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Social networking, knowledge sharing, and student learning: The case of university students

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ABSTRACT

The recent development of social networking brought new opportunities not only for socializing and marketing but also for knowledge sharing and learning. As the social computing technology is relatively new, a review of literature revealed lack of research on the impact of ways of using social networking sites (SNS) on knowledge sharing and learning among tertiary students. This paper aims to empirically examine the various categories of SNS use including: chatting and online discussion, creating knowledge and information content, file sharing, and enjoyment and entertainment by tertiary students at a University in Saudi Arabia. It will investigate the impact of these categories of SNS use on knowledge sharing and learning performance. We adopted a cross sectional survey questionnaire for data collection, and received 308 valid responses from a sample of students that include graduates and undergraduates. The results show that there are significant positive relationships between both chatting and online discussion and file sharing and knowledge sharing, and entertainment and enjoyment with student learning. The paper concludes with a discussion of the limitations and implications of this study, along with directions for further research.

1. Introduction

Recent technological advances in telecommunications, the Internet and World Wide Web (WWW) brought to light more opportunities for online applications. A major development of Web applications during the last decade, termed as Web 2, is the emergence and intensive use of social networking sites (SNS). Examples of such SNS are Myspace, Facebook, LinkedIn, Twitter, Flicker, Instagram, and WhatsApp. SNS promote interactions and allow users to communicate information and personal experiences. They allow individuals to create their profiles and connect, interact, and collaborate with others (Boyd & Ellison, 2008). In the beginning, people used SNS for social interaction and communications. Subsequently, because of the excessively large number of users joining and visiting these SNS, commercial organizations started to exploit them for marketing, recruitment, and ideas and/or knowledge generation and information sharing. A natural dimension of human interactive behaviour is the discussion of topics, issues, and ideas. Thus, consequently SNS use evolved into knowledge sharing and learning at both individual and organizational levels.

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Traditionally, most internal and distance learning higher education institutions adopt learning management systems to deliver online learning to learners. Nowadays, however, many students use SNS to share information, discuss topics or concepts, and collaborate to complete homework assignments or term projects. SNS provide convenient and speedy ways of peer-to-peer exchange of knowledge and collaboration, which seems to be a preferred method of learning. This new learners' behaviour encourages self-learning and represents a significant driving factor for a shift from the traditional teacher-centered learning to student-centered learning. Patel, Darji, and Mujapara (2013) conducted a survey to show how an intelligent community and SNS are useful for students and professionals. Their study generated some descriptive statistics describing how the use of SNS among a sample of learners and professionals enhances learning. They found that approximately 163 participants out of 226 use social networking for learning purposes. Moreover, recent research has investigated how SNS benefit learners and professionals (Redmond & Lillis, 2010). They found that some top-ranked MBA schools are actively using SNS to provide a learning environment for an extensive network of students and faculty members. Stokic, Correia, and Reimer (2013) conducted a study to explore supportive social computing based technologies for cross-organizational collaborative learning and knowledge building activities. The results of their study confirmed the relationships between collaboration supported by SNS and motivation to learn, and between the willingness to share knowledge and the self-efficacy for learning and knowledge building. Most previous research (Carter & Nugent, 2011; Jadin, Gnambs, & Batinic, 2013) focused on investigating the effect of particular SNS tools (for example, YouTube, Facebook, WhatsApp, blogs, and wikis) on knowledge sharing or student learning, but not the way SNS uses influence knowledge sharing and learning.

Based on the way SNS are used, this paper proposes four categories of SNS use. These categories are (1) chatting and discussion through blogging (for example, Twitter), (2) content creation (for example, wikis), (3) files sharing through virtual data storage drives (for example, SkyDrive and Dropbox), and (4) enjoyment and entertainment (for example, Facebook and Instagram). A search of literature revealed a lack of research exists on investigating the effects of these four categories of SNS use on knowledge sharing and learning at the tertiary level of education, both locally and internationally. Therefore, this study aims to achieve the following three objectives:

1. Measuring the extent of the four categories of SNS use: (1) chatting and discussion, (2) content creation, (3) files sharing, and (4) enjoyment and entertainment.
2. Measuring the impact of the four categories of SNS use on both knowledge sharing and student learning.
3. Measuring the impact of knowledge sharing on student learning performance.

The findings of this study will have value for academia as well as practical implications for the Saudi education sector in general and higher education institutions in particular. This research is valuable as it will be amongst the first empirical research of its kind in Saudi Arabia and probably in the Middle East. The study will spur future research into the educational values of using social media. In section 2, we will provide a background of the study from the relevant previous research. Next, in section 3 will present the research model. Then, we will outline the research method and materials, including the used measures, data collection, and date analysis in Section 4. Section 5 will discuss the analysis results, and section 6 will conclude the paper.

2. Background

2.1. Social networking

Social networking is significant and global phenomena recently emerged because of the major development of Web applications during the last decade, termed as Web 2. Because Web 2 supports social networking activities, the literature characterized it as "collaborative" and Web 1 as "distributive" (Oreilly, 2007). SNS provide opportunities for forming virtual communities. Innovators design SNS to promote interactions and to communicate information and personal experiences. Since their emergence, SNS have become very popular and pervasive, for both public and private organizations. The most recent published statistics by the Economist (2014), show that about 8 million of the Saudi Arabia's 31 million people use Facebook, more than 5 million use Twitter, and that Saudis watch an average of seven YouTube videos a day. According to *The Economist (2014)*, Saudi Arabia has the world's highest penetration of the microblog. The number of users rose by 45% between 2012 and 2013, and the largest number of social media users are aged between 26 and 34 years. Boyd and Ellison (2008) defined social network sites as "web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system" (p. 211). Examples include Facebook, Twitter, WhatsApp, LinkedIn, and YouTube.

Nowadays, many students use SNS to share information and knowledge, collaborate to complete homework assignments or term projects, and discuss concepts and ideas. For example, students have used Facebook Groups as a learning management system and they are satisfied with it (Wang, Woo, Quek, Yang, & Liu, 2012). The use of SNS is becoming popular among students (Chu & Meulemans, 2008). They found the majority (90%) of Myspace and Facebook used it to communicate with others about school, professors, or courses.

2.2. Knowledge sharing

Bukowitz and Williams (1999) define knowledge sharing as an activity through which knowledge (such as information, skills, or expertise) is exchanged among people, friends, families, communities, or organizations. In general the use of information technology communications tools support knowledge sharing (Eid & Nuhu, 2011). SNS are very well suited to support interactions, information sharing, and exchanging personal experiences. A number of previous studies measured the impact of using particular SNS on knowledge sharing. For example, the study by Chan, Chu, Lee, Chan, and Leung (2013) compared the use of blogs and Facebook for supporting knowledge management activities of creation, sharing, and application. They found that both tools generally support knowledge management but Facebook has more capabilities and potential than blogs in support of knowledge sharing. Other studies explored the effect of specific factors on using some SNS tools for knowledge sharing (Jadin et al., 2013; Ma & Chan, 2014; Pi, Chou, & Liao, 2013; Yu, Lu, & Liu, 2010). Yu et al. (2010) found fairness, openness, enjoying helping, and usefulness (relevancy) factors influence knowledge sharing among online communities using Weblogs. Pi et al. (2013) examined factors that affect the user's willingness of using Facebook Groups for knowledge sharing. Their results indicated that reputation significantly affects the knowledge sharing attitude of Group members, and a sense of self-worth would directly and indirectly (through subjective norm) affect knowledge sharing. Human behaviour factors including attitude, subjective norm, Web-specific self-efficacy and social network ties predict knowledge sharing among students using SNS tools (Chen, Chen, & Kinshuk, 2009). Other human behavioural factors of altruism, perceived online attachment motivation, and perceived online relationship commitment of SNS users have significant impact on online knowledge sharing (Ma & Chan, 2014). Panahi, Watson, and Partridge (2012) offer a theoretical model, which maps social media characteristics and knowledge sharing requirements. Their model hypothesized five social networking characteristic variables (social interaction, experience sharing, observation, informal relationship/networking, and mutual trust) and their influence on tacit knowledge sharing.

2.3. Learning performance

We define learning performance as the extent to which a student is making progressive learning in achieving educational goals in terms of added knowledge and skill building during education. Student learning performance, which is the focus of our study, is concerned with the effectiveness of the student learning process or experience (Ko, 2012; Yang & Tang, 2003), rather than on academic achievement. SNS have educational value and potential to encourage student motivation and engagement in the learning process (Thorne, Black, & Sykes, 2009). Using these SNS tools by learners and professionals enhance their learning experience (Patel et al., 2013). Recent research has demonstrated how the use of SNS tools benefit learners and professionals (Kumar & Rajendra, 2012; Redmond & Lillis, 2010; Sri Jothi, Neelamalar, & Prasad, 2011). Online social networking software provides a better learning environment through increased interaction and online discussion and provides higher-level learning among students than do traditional learning management tools (Lin & Tsai, 2011; Thoms & Eryilmaz, 2014). SNS eliminate the time and space limitations of the traditional face-to-face teaching approaches. Facebook, for example, provides an easy to use tool for interactions and exchange of information anytime and anywhere, among students themselves as well as between students and instructors (Bosch, 2009). Yu et al. (2010) found that learners who engaged more in social networking using Facebook performed better academically. However, Kirschner and Karpinski (2010) found that college students using Facebook have reported lower academic performance than non-users since they used Facebook more for leisure than for discussing and sharing course materials. The results of Kirschner and Karpinski (2010) do not negate the benefits of using SNS for both learning and teaching. According to McWilliam and Dawson (2007), focusing on social interaction in online learning will contribute to meaningful learning and student's creativity. Our study focuses on learning experience or learning performance in relation to the ways SNS are used.

3. Categories of SNS use

According to Chiu, Hsu, and Wang (2006), the widely applied social cognitive theory proposed by Bandura (1986), considers human behaviour as a triadic, dynamic, and reciprocal interaction of personal factors, behaviour, and the social network system. The core factors of the theory are self-efficacy and outcome expectations. Self-efficacy is "a judgment of one's ability to organize and execute given types of performances," and the outcome expectation is "a judgment of the likely consequence such performances will produce" (Bandura, 1997, p. 21). From the post positivist perspective, knowledge is an outcome of a negotiation and consensus process among participating individuals, and knowledge sharing is a consensual understanding situated in an experience (Peters & Burbules, 2004). Engaging in observational learning and participating in both class and online group discussions, in the context of a learning community, contribute to knowledge sharing (Yeh, Huang, & Yeh, 2011). According to Pettenati and Cigognini (2007), the connectivism theory of learning is social networking applied to learning and knowledge management. Löfström and Nevgi (2007) posit that learner participation and social interaction take different forms, including dialogue, reflection, collaboration, and knowledge sharing. These theoretical concepts imply that knowledge sharing and learning in social systems are dependent on social interaction, participation, observation, reflection, negotiation, and consensus behaviours. In SNS, these behaviours appear in various forms including chatting and online discussion, creating new knowledge and

dissemination, file sharing for information exchange, and entertaining. Accordingly, the categories of SNS use including online discussion, knowledge/content creation, file sharing, and entertainment can have an impact on both knowledge sharing and on learning performance. Daft and Lengel (1986) proposed the media richness theory. They postulated that the efficiency of student communication will improve by matching the right media with students' informational needs. Currently, SNS that provide varieties of rich media and online interactive environments designed for different activities including online discussion, file sharing, creating content, and entertainment. Facebook, WhatsApp, Twitter, and YouTube are good examples of these SNS.

Majchrzak, Faraj, Kane, and Azad (2013) theorized four affordances of social media that support online knowledge sharing in an organizational context. These four affordances are meta-voicing, triggered attending, network-informed associating, and generative role taking. The authors found that when meta-voicing during a visible knowledge sharing conversation or online discussion, individuals who spend time being informed of the issues and thus meta-voice (comment) from a position of knowledge rather than pure reaction are more likely to move the conversation (discussion) forward productively. According to Majchrzak et al. (2013), the application of critical mass theory (Oliver & Marwell, 2001), can explain how meta-voicing helps an online knowledge conversation to be more productive. Moreover, nowadays, the use of wikis and blogs for knowledge content creation and sharing (Jadin et al., 2013; Levy, 2009) is common among individuals. In addition, it is obvious from visiting YouTube sites, Facebook, WhatsApp, Dropbox, or Instagram, the significant amount of content creation, file sharing, and entertainment activities taking place by both individuals and organizations, within Saudi Arabia and overseas. Hence, we here provide a taxonomy of four categories of behaviour construct of SNS use that can affect knowledge sharing and student learning. These include:

- Chatting and online discussion
- Content creation
- File sharing, and
- Enjoyment and Entertainment.

We define a category of SNS use as the social networking activity performed by students using one or more SNS.

3.1. Chatting and discussion

Based on the theoretical work by Majchrzak et al. (2013), we here define chatting and online discussion as an activity, through which ideas, concepts, assignment issues, practice, etc., are thrown around, reflected upon and negotiated among a group of individuals using one or more SNS. The study views the chatting and discussion construct as one concept since it is focused on understanding the learner use of any of the SNS tools for the purpose of communicating views, questions and answers, discussing assignments, or discussing any issue related to their course of study. The research by Lee, Cheung, Lim, and Sia (2006) aimed at identifying factors influencing knowledge sharing during web-based discussion boards. They found that enjoyment of helping others is a major reason for customer knowledge sharing on web-based discussion boards, and the lack of knowledge self-efficacy is the main reason why customers do not desire to share knowledge with others. Their study is conducted in the context of customers' purchases not on student learning. Ma and Yuen (2011) have investigated the effect of learner's interpersonal factors on online knowledge sharing behaviour, through interactions in the form of online discussion and collaborative learning environments. They found that perceived online attachment motivation and perceived online relationship commitment significantly influence knowledge sharing behaviour. An earlier study by Schrire (2006) examined the role of asynchronous discussion in knowledge building among learners. Schrire (2006) proposed a model for analysing collaborative knowledge building in asynchronous discussion based on studying online discussion forums in the higher education context.

Stokic, Correia, Reimer, and Social (2013) proposed a model for an extended organization in which they explored the use of supportive social computing based technologies for cross-organizational collaborative learning and knowledge building activities. They tested their model by two case studies. The results of correlation analysis confirmed the relationships between collaboration supported by SNS and motivation to learn, and between the willingness to share knowledge and the self-efficacy for learning and knowledge building. Hammond and Wiriyapinit (2005) found that online discussion use in distance learning for an MBA course provided a positive learning experience. Balaji and Chakrabarti (2010) proposed a conceptual model based on online learning theory (Anderson, 2004) and media richness theory (Daft & Lengel, 1986) to investigate the effect of online discussion forums on learning. They found that the perceived richness of online discussion forums has a significant positive effect on student interaction and learning. In general, the literature search found a lack of research on studying the relationship between categories of SNS use and knowledge sharing. Despite its importance, the relationships between the SNS-based chatting and online discussion and both knowledge sharing and learning performance are not fully understood. Hence, we formulate the following hypotheses:

H1. *Chatting and discussion have an impact on knowledge sharing*

H2. *Chatting and discussion have an impact on learning performance*

3.2. Content creation

Nowadays, the use of SNS for knowledge and information content creation and sharing is common among individuals. Examples include wikis, blogs, YouTube, Facebook, WhatsApp, etc. Levy (2009) believes SNS, especially wikis and blogs, have great potential for supporting knowledge management activities in an organizational setting. Based on the knowledge creation theory offered by Nonaka and Takeuchi (1995), we define Content Creation as an activity through socialization, personal ideas, experiences, assignment issues, etc. written down and/or video recorded, and published by individuals using one or more SNS.

Becerrs-Fernandez and Sabherwal (2010) note that in addition to traditional knowledge management technologies, some organizations use emergent Web 2.0 technologies such as wikis and blogs for knowledge content creation and sharing. According to Bebensee, Helms, and Spruit (2011), wikis have limited use for content creation in the utility industry. Carter and Nugent (2011) found that learners use a variety of SNS such as wikis, Twitter, and Facebook for knowledge content creation through personal learning networks and virtual community of practice. With respect to the use of the Wikipedia tool, Jadin et al. (2013) found that personal traits of trendsetting and opinion leadership can predict knowledge sharing, but not pro-social value orientation. Moreover, the individual differences in motivations to write moderates the effect of pro-social value orientation on knowledge sharing. This study will investigate these less understood relationships between SNS-based content creation and both knowledge sharing and student learning. Hence, we formulate the following hypotheses:

H3. *Content creation has an impact on knowledge sharing*

H4. *Content creation has an impact on learning performance*

3.3. File sharing

University students often use SNS to share content files such as lecture notes, assignment information, project tasks, instructional videos, etc. Examples of these commonly used SNS for file sharing include Dropbox, WhatsApp, and YouTube. Our literature search could not find a definition for a file sharing construct in the context of social networking. For the purpose of the study, we define file sharing as an activity through which knowledge contents saved in files and exchanged by learners using one or more SNS. Elaimi (2014) found that the use of Web 2.0 technologies do not significantly affect knowledge sharing behaviour in Saudi organizations. However, the study found that frequently used technologies of Web 2.0 include social networking, instant messaging, and file sharing. Ozlati (2012) found that organizational document management systems and web file sharing tools showed a positive correlation pattern with different types of trust. Most existing research on the use and/or impact of file sharing on knowledge sharing are carried out in the organizational context. Moreover, most previous research is about peer-to-peer file sharing from the ethical and legal perspectives (Moore & McMullan, 2004). There is very limited research on the effect of social media-based file sharing on knowledge sharing in the tertiary education context. This study will investigate the less understood relationships between SNS-based file sharing and both knowledge sharing and student learning. Hence, we formulate the following hypotheses:

H5. *File sharing has an impact on knowledge sharing*

H6. *File sharing has an impact on learning performance*

3.4. Enjoyment and entertainment

Teh, Yong, Chong, and Yew (2011) investigated the effect of five personality factors on entertainment knowledge sharing behaviour. They found that extraversion, neuroticism, subjective norm positively affect the attitude towards knowledge sharing. Openness to experience negatively affects attitudes towards knowledge sharing. Our literature search could not find a definition for the enjoyment and entertainment construct in the context of social networking. For the purpose of the study, we define enjoyment and entertainment as an activity through which games are played individually or in groups, and photos or videos saved in files and shared by individuals using one or more SNS. Trybus (2014) posits that game-based learning motivates learners and improves learners' engagement and interactions, which greatly improve student learning. Pastor (2012) believes that social media entertainment tools provide optimal conditions to encourage engagement in learning, and calls for further research in the use of entertainment in education. When videogames are designed in a way to address certain skills or to demonstrate problem solving in a particular field of study, they can be very beneficial tools for teaching (Griffiths, 2002). Our literature search found a lack of research on the effect of social media-based enjoyment and entertainment on both knowledge sharing and on student learning. This study will investigate the less understood relationships between SNS-based enjoyment and entertainment and both knowledge sharing and student learning. Hence, we formulate the following hypotheses:

H7. *Enjoyment and Entertainment have an impact on knowledge sharing*

H8. *Enjoyment and Entertainment have an impact on learning performance*

3.5. Knowledge sharing and learning performance

Chang and Chuang (2011) believe that knowledge emerges from integrating information, experience, and theory. When people form groups and interact with each other, they tend to share knowledge and experiences, thus augmenting learning. In investigating knowledge sharing and learning in an organizational context, Kane, Robinson-Combre, Zane, and Berge (2010) found that knowledge sharing supports organizational learning with social networking tools. In the academic context, Cao, Ajjan, and Hong (2013) found that social media use has a positive effect on student's learning outcomes and their satisfaction. Aslam, Khuram, Syed, and Ramish (2013) studied the impact of knowledge sharing on academic performance. They measured learning performance with the CGPA (cumulative GPA). However, they did not find a significant relationship between them. They attributed their results to the use of relative (norm-referenced) grading technique, like CGPA. CGPA contributes to the competitive environment of the class and hence hinders knowledge sharing (Rose, 2011). He (2009) examined the relationships between quantity and quality of knowledge sharing and students' grades. She found that there was a significant relationship between the quantity of knowledge sharing and students' grades, but not with the quality of learning (or learning performance). In our study, the learning performance covers the various activities of the student learning experiences such as written and oral communications, self-dependency, debating, leading, problem solving and creativity, etc. Therefore, we argue that knowledge sharing affects high quality learning and student performance. Hence, we formulate the following hypothesis:

H9. *In the context of using SNS tools, knowledge sharing has an impact on learning performance*

The present study proposes that using SNS in the form chatting and online discussion, content creation, file sharing, and enjoyment and entertainment affect knowledge sharing and learning performance among students in higher education. Fig. 1 presents the conceptual model, which depicts all the above stated nine hypotheses.

4. Research method

In a bid to examine the impact of the four categories of SNS use on both knowledge sharing and learning performance, the study undertook a survey with online questionnaires. The survey instrument reflected the research model depicted in Fig. 1. To ensure generalization of the findings of this study, we posted the questionnaires, using the KFUPM internal email system, to all students (including undergraduate and graduate) currently registered in KFUPM. The student population is around 10,000 students. After a three-week period from posting the initial questionnaire and sending out one reminder, we received 308 responses.

4.1. Measures

In order to measure the impact of the extent of each of the four SNS categories of use on both knowledge sharing and learning performance from the individual student's perspective, the study adopted the quantitative survey questionnaire
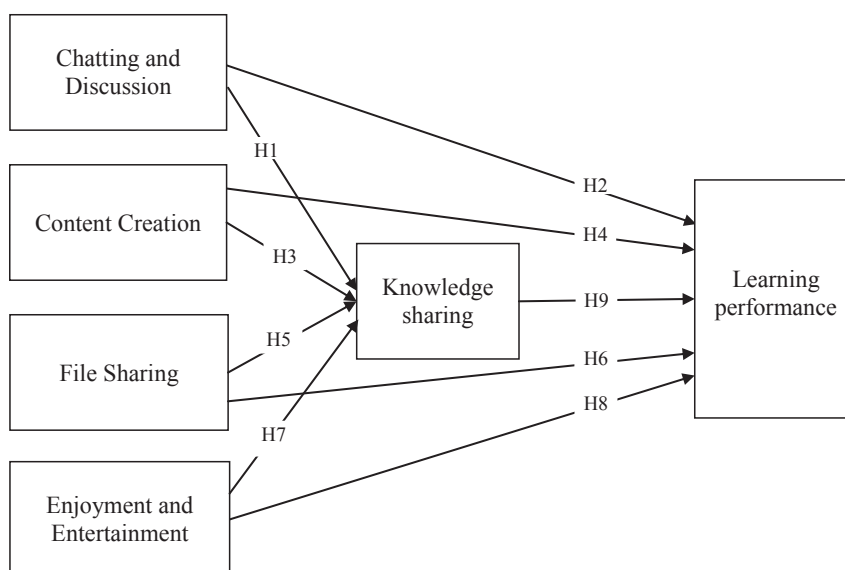

Fig. 1. The research model.

method. The survey instrument reflected the conceptual model depicted in Fig. 1. To improve the reliability and validity of the questionnaire instrument, we used multiple-item measures for all of the study variables. We developed a universal measure for measuring the four categories of SNS use constructs. To measure the extent of the four categories of SNS use, we recorded the answers of respondents along a five-point scale (1-Never, 2-Once a month, 3-Once a week, 4-Daily, and 5-Hourly) against the used SNS tools for each of the four categories. We asked the same question against eight selected popular SNS tools. The eight selected SNS tools include Twitter, WhatsApp, Facebook, YouTube, Dropbox, Instagram, LinkedIn, and wikis. According to Coltman, Devinney, Midgley, and Veniak (2008), we consider the instrument used for measuring the four constructs of the SNS categories of use as formative constructs for the following three reasons:

1. Nature of construct; the category of SNS use constructs are dependent on the eight items used to measure the extent of the four category of SNS use.
2. Direction of causality; any change or variation in any of the eight items can cause change in the category latent construct. However, any change in any category of SNS use will not cause change to any extent from using any of the measuring SNS.
3. Characteristics of indicators; the measuring eight items of any of the categories of SNS have no common theme and thus, they are not interchangeable. That is, removing any of the eight items from the measuring model for any of the categories of SNS construct will affect the measured latent construct.

As for measuring knowledge sharing, we used a five-point Likert scale (1-Strongly Disagree, 2-Disagree, 3-Neutral, 4-Agree, 5-Strongly Agree) based on six items. We adopted the six items for measuring knowledge sharing from Chai, Das, and Raghav (2011) with slight modifications. Similarly, we measured learning performance using a five-point Likert scale (1-Strongly Disagree, 2-Disagree, 3-Neutral, 4-Agree, 5-Strongly Agree) based on five items. We adopted three out of the five items from Blasco-Arcas, Buil, Hernández-Ortega, and Javier-Sese (2013) with slight modifications. The other two items are self-developed based on insights from the literature, and the definition of the learning performance construct given in this study. The last part of the survey instrument covers the demographics of respondents, including age, nationality, marital status, experience with SNS, student class (preparatory, freshman, etc.), study level (undergraduate and graduate), CGPA, and major. In addition, in order to establish face validity and to improve the format and content of the questionnaire items, for clarity and readability, we initially distributed a pilot questionnaire to a focus group including ten students for reviewing and giving feedback (Creswell, 1994). Accordingly, the initial questionnaire was refined and finalized, and then posted via the internal email system, to the student population at KFUPM. We used the Google Forms tool to develop and publish the questionnaire online.

4.2. Data collection

The authors administered the questionnaires online. They selected sample units including all undergraduate and graduate students currently enrolled at KFUPM during the 2014–2015 academic year. The sample is all KFUPM students. The population is around 10,000 students. In a 5-week period including one reminder, the total number of responses gathered was 308 resulting in approximately a 3.1% response rate. Moreover, since the questionnaire validates and control the responses form inputs, all entries were complete and valid, and therefore considered in the data analysis. Table 1 depicts some descriptive statistics on the respondents' demographic characteristics. Table 1 show that 99% of respondents used one or more SNS. More than half of the respondents (55.1%) have more than five years' experience using SNS. Also 41.6% of the respondents have two to five years' experience using SNS and 2.3% have less than one-year experience. Concerning the nationality of respondents, 60.1% of the respondents are Saudi and 39.9% are non-Saudi. The majority of respondents were not married (83.9%) and 16.9% are married. A majority (65.9%) of the respondents are undergraduate and 34.1% are graduate. Amongst the undergraduate, 17.5% were preparatory year students, 13.6% were freshman, 9.1% were sophomore, 14.3 were junior, and 11% were seniors. With respect to the college respondents, 15.6% were from the College of Computer Science & Engineering (CCSE). And 6.2% were from the College of Environmental Design (CED), 51.9% were from the College of Engineering Sciences & Applied Engineering (CES & AE), 5.5% were from the College of Science (CS) 14.9% were from the College of Industrial Management (CIM), and 5.8% were from the Preparatory Year Program (PYP).

Table 2 depicts the extent of SNS use for Chatting and Discussion. The statistics in Table 2 show the most dominant SNS tool used by respondents for Chatting and Discussions is WhatsApp (92.5%) after excluding the (7.5%) in the Never category. Out of the 92.5%, 1.9% used it monthly, 6.5% used it weekly, 36.4% used it daily and 47.7% used it hourly. The next SNS tools used for Chatting and Discussion is YouTube (82.8%) and then Facebook (74.4%).

Table 3 depicts the extent of SNS use for Content Creation. The statistics in Table 3 show the most dominant SNS tool used by respondents for Content Creation is YouTube (89.0%), after excluding the Never category (11.0%). Out of the 89.0%, 12.0% used it monthly, 18.2% used it weekly, 44.8% used it daily and 7.8% used it hourly. The next SNS used for content creation is WhatsApp (79.2%), and then Facebook (66.2%).

Table 4 depicts the extent of SNS use for File Sharing. The statistics in Table 4 show the most dominant SNS tool used by respondents for file sharing is WhatsApp (80.8%), after excluding the (19.2%) in the Never category. Out of the 80.8%, 13.3% used it monthly, 26.0% used it weekly, 31.5% used it daily and 10.2% used it hourly. The next SNS used for file sharing is Dropbox (61.7%) and then Facebook (56.5%).

Table 1
Demographic characteristics of SNS adopters and non-adopters.

Variable	Value	N	%
Experience	Never used	3	1
	Less than 1 year	7	2.3
	2 to 5 years	128	41.6
	More than 5 Years	170	55.1
Nationality	Saudi	185	60.1
	Non Saudi	123	39.9
Marital status	Married	52	16.9
	Not married	256	83.9
Academic background	Undergraduate	203	65.9
	Graduate	105	34.1
Class	Prep	45	17.5
	Freshman	42	13.6
	Sophomore	28	9.1
	Junior	44	14.3
	Senior	34	11.0
	Graduate	106	34.1
College	CCSE	48	15.6
	CED	19	6.2
	CES & AE	160	51.9
	CS	17	5.5
	CIM	46	14.9
	PYP	18	5.8
Cumulative GPA	<2.00	12	3.9
	2.00—2.50	46	14.9
	2.51—3.00	70	22.7
	3.01—3.50	86	27.9
	3.51—4.00	94	30.5

Table 2
The extent of SNS use for chatting and discussion — N (%).

SNS tool	Never	Once a month	Once a week	Daily	Hourly
Twitter	134 (43.5%)	58 (18.8%)	39 (12.7%)	61 (19.8%)	16 (5.2%)
WhatsApp	23 (7.5%)	6 (1.9%)	20 (6.5%)	112 (36.4%)	147 (47.7%)
Facebook	79 (25.6%)	45 (14.6%)	42 (13.6%)	92 (29.9%)	50 (16.3%)
YouTube	53 (17.2%)	17 (5.5%)	59 (19.2%)	138 (44.8%)	41 (13.3%)
Wikis	163 (52.9%)	44 (14.3%)	63 (20.3%)	35 (11.4%)	3 (1.1%)
Dropbox	137 (44.5%)	71 (23.1%)	58 (18.8%)	35 (11.3%)	7 (2.3%)
Instagram	146 (47.4%)	28 (9.1%)	37 (12.0%)	60 (19.5%)	37 (12.0%)
LinkedIn	195 (63.3%)	50 (16.2%)	42 (13.6%)	18 (5.8%)	3 (1.1%)

Table 3
The extent of SNS use for content creation — N (%).

SNS tool	Never	Once a month	Once a week	Daily	Hourly
Twitter	154 (50.0%)	42 (13.6%)	41 (13.3%)	49 (15.9%)	22 (7.2%)
WhatsApp	64 (20.8%)	31 (10.1%)	54 (17.4%)	96 (31.2%)	63 (20.5%)
Facebook	104 (33.8%)	37 (12.0%)	56 (18.2%)	86 (27.9%)	25 (8.1%)
YouTube	34 (11.0%)	38 (12.4%)	74 (24.0%)	138 (44.8%)	24 (7.8%)
Wikis	145 (47.1%)	35 (11.3%)	59 (19.2%)	62 (20.1%)	7 (2.3%)
Dropbox	142 (46.1%)	62 (20.1%)	58 (18.8%)	36 (11.7%)	10 (3.3%)
Instagram	192 (62.3%)	32 (10.4%)	28 (9.1%)	44 (14.3%)	12 (3.9%)
LinkedIn	224 (72.7%)	36 (11.7%)	23 (7.5%)	22 (7.1%)	3 (1.0%)

Table 4
The extent of SNS use for file sharing — N (%).

SNS tool	Never	Once a month	Once a week	Daily	Hourly
Twitter	247 (80.2%)	25 (8.1)	13 (4.2%)	18 (5.8%)	5 (1.6%)
WhatsApp	59 (19.2%)	41 (13.3%)	80 (26.0%)	97 (31.5%)	31 (10.2%)
Facebook	134 (43.5)	52 (16.9%)	58 (18.8%)	53 (17.2%)	11 (3.6%)
YouTube	216 (70.1%)	35 (11.3%)	27 (8.8%)	27 (8.8%)	3 (1.0%)
Wikis	268 (87.0%)	19 (6.2%)	13 (4.2%)	6 (1.9%)	2 (0.7%)
Dropbox	118 (38.3%)	77 (25.0%)	53 (17.2%)	44 (14.3%)	16 (5.2%)
Instagram	219 (71.1%)	33 (10.7)	25 (8.1%)	22 (7.2%)	9 (2.9%)
LinkedIn	272 (88.3%)	19 (6.3%)	9 (2.9%)	6 (1.9%)	2 (0.6%)

Table 5
The extent of SNS use for enjoyment & entertainment − N (%).

SNS tool	Never	Once a month	Once a week	Daily	Hourly
Twitter	134 (43.5%)	41 (13.3%)	37 (12.0%)	64 (20.8%)	32 (10.4%)
WhatsApp	45 (14.6%)	14 (4.5%)	28 (9.2%)	110 (35.7%)	111 (36.0%)
Facebook	92 (29.9%)	36 (11.7%)	36 (11.7%)	93 (30.2%)	51 (16.5%)
YouTube	7 (2.3%)	13 (4.2%)	56 (18.2%)	175 (56.8%)	57 (18.5%)
Wikis	208 (67.5%)	36 (11.7%)	34 (11.1%)	24 (7.8%)	6 (1.9%)
Dropbox	261 (84.7%)	23 (7.5%)	11 (3.6%)	8 (2.6%)	5 (1.6%)
Instagram	145 (47.1%)	19 (6.2%)	25 (8.1%)	79 (25.6%)	40 (13.0%)
LinkedIn	269 (87.3%)	16 (5.2%)	11 (3.6%)	7 (2.3%)	4 (1.6%)

Table 5 depicts the extent of SNS use for Enjoyment & Entertainment. The statistics in Table 5 show the most dominant SNS tool used by respondents for enjoyment & entertainment is YouTube (97.7%) after excluding the (2.3%) in the Never category. Out of the 97.7%, 4.2% used it monthly, 18.2% used it weekly, 56.8% used it daily and 18.5% used it hourly. The next SNS used for enjoyment & entertainment is WhatsApp (85.4%) and then Facebook (70.1%).

4.3. Data analysis

We tested the research model using the Partial Least Square (PLS) method using SmartPLS 2.0 (Ringle, Wende, & Will, 2005). We chose PLS primarily because it is able to model latent constructs under non normality and small to medium sample sizes. The evaluation of the research model according to PLS follows a two-stage process (Chin, 2010). The first stage is the evaluation of the measurement model by investigating the reliability and the convergent and discriminant validity of the constructs. The second stage is evaluating the structural model by testing the significance of the relationships between the model constructs. Our research model entails reflective (e.g. knowledge sharing and learning performance) and formative measures (e.g. categories of use: chatting and discussion, content creation, file sharing, and entertainment & enjoyment). Therefore, we will assess both the reflective and formative measurement models.

4.3.1. The reflective measurement model

Assessment of the reflective measurement model includes internal consistency and validity. The criterion for internal consistency is Cronbach Alpha. Value exceeding 0.7 indicates acceptable reliability (Nunnally & Bernstein, 1994). Table 6 presents the mean, standard deviation (SD), Cronbach Alpha (CA), and the average variance extracted (AVE) for all the reflective constructs. All CA scores exceeded the recommended value of 0.70 indicating that all constructs possessed good reliability.

Convergent validity involves the degree to which individual items reflecting a construct converge in comparison to items measuring different constructs. Commonly applied criteria of convergent validity are the outer loadings and the AVE proposed by Fornell and Larcker (1981). An outer loading of 0.70 and an AVE value of 0.50 ($\approx 0.7^2$) or more indicate that a construct explains more than half of the variance of its indicators and, thus, demonstrates sufficient convergent validity. Table 7 shows that all outer loadings exceeded 0.70 and the AVEs ranged from 0.623 to 0.751. One item with outer loading less than 0.7 (e.g. KS3) was dropped. In addition, all the factor loadings and their corresponding t-values exceeded 0.7 and 1.96 ($P < 0.05$), respectively, thereby demonstrating adequate convergent validity.

To assess the discriminant validity, Fornell and Larcker (1981) suggest the use of AVE, the average variance shared between a construct and its measures. The AVE should be greater than the variance shared between the construct and other constructs in the model (i.e., the squared correlation between two constructs). The diagonal elements of Table 6 are the square roots of the AVEs by the construct, while off-diagonal entries are the inter-construct correlation coefficients. For adequate discriminant validity, the diagonal elements should be greater than the off-diagonal elements in the corresponding rows and columns. All square roots of the AVEs were greater than the corresponding inter-construct correlation, therefore confirming discriminant validity of the reflective measurement model. The AVE criterion is not applicable to the formative measurement model.

Table 6
Correlation coefficients and square root of the AVEs[a].

	Mean	SD	CA	CD	CC	FS	ENJ	KS	LP
Chatting & discussion (CD)	2.586	0.664	N/A	**N/A**					
Content creating (CC)	2.364	0.685	N/A	0.677	**N/A**				
File sharing (FS)	1.808	0.576	N/A	0.611	0.678	**N/A**			
Enjoyment (ENJ)	2.454	0.645	N/A	0.638	0.582	0.579	**N/A**		
Knowledge sharing (KS)	3.315	1.004	0.879	0.421	0.418	0.456	0.340	**0.794**	
Learning performance (LP)	3.553	1.024	0.916	0.246	0.263	0.243	0.297	0.527	**0.866**

[a] Diagonal elements in bold are the Square Root of the AVEs.

Table 7
Factor cross loadings, t-statistics, p-value, AVE — Reflective measures.

Factor	Item	Cross loadings		Standard error	t-Statistics	p-value	AVE
		KS	LP				
Knowledge sharing (KS)	KS1	0.8546	0.4928	0.0161	53.0508	0.0000	0.6298
	KS2	0.8201	0.4872	0.0253	32.3905	0.0000	
	KS3	0.5727	0.2555	0.0557	10.2869	0.0000	
	KS4	**0.8560**	0.4008	0.0182	46.9884	0.0000	
	KS5	**0.8151**	0.4387	0.0240	33.9574	0.0000	
	KS6	**0.8066**	0.3986	0.0217	37.1805	0.0000	
Learning performance (LP)	LP1	0.4430	**0.8859**	0.0163	54.3794	0.0000	0.7506
	LP2	0.4793	**0.8752**	0.0134	65.0957	0.0000	
	LP3	0.4783	**0.8354**	0.0222	37.5722	0.0000	
	LP4	0.3846	**0.8531**	0.0230	37.1483	0.0000	
	LP5	0.4830	**0.8812**	0.0178	49.4375	0.0000	

4.3.2. The formative measurement model

Unlike reflective measures, formative measures do not necessary correlate. Therefore, the use of internal consistency and AVE criteria are not appropriate for assessing the reliability and validity of the formative measurement model. Instead, we assess the collinearity of the measures and the significance of their weights (Hair, Hult, Ringle, & Sarstedt, 2014). To assess the collinearity, we computed the variance inflation factor (VIF) of all formative measures. The values of VIFs, as presented in Table 8, are lower than the critical value of 10, which indicate the absence of collinearity. If any of the VIFs exceeded the critical value (i.e. 10), one should consider removing that measure. Next, we assess the significance of the formative measures by examining their outer weights and outer loadings. The outer weight determines the relative contribution of a measure to its constructs whereas outer loadings account for the absolute contribution. Hair et al. (2014) argued that one should consider the measures relative to or absolute contributions for its constructs. They suggested retaining the formative measures if:

1. The outer weight is significant,
2 The outer loading is > 0.5, or

Table 8
Factor weights, loadings, t-statistics, VIF — Formative measures.

Construct	Item	Weight	t-value	Loading	t-value	VIF
Chatting & discussion (CD)	CD1	0.3855	2.9364	0.5483	4.6596	1.282
	CD2	0.3073	2.1351	0.4996	3.9752	1.184
	CD3	0.4428	3.3472	0.4586	3.5125	1.172
	CD4	−0.4094	3.0704	0.1110	0.8763	1.359
	CD5	0.0599	0.4530	0.2693	2.1137	1.235
	CD6	0.4190	2.9696	0.6376	5.9112	1.306
	CD7	0.3021	2.0898	0.4687	3.9106	1.375
	CD8	0.1418	1.0181	0.3703	2.7901	1.131
Content creation (CC)	CC1	0.3717	2.7755	0.5893	5.2781	1.327
	CC2	0.2929	2.5010	0.5407	4.5100	1.248
	CC3	0.4173	3.0859	0.6087	5.3104	1.232
	CC4	−0.0783	0.5608	0.4042	3.3004	1.339
	CC5	0.1500	1.1667	0.3688	2.9940	1.225
	CC6	0.3614	2.6445	0.6237	5.8583	1.355
	CC7	0.0762	0.5164	0.4352	3.5761	1.330
	CC8	0.1657	1.1473	0.5207	4.0901	1.223
File sharing (FS)	FS1	0.0920	0.5245	0.3844	2.5455	1.437
	FS2	0.2938	2.2838	0.5185	4.4066	1.222
	FS3	0.4324	3.6196	0.6461	6.6713	1.148
	FS4	0.0610	0.3609	0.4970	3.6732	1.470
	FS5	0.0117	0.0879	0.3967	2.9964	1.355
	FS6	0.4855	4.0344	0.6613	6.4780	1.102
	FS7	0.1421	1.0493	0.4192	3.6341	1.421
	FS8	0.2200	1.8686	0.5338	5.7970	1.326
Enjoyment & entertainment (EE)	EE1	0.4606	3.1495	0.6998	6.2192	1.358
	EE2	0.2207	1.2627	0.6107	5.1170	1.404
	EE3	0.4493	2.9064	0.4825	3.3649	1.156
	EE4	0.0386	0.2218	0.4995	3.4256	1.337
	EE5	0.1240	0.8211	0.3959	2.8901	1.241
	EE6	0.2494	1.4552	0.5092	4.1042	1.456
	EE7	0.2579	1.4581	0.5613	4.4525	1.426
	EE8	−0.0496	0.3737	0.2827	2.1607	1.346

3 The outer loading is significant.

Table 8 presents the values of weights and loadings of formative measures. Based on the above criteria, we were able to retain all the measures.

4.3.3. The structural model

The proposed research model explained 24.6% and 30.1% of the variance in knowledge sharing and learning performance, respectively. The Stone-Geisser's Q^2 (Geisser, 1975; Stone, 1974) is used as a criterion for predictive relevance of the structural model. Using blindfolding procedure (Tenenhaus, EspositoVinzi, Chatelin, & Lauro, 2005), the cross-validated redundancy Q^2 for knowledge sharing and learning performance were 0.118 and 0.005. A Q^2 value of greater than zero is indicative of predictive relevance of the structural model (Henseler, Ringle, & Sinkovics, 2009). However, the low values of Q^2 imply low predictive relevance. The PLS path coefficients are summarised in Table 9. Not all the four categories of SNS use are significant. Only chatting and discussion (CD) and file sharing (FS) directly affected knowledge sharing (KS), supporting H1 and H5, respectively. CD and FS did not affect learning performance (LP), thus not supporting H2 and H6 respectively. Content creation (CC) neither affected knowledge sharing nor affected learning performance, thus not supporting H3 and H4. Enjoyment and Entertainment directly affected learning performance, supporting H8, but did not affect knowledge sharing, thus not supporting H7. Knowledge sharing strongly affected learning performance, supporting H9. File sharing and chatting and discussion use have no direct significant effect on learning performance. Since they had significant impact of knowledge sharing, and knowledge sharing was strongly affecting learning performance, it is possible that knowledge sharing mediates the relationship between chatting and discussion, file sharing, and learning performance. However, the Sobel test (Sobel, 1982) did not reveal a mediating effect of the knowledge sharing.

5. Discussion and implications

The data analysis results show that 99% of respondents or almost all KFUPM students are using one or more SNS. The majority of the respondents (96.7%) have more than five years' experience using SNS. About two-third of the respondents are undergraduate and a third are graduate. The undergraduate respondents are evenly distributed across different student classes. However, half of the undergraduate respondents came from the College of Engineering Sciences & Applied Engineering as this college has the largest number of students. The results show that the most dominant SNS tools used by respondents for chatting and discussions is WhatsApp (92.5%), YouTube (82.8%), and then Facebook (74.4%). Whereas the most dominant SNS tools used by respondents for content creation is YouTube (89.0%), WhatsApp (79.2%), and then Facebook (66.2%). The most dominant SNS tools used by respondents for file sharing is WhatsApp (80.8%), Dropbox (61.7%), and then Facebook (56.5%). The most dominant SNS tools used by respondents for enjoyment & entertainment is YouTube (97.7%), WhatsApp (85.4%), and then Facebook (70.1%). The findings of the extent of the four categories of SNS use has important practical implications for instructors teaching in educational institutions. Since WhatsApp has been found to be the mostly used tool for online chatting and discussion, instructors should focus on using it for encouraging group discussion, followed by YouTube and Facebook. Instructors should be encouraged to use YouTube for content creation, followed by WhatsApp and Facebook. Instructors should be encouraged to use WhatsApp for file sharing, followed by Dropbox and Facebook.

The study findings provide some support to the conceptual model presented in Figure 1. In particular, they support the premise that at KFUPM, chatting and discussion, and file sharing based on SNS tools are important predictors of knowledge sharing. In addition, enjoyment and entertainment is a predicator of learning performance. In addition, knowledge sharing is a strong predicator of learning performance. The content creation category of SNS use is not a predicator of both knowledge sharing and learning performance. Enjoyment and entertainment is not a predicator of knowledge sharing. We attribute this result to the fact that students use SNS for content creation more for enjoyment and entertainment, rather than for their knowledge sharing nor for learning purpose. Similarly, student's learning can benefit from the use of SNS tools for enjoyment and entertainment to a certain extent. Here, improvement in student's learning will be more in terms of communication skills and comprehension than in CGPA. Therefore, instructors teaching in educational institutions should encourage students to use SNS tools for online chatting and discussion and file sharing as this will greatly contribute to knowledge sharing and then

Table 9
Results of Hypotheses testing.

Hypothesis	Path	Coefficient	S. Errors	|T-Value|	p-value	Support
H1	CD ——> KS	0.1776	0.0682	2.5922	0.001	Yes
H2	CD ——> LP	−0.0645	0.0873	0.7391	0.460	No
H3	CC ——> KS	0.1145	0.0719	1.5928	0.112	No
H4	CC ——> LP	0.0428	0.0793	0.5398	0.590	No
H5	FS ——> KS	0.2658	0.0713	3.7299	0.000	Yes
H6	FS ——> LP	−0.0934	0.0809	1.1540	0.249	No
H7	EE ——> KS	0.0074	0.0616	0.1200	0.904	No
H8	EE ——> LP	0.1927	0.0898	2.1462	0.033	Yes
H9	KS ——> LP	0.5133	0.0634	8.0976	0.000	Yes

to improving learning performance as knowledge sharing strongly related to student learning. Instructors should also encourage students using YouTube for enjoyment and entertainment in a way to improve their learning performance.

The practical implication of the findings is that the effort toward promoting SNS usage for online discussion and file sharing is important in a bid to enhance a sense of knowledge sharing between students, which leads to improved student learning. To achieve this, we believe that educational institutions should make efforts to organize some orientation courses or seminars to instil the etiquette of positive SNS use by both instructors and students. Moreover, it may be wise to consider integrating the use of SNS for online discussion and file sharing in course syllabi design.

In summary, the findings indicate that using SNS tools for online topic discussion and file sharing can play an important role in the development of a framework for knowledge sharing and management among learners with the aim to improve student's learning. A framework that could be similar to the framework developed by Ismail and Chua (2005); however, their framework is aimed at promoting knowledge management among faculty members rather than among students. In terms of theoretical implications, the study results provide new insights to the body of knowledge on the extent and impact of the four categories of SNS use on both knowledge sharing and learning performance.

6. Conclusion

This study attempted to examine the effect of four categories of SNS use, namely chatting and online discussion, content creation, file sharing, and enjoyment and entertainment on both knowledge sharing and learning performance. Based on the findings of the literature review and the applied cognitive theory, we formulated a conceptual model, which depicts the nine study hypotheses. The first eight hypotheses present the relationships between each of the four categories of SNS use and both knowledge sharing and learning performance. The last hypothesis delineates the relationship between knowledge sharing and learning performance. In order to test the hypotheses and produce meaningful findings, the authors adopted the survey questionnaire method to collect the data, and then applied a thorough data analysis utilizing the structural equation model to test the hypotheses and analyse the results. The study found that chatting and online discussion and file sharing based on SNS tools are predictors of knowledge sharing. Enjoyment and entertainment is a predicator of learning performance, and knowledge sharing is a strong predicator of learning performance.

The results of the study implies that the use of SNS for chatting and discussion and for file sharing is becoming common among university students, and this positively affects knowledge sharing and impact student learning. In addition, the study found that the major SNS tools used by students in order of preference are WhatsApp, YouTube, and Facebook, which may be attributed to the SNS tool's desirable features rather than to the type of used electronic device. Thus, educational institutions in Saudi Arabia should consider integrating the use of these SNS tools in their design of courses in a way to promote knowledge sharing and learning. The study is not without limitations. The results apply to KFUPM. Therefore, more studies in other universities in Saudi Arabia as well as in other countries will increase the generalization of results. Other studies in the context of organizations will enrich the body of knowledge in terms of providing insights of the similarities and differences between the contexts of students and employees.

Acknowledgement

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