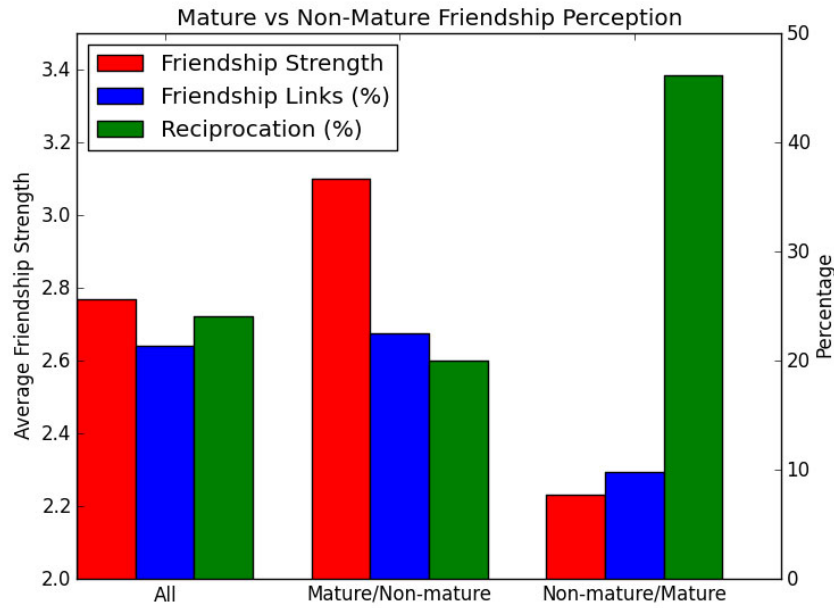


Figure 8 Friendship Perception.

Asymmetric Social Relationships

The remainder of the questions on the questionnaire referred to asymmetric social relationships. Respondents selected those people to whom they would turn if they had a problem or those people whose opinions they valued, suggesting a relationship of respect or authority. These relationships are normally qualitatively different to the friendship relationship, which is generally understood as a mutual relationship between equal partners. On the survey, respondents were given a set of seven (non-learners) authority figures who could be selected along with classmates and indeed there was a strong tendency to choose such external authorities.

Firstly, it was noteworthy that when faced with a problem, there was a tendency to rely on people who were regarded as friends. Indeed, for questions 1 and 2, which asked who the respondent would turn to if they had a personal or college/work problem, the degree of overlap with the friendship network was high (72% in the case of question 1 and 83% in the case of question 2). People whose opinions were valued were somewhat less closely corresponding to friends. In the case of questions 4, 5 and 6, the overlap with the friendship graph was 59%, 63% and 62% respectively. Thus, for approximately 40% of these relationships, classmates who were not recognised as friends were recognised as people whose opinions should be respected.

Nevertheless, gender played a strong role in selection of such links. Clustering the five graphs corresponding to questions 1, 2, 4, 5 and 6 found gender leads to modularity values of 0.21, 0.20, 0.31, 0.25 and 0.21, respectively. For comparison, the best clusterings yielded modularity values of

0.43, 0.36, 0.40, 0.33 and 0.35 respectively, showing a strong tendency for male-to-male and female-to-female links in all of these graphs. On the other hand, clustering nodes according to the pathway of the individuals into the programme did not yield cohesive clusters. In all cases, the modularity value for clusters based on pathway was almost zero. This is summarised in Figure 9.

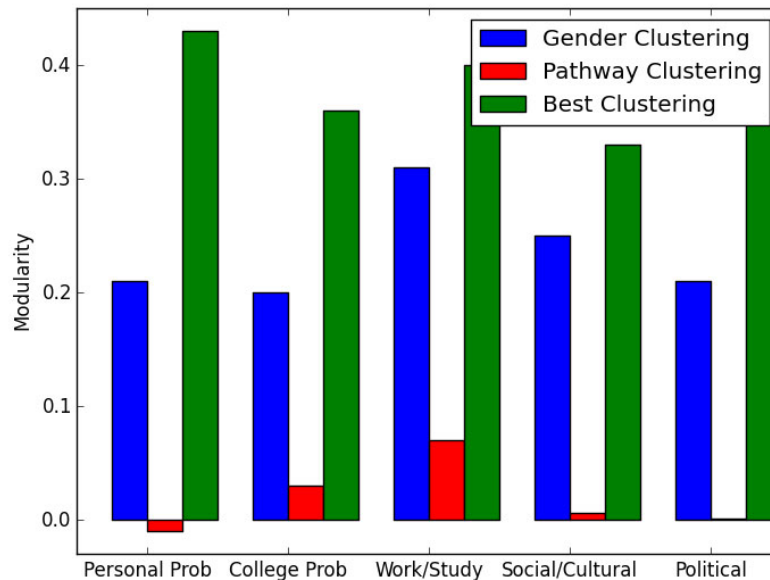


Figure 9 Modularity of Influence Graphs when clustering according to gender and pathway, compared to the modularity of the best clustering

From these graphs, it was possible to rank individuals according to their authoritative-ness. An authoritative person was one whose opinions were generally highly regarded by others in the class. We applied a Link Analysis Ranking method to assign an authority value to an individual in proportion to the number of authoritative people who valued the individual's opinion. Once an authoritative value was computed, all individuals in the graph were ranked according to their authority, giving a rank of 1 to the least authoritative person, a rank of 2 to the next least authoritative person, and so on. We included in this analysis a special node corresponding to an external figure. As expected, in most cases, this node was the most authoritative node, as there was a general tendency to select external figures for the questions asked. We also grouped the ranking according to gender and examined the pathway grouping of most interest to us, i.e. the mature learners. We calculated the average ranking for each grouping: the higher the average, the more influence within the group. The results are summarised in Figure 10.

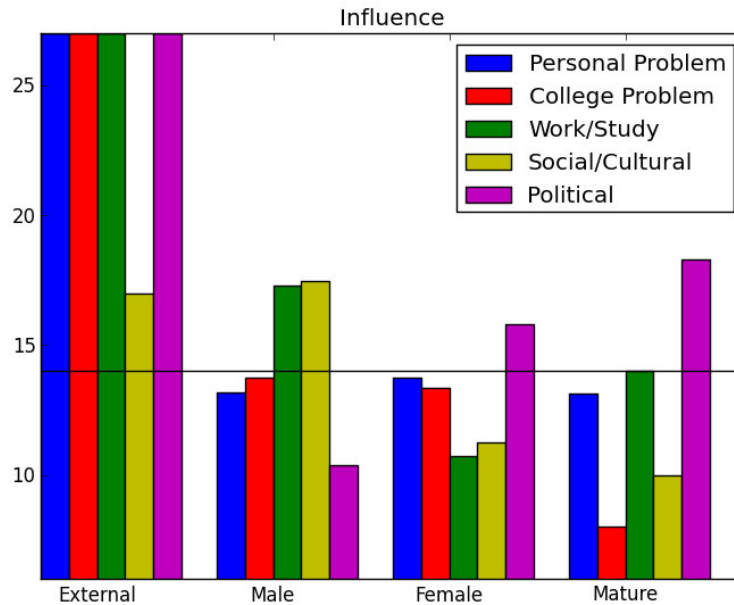


Figure 10 Average ranking of clusters according to their authoritativeness. The black line indicates the overall average authoritativeness. Groups with average authority above this line have higher influence than average in the class.

Results of the Social Network Analysis: Online Network (Facebook)

One question of interest to us was whether the online world offered a qualitatively different social sphere to the real world. In particular, we considered whether the marginalisation effect that we have noted for mature learners in the above analysis also presented in the virtual social space or if it was ameliorated or indeed reversed. We asked respondents to indicate who they were friends with on Facebook, an online social networking service commonly used by the class group. One immediately noticeable point was that the network of Facebook links was much denser (40% of all possible links were selected) than any of the face-to-face networks. The weak social connection of *shares a class with* seemed sufficient for many respondents to warrant a connection on Facebook. We concluded that the presence of a Facebook link was a weak predictor of stronger social ties, such as respect and authority. In Figure 11, Facebook ties between mature learners and the rest of the class are shown.

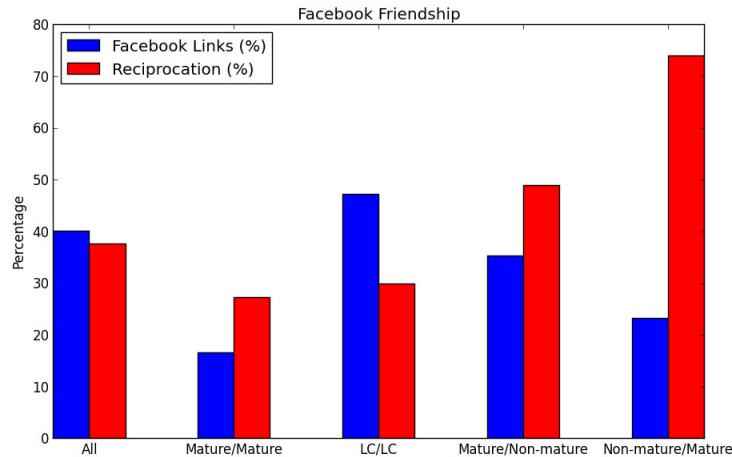


Figure 11 Facebook Friendships Organised by Pathway.

Limitations

This study was carried out with a small sample group, namely, all members of a class-group and therefore, the data gathered is not statistically significant. In addition, the participants were all from one class group in a business programme which allowed interesting insights into the networks within that group and to a small number of external figures but it would also be useful to consider the learning experiences of other learners in other programmes, both within the institute and beyond. While a pilot phase was carried out to highlight relevant themes within the class-group and within the smaller group of mature learners, further research would benefit from examining additional themes and characteristics within the class-group which have an impact on the learning experience.

The pandemic restrictions of 2020 are obviously having impacts on teaching and learning in HE and a study which considers the issues examined here in that changed context would be useful.

The learners identified Facebook as their most commonly used social networking tool so this was the online environment considered in this study. Further studies could expand to examine other platforms such as Twitter, Instagram, etc.

Lastly, although we hypothesised that collaborative learning groups (whether formal or informal) could be a useful learning support, the data indicated that characteristics such as age and gender were counter-productive in establishing the close links needed for such groups to be established.³ This is a point of concern and additional research would be useful to better understand this outcome.

³ The reference to the 'Mature Students' Society' in the pilot study was an unexpected research result and suggests that this campus society may provide informal collaborative supports but for many mature students, access to this support was hampered by a lack of knowledge of the workings of the society. Further research would be needed to examine this in more detail.

Conclusions and Recommendations

This study focused on an analysis of the social support structures available to students in higher education in Ireland: in particular, it compared the social support structures used by mature learners (23 years and older) with those used by direct entry learners in the class group. It also examined gender differences in the class-group and the impacts of these on the learner experience.

An important part of this study centred on an examination of the place of social networking in the provision of social supports. It showed that social networking was used differently by different groups in the class group with these different usages impacting on the quality and effectiveness of the student learning experience. Key findings for the mature learner group were:

1. Fear/apprehension of the learning environment and of learning itself (some learners had not attended formal education for many years);
2. Importance of social networks in overcoming problems - family, friends, colleagues, online support networks;
3. Importance of communication skills - time and task management were singled out for mention;
4. Difficulties of finding the correct balance of all social supports available;
5. Need for more 'blended learning' so that the need for physical attendance on campus was reduced;
6. Overall, the HE sector provided worthwhile and life-affirming experience for mature students.

Overall, the results demonstrated that a social network analysis (SNA) of the network data of whole class groups can yield some interesting insights into both class dynamics, as well as the challenges encountered and learning mechanisms used by specific learners. By providing an increased understanding of the learner experience, the research helped to build understanding of the factors impinging on student engagement, motivation and success.

In addition, our paper applied role analysis to support networks. In utilising this methodological approach, new challenges were encountered. In the main, these were due to the fact that support networks are multi-dimensional which require our role analysis to deal with multi-relational data, involving different dyadic relations which contribute to the overall support strength in different degrees. Importantly, we discover that certain relationships may be inhibitive of social support and thus the role analysis must take account of negative and positive links. Similar or further work in the field should also build on and deepen these insights.

In summary, this project examined the social support networks of a class group of learners, with a particular comparison between mature learners and others. A central methodology included a role

analysis that categorised the class group into groups according to the structure of their support networks in order to discover social isolation. The project also aimed to discover social integrators, that is, individuals, or networks of individuals, who are key to functioning support networks.

We hope that the findings of this study may help to target where social supports in HE need improvement and will provide insights into the learner experience for all, and especially for mature students.

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Appendix A: Qualitative Data Gathering

A. Focus Groups

Focus Group 1: Self-selection from whole class group (N=14: 9 females and 5 males)

Focus Group 2: Self-selection of all mature learners (N=5: 3 females and 2 males)

The focus groups were run as a facilitated conversation, lasting approximately one hour, with both focus groups using the same set of discussion prompts introduced by the facilitator in a flexible manner to encourage as much lively debate and input as possible.

Focus group Discussion Prompts (order and wording flexible)

1. Being a full-time HE learner (positives, negatives);
2. Friendships for learners in a class group (important, unimportant; useful, not useful; different types);
3. Online friendships for learners in a class group (important, unimportant; useful, not useful; different types);
4. Collaborative Learning Groups (formal and/or informal; important, unimportant; useful, not useful)
5. Relationships with non-learners e.g. lecturers, managers, others; (important, unimportant; useful, not useful);
6. Age of learners (important, unimportant)
7. Gender of learners (important, unimportant)

B. Semi-structured interviews:

(N=5: 2 - direct entry from secondary school, both male; 3 – mature learners, all female)

The interviews (lasting approximately 30 minutes) were run as a directed conversation with all five interviews using the same set of questions (open-ended and worded in accessible language to encourage as much input as possible).

1. Do you enjoy being a full-time HE learner? If yes, tell me about that. If no, tell me about that.
2. What gives you the greatest satisfaction as a learner? Tell me about it.
3. What gives you the most challenges as a learner? Tell me about it.
4. Is friendship in the class group important? If yes, tell me about it. If no, tell me about it.
5. Are you friends on social media with any of the people in the class? If yes, tell me about it. If no, tell me about it.
6. Do you collaborate with your class mates for learning purposes? If yes, tell me about that. If no, tell me about that.
7. Do you consult with non-learners in the college for social support? If yes, tell me about that. If no, tell me about that.
8. Are there non-learners in the college whose opinion you would value above others? If yes, tell me about that. If no, tell me about that.
9. Do you think that age has an impact on your learning? If yes, tell me about it. If no, tell me about it.
10. Do you think that gender has an impact on your learning? If yes, tell me about it. If no, tell me about it.

Appendix B: Quantitative Data Gathering

C. Survey

Personal Details:

1. Name:
2. Age:
3. Gender:
4. Pathway to HE: (Tick one (only) of the following):
 - Direct Entry from Secondary School
 - Post Leaving Certificate Course (or similar) after Secondary School
 - Mature Learners

Using the matrix provided, tick each box that refers to a person (whether from your class group, lecturers, course co-ordinator, Head of Department, Head of School, college counsellor, SU representative, doctor/nurse) that you would consult in the following circumstances:

Q1. Tick the boxes of the people you would talk to about personal problems.

Q2. Tick the boxes of the people you would talk to about learning and college problems.

Q3. On a likert scale of 1-5, (where 1 is a weak friendship and 5 is a strong friendship), indicate the strength of friendship with the people in the class group.

Q4. Tick the boxes of the people you would talk to about social and cultural problems.

Q5. Tick the boxes of the people you would talk to about political problems.

Q6. Tick the boxes of the people you would talk to about career and work problems

Q7. Tick the boxes of the people in the class group that you are friends with on Facebook.