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Social capital from online discussion forums: differences between online and blended modes of delivery

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Abstract

This study explored the concept of social capital in higher education contexts by investigating student discussion forum activity and academic performance. To address these aims online discussion forum logs, student marks and teaching delivery method (blended or fully online) data were extracted from the universities learning management system (LMS). Student social network centrality measures were then calculated from the course discussion activity and correlated against student academic performance for each delivery mode. Drawing on social capital and social network theories the analyses identified that in comparison to low performing students the high-performing group held more central positions in their networks and tended to establish dense social connections with students of a similar academic ability. It was also observed that the relationships formed in blended teaching units were of a greater intensity and reciprocity than those established in fully online teaching units indicating a higher level of social capital was reached. This difference in the amount of available social capital between the two teaching modes suggests that students in blended units have comparatively greater access to resources embedded within the network, which in turn can be mobilised to assist them in their academic endeavours.

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This study explored the concept of social capital in higher education contexts by investigating student discussion forum activity and academic performance. To address these aims online discussion forum logs, student marks and teaching delivery method (blended or fully online) data were extracted from the universities learning management system (LMS). Student social network centrality measures were then calculated from the course discussion activity and correlated against student academic performance for each delivery mode. Drawing on social capital and social network theories the analyses identified that in comparison to low performing students the high-performing group held more central positions in their networks and tended to establish dense social connections with students of a similar academic ability. It was also observed that the relationships formed in blended teaching units were of a greater intensity and reciprocity than those established in fully online teaching units indicating a higher level of social capital was reached. This difference in the amount of available social capital between the two teaching modes suggests that students in blended units have comparatively greater access to resources embedded within the network, which in turn can be mobilised to assist them in their academic endeavours.

Introduction

In keeping with contemporary learning theory, current information and communication technologies (ICTs) are increasingly being adopted to promote socially orientated pedagogies. These tools provide students with the opportunity to establish relationships that facilitate working together and the sharing of ideas and information (Anderson, 2006) regardless of location. It is this flexibility of access (time and place) to course content and peers that has driven high levels of ICT adoption within the education sector (Means, Toyama, Murphy, Bakia, & Jones, 2010). The integration of communication tools such as online discussion forums are now seen as essential for promoting student–student interaction and, in turn, for improving educational outcomes (Means et al., 2010).

There is much research to support the educational benefits associated with participation in online discussion forums. For instance, discussion forum activity can facilitate student-centred learning (Ellis, 2001), and support student engagement (Jahnke, 2010); sense of community (Davies & Graff, 2005; Dawson, 2006; Rovai, 2002) and academic performance (Carceller, Dawson, & Lockyer, 2013; Morris, Finnegan, & Wu, 2005). While the pedagogical benefits associated with discussion forum participation have now been well established, there has, however, been limited investigation into the types of relationships that manifest in this medium and how these relationships can be leveraged for academic advantage regardless of the delivery mode (i.e., blended or fully online).

This article presents the results of a study investigating the relationship between students' academic performance and the level of social capital evolving from participation in an online discussion forum. The article also explores the difference in social capital generated between fully online and blended modes of delivery. In so doing, the article contributes to the understanding of the role online discussion forums can play in generating opportunities for students to build and establish social capital in order to support their academic endeavours. The findings have practical implications for those interested in designing for social interaction within the educational context.

Review of the literature

Creation of social capital

The concept of social capital is a well-recognised important personal and social resource for adding value to our lives (Bourdieu, 1986; Coleman, 1994; Putnam, 2000). In the education context, theoretical understandings of social capital have been applied to inform research about student learning and retention (e.g., Dika & Singh, 2002; Goddard, 2003; Hommes et al., 2012). The concept of social capital is derived from Marx's (1849) discussion of capital as the surplus value of production with those controlling the means of production capturing the surplus value. The process described by Marx can be integrated into a model of social capital – which can bee seen as a process that takes an available set of resources, which are offered in return for something else for which a benefit is perceived. This model is echoed in Lin's (2008) definition of social capital in noting the importance of social connections and relationships as a set of available resources in a network that can be accessed and/or mobilised to generate a potential return.

But not all relationships are the same; they vary in intensity and reciprocity. Lin (2008) delineates these varying patterns of social relations into three layers: outer, intermediary and inner most layer. The level of reciprocity and intensity of the relationships differentiate the layers. Each layer is characterised by different types of interactions, and as such will result in the formation of different types of social capital. It then follows that the type of social capital established ultimately influences the level of and type of access to resources.

While social capital is context specific and is multidimensional in nature, numerous researchers have identified a range of useful proxies for measuring social capital. For example, some draw on trust (e.g., Coleman, 1988; Kilpatrick, 2000; Putnam, 1993), norms (e.g., Coleman, 1988; Fukuyama, 2001; Portes, 1998); social interaction (Snijders, 1999), and/or the characteristics of a social network (e.g., Kilpatrick, 2000; Lin, 1999; Snijders, 1999) as potential proxies. Regardless of the diversity of proxies used to identify and measure social capital all of these approaches recognise that the concept is network-based (Lin, 2008). In essence, the basic premise of social capital is that the social structures created from the relationships we establish provide access to a diversity of resources, that when mobilised can assist us to achieve our desired goals and objectives (Kennan & Hazleton, 2006). There is a direct interrelationship between the concept of social capital and social network analysis. In short, social networks are the central building blocks of social capital. Social network analyses are therefore commonly used as a means for both identifying and measuring social capital (e.g., Aldridge, Halpern, & Fitzpatrick, 2002; J. S. Brown & Adler, 2008; Cho, Gay, Davidson, & Ingraffea, 2007; Haythornthwaite, 1996; Sun, 1999).

Social networks evolving from online discussion forums

Social networks are social structures formed from the relationships that occur between individual actors (individuals or organisations) (Wasserman & Faust, 1994). In its simplest form, a social network describes the relationships established between people. These connections can be to family, friends, peers or colleagues, and as such these relationships vary in intensity and reciprocity, from very weak to strong close bonds. Each of these different types of relationships established can provide access to the different types of support an individual may require (i.e., social, economic, informational, instrumental support) throughout their lives.

In the educational context, a teaching unit's online discussion forum provides students with the opportunity to interact and establish a relationship with their peers. Through these interactions, a social network is established. The networks formed through online discussion forum activity are purposely designed in order to promote the elements of social learning (peer-peer interaction). As such, the networks that evolve through the use of this medium have a fixed membership comprised of those enrolled in the teaching unit. Although in this context membership is typically not optional, an individual's decision to participate or not often is.

For a variety of reasons, not all students enrolled in the discussion forum will be active participants. For instance, learner characteristics and dispositions (Prinsen, Volman, & Terwel, 2007), technology and content area experience (Vonderwell & Zachariah, 2005) and attributes of the discussion forum (Cheung & Hew, 2008) have all been noted to influence student participation. While it is considered that online

discussion interaction may lead to better academic outcomes (Weisskirch & Milburn, 2003), an individual's contribution is likely to be low or non-existent unless there is a perceived benefit. Even when an assessment value is associated with participation in the online discussion forum, some students may still choose to forgo participation (Graham & Scarborough, 2001). Students have many competing demands and motivations and will make an assessment of the costs and benefits associated with investing in an online learning activity (Astone, Nathanson, Schoen, & Kim, 1999), and weigh this up against the expected return. If the cost of participation is considered to be higher than the anticipated return they are likely to limit their engagement. It is therefore important that the learning design focuses on activities that are engaging and meaningful to encourage participation and achievement of the intended learning outcomes.

In an open online discussion forum every student is aware of, and able to communicate with, every other member of the network. Even if a student chooses not to invest in communicating directly with others (i.e., a lurker or passive participant), the student may still be considered as part of the network. Irrespective of their level of contribution all students have access to the resources and information contained in the communications posted. However, access to information flowing through a network is different to interactions with others (Henri, 1992) and therefore does not constitute the establishment of a relationship. It is the active participation in the network that constitutes investment in, and provides structure to, the social network, which in turn provides increased access to social capital that can be used to mobilise resources to support the student's academic endeavours.

Social network analysis (SNA) and centrality measures

Social network analysis (SNA) focuses on the characteristics of the relationships established, rather than on the characteristics of the individual actors in isolation. This process provides a methodology for analysing complex social structures (Otte & Rousseau, 2002). SNA examines the specific structural attributes of the relationships that are established (Wasserman & Faust, 1994) and therefore is used to identify the central, prominent or influential individuals within a network. These structural attributes reflect an underlying social structure that not only influences the flow of communications, but also the degree to which an individual actor can rapidly draw upon the resources that reside in that network. Hence, the position an individual occupies within a network impacts upon their capacity to readily access the diversity of resources that are embedded within the network structure (Borgatti, Mehra, Brass, & Labianca, 2009). These relationships within the learner's social network can be measured, benchmarked and demonstrated using the SNA centrality (Freeman, 1979) and are representative of the social capital established (Freeman, 1979).

Centrality measures capture different aspects of an individual's importance or prominence in their social network. There are several well-established measures of importance such as degree, betweenness, closeness and eigenvector. Degree measures the extent an individual is embedded in their network, which can be defined as the number of direct connections each individual (node) has within their social network. The first and simplest of the degree centralities is nodal-degree (known simply as degree centrality), which can be defined as the number of direct links to other individuals (nodes) in the network and represents the potential for activity in communication (Freeman, 1979). There are two other kinds of degree for each node, providing an additional level of analysis by identifying the incoming (in-degree) and outgoing (out-degree) connections. In-degree refers to the number of connections made by others to the individual and is said to represent an individual's prominence in their network (Henneman & Riddle, 2005). Out-degree is the number of connections initiated from the individual, representing an individual's level of influence in the network (Henneman & Riddle, 2005). Individuals with high degree centrality have a greater number of connections (high exposure) and are generally considered as more active (Haas, 2009) and prominent (Wasserman & Faust, 1994).

Betweenness centrality measures the extent to which an individual lies between others in their network. Betweenness is considered a measure of the potential influence (Wasserman & Faust, 1994) arising from their position within the network. For instance, individuals located in strategic positions can actively influence what information does or does not flow through the network. Individual actors with a high betweenness centrality are often referred to as *gatekeepers*. Due to the position of these actors in the network they can control the flow of information (Haas, 2009) and therefore have the potential to influence others (Friedkin, 1991) through both direct and indirect pathways. Thus, an individual can

potentially have fewer connections but be located in a strategic position that provides them with a great deal of power in the network.

Closeness centrality is considered a measure of reach, based on the premise that individuals in the network with the shortest paths will be able to access all other members of the network quicker than any other. In other words, closeness is a measure of how long it will take information to spread from a given individual to all others in the network. An individual with a high closeness centrality is said to be connected to all others through a small number of connections (Otte & Rousseau, 2002) and reflects the ease of communication and flow of resources between the members of the network (Haas, 2009).

Eigenvector centrality is an index of how well an individual is connected. Eigenvector recognises that not all relationships (connections) are the same in terms of the level and type of resources they can provide. For instance, established relationships to highly connected people in the network will provide greater access to resources than less connected peers (Newman, 2012). Eigenvector centrality provides a measure that incorporates both the number and quality of the connections an individual actor has formed.

These measures of network centrality provide insight into the prominence of individuals within a network. In the education setting an individual's position or centrality in their social network has been found to be associated with academic advantage. For example, Baldwin, Bedell, and Johnson, (1997) observed degree centrality in a Master of Business Administration program that advice networks had a significant and positive effect on academic performance. Their findings were also confirmed in a separate study conducted on a management information systems course (Yang & Tang, 2003). Similarly, Smith and Peterson (2007) found *prestige* (i.e., in-degree) in advice networks was positively associated with academic performance in a communication undergraduate class. In another study Cho et al. (2007) observed that degree and closeness centrality in an engineering class were positively associated with student performance. The degree centrality within friendship networks has also been demonstrated to be positively associated with academic performance. However, friendship networks tend to have a lower effect on student performance in comparison with advice networks (Hommes et al., 2012)

Although numerous studies have investigated the role of centrality in academic performance, few have looked at how an individual's position in the network and therefore access to social capital differs in online and blended modes of delivery. This study uses SNA to explore the nature of the social networks formed through student participation in online discussion forums in both online and blended teaching units. Specifically, the study seeks to identify if a relationship exists between an individual's position in the network and their overall academic performance. In so doing the study aims to understand how network positioning and therefore access to social capital can be mobilised to provide access to resources that can assist a student in their academic endeavours. This understanding will better inform pedagogical practices, providing teachers wishing to establish a more social pedagogy with a better understanding of the nature of the relationships established in both online and blended modes of delivery.

Methodology

The present study aimed to determine if the level of social capital established from a student's active participation in an online discussion forum can be used to mobilise resources in order to improve their overall academic performance.

Specifically, the study was designed to address the following research questions:

- Does a relationship exist between a student's social capital and their academic performance (final mark for a teaching unit)?
- Does the social network resulting from active participation in a teaching unit's online discussion forum provide access to the same level of social capital in online and blended teaching units?

The population sample for this study was drawn from 213 teaching units in the Faculty of Arts at a large Canadian research-intensive university. The teaching units were typically 13 weeks in duration, of which 20 were fully online and 193 blended. Online teaching units are units of study delivered fully online as an alternative to face-to-face instruction. Blended teaching units are those delivered by combining face-to-

face and online instruction. Only teaching units that incorporated an online discussion forum were selected for the study.

The study sample included students who completed the teaching unit (i.e., students who were officially enrolled at the end of the semester) and to whom a final mark was awarded (excluding a grade of 0). The total sample size comprised 10,087 students, of whom 3,650 actively participated in their online discussion forum. For this study, participation in the online discussion forum is defined as a student who has posted a message or has responded to a message. Participation is based on contributions to the discussion forum (post or reply). The focus of this study was to explore the active participation of a student in their discussion forum through posts to the discussion forum. The nature of the contribution and the length of post were not considered.

A student's pattern of communication and connectedness in their discussion forum were used to establish a network structure which was measured/quantified using SNA centrality measures (Freeman, 1979) and network composition. These centrality measures serve to quantify the relationships established by a student and can be considered as representative of their level of investment and reflect the degree of available social capital that could be potentially mobilised to assist them in their academic endeavours.

Quantitative data including discussion forum activity logs (number of posts and replies) were initially extracted using SNAPP (Bakharia & Dawson, 2008) and then imported into Netdraw (Borgatti, 2002) for further network centrality calculations. The network centrality data were then analysed using the statistical package for the social sciences (SPSS Inc., 2009) for patterns of interaction and levels of relationships established. Analyses indicate that the data was negatively skewed and with excess kurtosis, hence, non-parametric tests were adopted.

Limitations

There are several limitations in the study that potentially impact upon the generalisability of the findings. Firstly, the study contains a large number of variables that cannot be controlled. These include instructional method, teacher involvement in the discussion forum and the specific learner characteristics. However, this criticism can be made of most educational research that investigates delivery methods (G. Brown & Wack, 1999) as an independent variable. Secondly, the study did not investigate the impact of external networks or connections established beyond the class discussion forum. An individual's pre-existing social networks will influence the type of support and information they require (Dawson, 2008) and subsequently the level of investment they choose to make in their teaching unit's online discussion forum. Furthermore, the results presented in the study are confined to one institution and therefore consideration of institutional context and culture must be factored in when interpreting the generalisation of the findings.

Results

To address the research questions it was necessary to investigate a number of relationships related to a student's final mark, and determine if these relationships were influenced by the delivery method (online or blended). Firstly, a comparison was undertaken between the final marks of those students who participated in their unit's online discussion forum with those who did not participate. Secondly, for the group of students who participated in their unit's online discussion forum, the relationship between a student's final mark and the centrality measures and network composition was analysed. Thirdly, the level of participation in the unit's online discussion forum for both high- and low-scoring students was examined.

Online participation and final mark

To investigate the relationship between a student's participation in the unit's online discussion forum and their final mark a Mann-Whitney test was conducted. Table 1 presents a summary of these results.

Table 1
Summary results of final mark and discussion forum participation

Statistic	Frequency statistics – Final mark	
	No participation	Participation
n – no. of students	6437	3650
Mean	69.93	73.97
Median	72.00	76.00
Std deviation	13.062	11.654
Mann-Whitney test	$U = 9483418, p < .001, r = .16$	

Students who actively participate in their teaching unit's online discussion forum achieved a significantly higher final results (mean and median values) than those who did not participate.

The influence of the delivery method (online or blended) on the relationship between final mark and online participation was also investigated. Table 2 presents a summary of the results.

Table 2
Summary results of final mark, delivery method and discussion forum participation

Statistic	Frequency statistics – Final mark split by delivery method			
	Online delivery		Blended delivery	
	No participation	Participation	No participation	Participation
n – no. of Students	882	576	5555	3074
Median	72.00	74.00	72.00	76.00
Mean	69.51	72.16	69.99	74.31
Std deviation	13.521	12.479	12.987	11.463
Results	$U = 222320, p < .001, r = .11$		$U = 6778450.5, p < .001; r = .17$	

There was no significant difference in the final mark for those students who did not participate in the unit's online discussion forum (irrespective of delivery mode). However, for students who did participate in their forum, those in blended units achieved higher final results (mean and median values) than those from fully online teaching units.

Centrality measures and final mark

Further analysis was conducted on the group of students who participated in their unit's online discussion forum to investigate if a relationship exists between a student's final mark and the centrality measures of the social network evolving from participation in the unit's online discussion forum. A Spearman's correlation coefficient was calculated between final mark values and centrality measures. Table 3 presents a summary of the correlation analysis.

Table 3
Summary results of final mark and SNA variables and split by delivery method

		Spearman's Correlation – Final mark split by deliver method		
		Both modes	Online	Blended
Degree	Correlation	.107**	.228**	.088**
	Sig. (2-tailed)	.000	.000	.000
	N	3650	576	3074
Betweenness	Correlation	.098**	.176**	.086**
	Sig. (2-tailed)	.000	.000	.000
	N	3650	576	3074
Closeness	Correlation	-.007	.065	-.023
	Sig. (2-tailed)	.666	.121	.200
	N	3650	576	3074
EigenV	Correlation	.142**	.258**	.123**
	Sig. (2-tailed)	.000	.000	.000
	N	3650	576	3074

**Correlation is significant at the 0.01 level (2-tailed).

The analyses indicate that irrespective of the delivery method (online or blended) there is a weak but significant positive relationship between the final mark and the centrality measures of degree, betweenness and eigenvector. In contrast, no significant correlation was found between final mark and closeness centrality.

These results indicate a considerable variation between the correlation coefficients calculated for online and blended teaching units, with the strength of this correlation higher for the online teaching units. It was observed that those students with higher final marks also held more central positions in their network than those with a lower final mark.

Connection direction

In certain situations it is important to distinguish between the connections made by others to the student (in-degree) and the connections initiated by the student (out-degree). To investigate this relationship a Spearman's correlation coefficient was calculated. The influenced of the delivery method (online or blended) was also investigated and a Spearman's correlation coefficients were again calculated, split by delivery method. Table 4 presents a summary of these results.

Table 4
Summary results of final subject mark and SNA variables

Spearman's Correlation – Final mark split by delivery method				
		Both bodes	Online	Blended
Degree	Correlation	.107**	.228**	.088**
	Sig. (2-tailed)	.000	.000	.000
	N	3650	576	3074
In-degree	Correlation	.113**	.212**	.098**
	Sig. (2-tailed)	.000	.000	.000
	N	3650	576	3074
Out-degree	Correlation	.094**	.221**	.075**
	Sig. (2-tailed)	.000	.000	.000
	N	3650	576	3074

**. Correlation is significant at the 0.01 level (2-tailed).

The analyses indicate that a student's final mark was significant and positively correlated with both in-degree and out-degree centrality measures. That is, high scoring students also had high in-degree and out-degree values. This would result in active students (those with many posts) receiving many replies.

Network composition and final mark

In order to investigate the influence of an individuals' ego-network and hence direct level of social capital the marks of the relationships to an individual actor were mined and calculated. This was achieved by identifying the final mark for each student any individual was connected to, and then establishing the mean final mark for each ego-network (EgoMark). An EgoMark could not be calculated for those students who posted but did not receive a reply or only connected to the teacher or with students for whom no final mark was recorded (discontinued, technical fails, etc.). This reduced the sample size to $n = 2462$. The EgoMark value represents a measure of an individual's network composition reflecting the mean final mark of all students they have directly connected with.

A Spearman's correlation coefficient was calculated between final mark and the EgoMark values. Table 5 presents a summary of these results.

Table 5
Summary – EgoMark: By mark and split by delivery method

	Spearman's Correlation – Final mark split by delivery method			
		Both modes	Online	Blended
EgoMark	Correlation	.214**	.239**	.210**
	Sig. (2-tailed)	.000	.000	.000
	N	2462	358	2104

** Correlation is significant at the 0.01 level (2-tailed).

The results suggest that high-scoring students tend to develop connections with other higher-scoring students. While low-scoring students tended to develop connections with lower-scoring students.

High- and low-scoring students

High- and low-scoring student groupings were further investigated for differences in their network composition. The aim was to explore if the patterns of interaction and the network composition was different for high-scoring students and their lower-scoring peers. The groupings were based on those students who received a final mark between 40% and 59% (low-scoring) and those with a final mark between 80% and 100% (high-scoring). Students with a final mark below 40 were considered to have not fully engaged in the teaching unit and as such were not considered. The analyses were further delimited by delivery mode. Table 6 presents a summary of these results.

Table 6
Summary of high- and low-scoring student groupings

		Online delivery				Blended delivery			
		Mark	Degree	EigenV	EgoMark	Mark	Degree	EigenV	EgoMark
40–59	N	65	65	65	27	226	226	226	148
	Mean	53.72	2.97	.069	71.90	52.36	2.5	.093	74.52
	Std error of mean	.635	.580	.013	1.404	.299	.232	.009	.767
	Median	56.00	1.00	.020	73.60	53.00	1.00	.044	75.50
80–100	N	175	175	175	121	1108	1108	1108	757
	Mean	84.14	6.41	.145	76.75	84.93	3.93	.137	77.91
	Std error of mean	.294	.515	.010	.605	.129	.161	.007	.319
	Median	84.00	3.00	.123	77.50	84.00	2.00	.091	78.58

Analysis of the mean and median values for degree, EigenV and EgoMark indicate that high-scoring students developed connections with higher degree, EigenV and EgoMark values than their low-scoring peers. To investigate the relationships further Mann-Whitney tests were conducted. Table 7 presents a summary of the results.

Table 7
Summary results of Mann-Whitney tests for each grade band

		Mann-Whitney tests – Split by delivery method	
		Online delivery	Blended delivery
Mark		Mark: 80–100	Mark: 80–100
40– 59	Degree	$U = 3479.0, p < .001, r = .30$	$U = 110782.0, p < .001, r = .12$
	EigenV	$U = 3319.0, p < .001, r = .32$	$U = 110801.5, p < .001, r = .12$
	EgoMark	$U = 983.0, p = .001, r = .27$	$U = 46265.5, p < .001, r = .16$

Mann-Whitney tests indicate that a difference exists between high- and low-scoring students when it comes to the number (degree) and the quality (EigenV) of the connections they establish and the academic scores of those they connect with (EgoMark). A significant and positive correlation exists with a student's final mark, irrespective of the delivery method, with the strength of the correlation higher for the fully online students.

Discussion

This study provides several important findings for teaching and learning practice. The findings are consistent with our earlier work (Carceller et al., 2013) that an academic advantage may be derived for those students that actively participate in their online discussion forum. This aligns with the idea that communication activity represents investment in social networks and in the social capital cycle. This investment provides students the opportunity to increase the pool of available social capital (Lin, 2008), which could be leveraged to access informational, instrumental or emotional support to support their academic outcomes.

The findings suggest that, irrespective of the delivery method, a significant difference exists between high- and low-scoring students in terms of the size and composition of the networks they establish with their peers. High-scoring students connected with more people (degree centrality), are connected to those who are also well connected (eigenvector centrality) and tend to develop connections with other high-scoring students (EgoMark) than their low-scoring peers. Thus, high-scoring students tended to hold more central positions in their social network in contrast to their lower-scoring peers.

Centrality is based on the idea that individuals who hold a more central position to others in their social network are in a position of advantage, by having more ways to satisfy their needs and are less dependent on any other specific individuals (Wasserman & Faust, 1994). Thus, low-scoring students who are positioned less central in their social networks have fewer opportunity to access and mobilise social capital, which in turn provides them with access to fewer resources that when mobilised would assist them in their academic endeavours.

The problem of low-scoring students having access to fewer resources than their high-scoring peers is compounded by the quality of the resources they have access to. Low-scoring students tended to establish connections with other low-scoring students, which reflects the view that individuals are more likely to communicate and support those who are structurally similar (Burt, 1982; Friedkin, 1993; McPherson, Smith-Lovin, & Cook, 2001). Thus, an individual's personal characteristics influence and shape the networks they form, and will influence their interactions and the information they receive. This is partly because connections with non-similar individuals dissolve at a higher rate (McPherson, et al., 2001). As Festinger's (1950) theory of social comparison proposed, individuals use structural position as a way to identify those similar to themselves. Those students with high marks and more central positions in their networks are more likely to communicate with other more high-performing and central individuals, providing them with access to more knowledgeable individuals than the low-performing students (Dawson, 2010). It then follows that those students with higher marks will be in a position of advantage both because of the number of connections established and the quality of the resources that can be accessed.

The study also found that there was no significant difference in the final result between those students in online or blended modes of delivery who did not participate in their discussion forum. This is consistent with the understanding that the mode of delivery has no significant effect on student outcomes (Clark, 1983; Means et al., 2010; Russell, 2001; Sussman & Dutter, 2010). Yet the students participating in the discussion forum of blended units achieved higher results, and connected with fewer others than those in fully online units who participated in their discussion forum. This is not surprising given the variation in intensity and reciprocity of the connections established in the discussion forums of the two groups – suggesting that students in blended models have developed stronger connections, providing them with a form of social capital that can better assists them in their academic endeavours.

This difference in social capital, in part, can be attributed to how relationships are established and evolve in online and blended teaching units. Throughout the 13-week duration of the teaching units the reputation, trust and resulting relationships develop as the level of social penetration increases, gradually from superficial to more intimate levels over time (Altman & Taylor, 1973; Yum & Hara, 2006). Relationships will initially start in what Lin (2008) describes as the "outer layer", which is comprised of typically weak relationships, providing a sense of shared membership and identity with little access to the resources of the network. With time and continued interaction the relationships are likely to develop to the "intermediary layer" (Lin, 2008), providing greater access to resources that can be mobilised (Lin, 2001).

Those relationships established and maintained fully online will go through slower relationship development as their communications are, for the most part, restricted to the online environment. Students communicating fully online generally do not have the benefit of the additional information provided through the implicit cues, and the cultural and social contexts that are available when communicating face-to-face (Olson & Olson, 2000). Thus, the level of social penetration and subsequent levels of trust and understanding for students communicating fully online will, for the most part, establish weaker relationships with a lower level of intensity and reciprocity.

For those students in blended units their online discussion forum only represents their online interactions, which is only a small component of their social network and does not represent their communications with their peers by other means. Students in blended units will use the online forum to develop and maintain their existing offline relationships (Boyd & Ellison, 2007), selectively choosing which relationships to strengthen and reinforce online (Subrahmanyam, Reich, Waechter, & Espinoza, 2008). The greater intensity and reciprocity of the relationships in blended environments allows students to increase their access to social capital and in turn access the resources they may need.

The study of social capital and social networks is complex and influenced by many factors. Students belong to numerous networks that can assist them through their studies. This study focused on the social network established in the teaching unit's online discussion forum. While the discussion forum is generally the main form of communication for fully online students it is not likely to be for students participating in blended modes of delivery and does not capture all the interactions a student has (online and offline) with their peers. Online discussion forums have been shown to be a significant indicator of an individual's face-to-face behaviour (Rosen, Stefanone, & Lackaff, 2010), size of offline networks (Kanai, Bahrami, Roylance, & Rees, 2011) and student interactions and social structures offline. The opportunity to interact face-to-face results in relationships established in blended teaching units to most likely be of greater intensity and reciprocity and will result in a higher level of social capital generated. Therefore, it is important for teachers to be clear on the aim of the online discussion forum in their particular context, as it may be necessary to provide additional activities to students in fully online units that will allow them to develop and strengthen their relationships (Dawson, 2008; Hommes et al., 2012) to allow them to generate the levels of social capital that will assist them in their academic endeavours.

Whilst there are many other factors beyond those investigated in this study which will influence the nature of networks established, this work makes an important contribution to the understanding of the development of social capital in different modes of delivery, not just that the possession of social capital influence academic achievement, but that social capital evolves differently within different delivery methods. Additionally, participation in an online discussion forum is not the only determinant of social capital, nor is the individual's position in the network. The individuals a student connects with, the nature and penetration of these relationships, which include aspects of time (length of relationship), the number of relationships and level of relationship development are all-important and contribute to the ability to create and mobilise social capital. All these factors will better position instructional designers to determine when it is appropriate to consider the implementation of a discussion forum in a particular teaching context and when other choices (group work, etc.) may be more suited to their pedagogical goals.

Future research would benefit from further exploring the connections (other than through a discussion forum) that students establish, as well as better understanding other attributes of the students (e.g., external networks, personal characteristics) that encourage them to participate in their forums, providing greater insight into the role of discussion forums may play in a unit of teaching. Further research is also needed to explore how the nature and intensity of relationships students establish are influenced by teacher participation in the discussion forum. This will help better understand how the nature of teacher participation in the discussion forum might influence the forms of social capital established by students.

Conclusion

As the use of online discussion forums and other forms of technology-mediated communication continues to grow in both fully online and blended modes of university teaching it becomes important to understand the impact, the networks established might have on the development of social capital that can assist

students in their academic endeavours. This article begins to provide an understanding of the role that online discussion forums have on academic outcomes in both online and blended modes of delivery, and suggests that the nature of the networks and subsequent social capital established in blended teaching units is substantially different to that establish in fully online teaching units. This may in part be driven by the level of social capital that can be established throughout the duration of the teaching units.

The findings of this study highlight that not all students will use the discussion forum. The findings also suggest that when students do use the forum, they are more likely to communicate and support those on the discussion forum that are structurally similar. This will exacerbate the problem of low-scoring students, providing them with access to lower quality of social capital, which will result in access to fewer and poorer quality resources than their high-scoring peers. Thus, it may be necessary for teachers to take additional action to provide low-performing students with the opportunity to establish connections and interact with their high-scoring peers to establish a form of social capital with better resources.

Social capital can be a valuable concept in the field of higher education. It demonstrates why individual students develop particular relationships, why these relationships vary across different delivery methods and how these relationships may vary over time. The concept of social capital highlights the importance of social relationships in higher education as a means facilitate access to informational, instrumental or emotional support.

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