Online formative assessments with social network awareness

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ABSTRACT

Social network awareness (SNA) has been used extensively as one of the strategies to increase knowledge sharing and collaboration opportunities. However, most SNA studies either focus on being aware of peer's knowledge context or on social context. This work proposes online formative assessments with SNA, trying to address the problems of online formative assessment (i.e. lack of individual assistances and low participant rate) and enhance learning effectiveness. This study focuses on being aware both peer's social context and knowledge context for student to promote the opportunity of peer interaction and to select the appropriate helpers to ask for help when facing problems in online assessments. Social-context information particularly includes centrality (i.e. social network position) of a candidate, and social distance (i.e. the shortest distance between the candidate and a seeker) in a sociogram, and nimbus (i.e. willingness to help others) of a candidate. A corresponding system, called Social Network Awareness for Formative Assessments (SNAFA), is further developed. The education experiments particularly focused on the effects of social-context awareness on learning activity and social activity. The results showed that the SNAFA not only increase the participant rate of students on formative assessment and opportunities of knowledge sharing, but also promote learning achievement, compared to the Traditional Formative Assessment (TFA). Meanwhile, centrality, which is represented by two indices: degree and closeness, also plays an important role in the SNAFA environment. More specifically, students with higher centrality (regardless of degree and closeness) 1) are more likely to take advantage of the social network position to ask for help, 2) easily become target helpers that peers seek to, 3) utilize the SNAFA more frequently, and 4) have better learning achievement, compared with those with lower centrality.

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1. Introduction

Formative assessments, continuously embedded in the teaching and learning process of a curriculum, attempt to improve learning achievements by offering feedbacks on performance (Sadler, 1998). In addition to providing teachers with opportunities to adjust teaching strategies, formative assessment also provides students with feedbacks to revise their misconceptions (Bransford, Brown, & Cocking, 2000; Wang, 2007). Feedbacks received during the process of formative assessment facilitate student learning, assist students in reflecting on their learning, and improve their motivation (Marriott, 2009; Wang, 2007).

In general, providing feedback on formative assessments is difficult for teachers because they face a large number of students, lengthy pieces of work, or practical constraints such as time and workload (Buchanan, 2000; Wang, 2007). Additionally, the amount of questions that students generate in an assessment can overwhelm a teacher (Pear & Crone-Todd, 2002). Online formative assessment systems may solve the above difficulty, but most of them only provide fixed and predetermined answers and references as learning feedback. These predetermined answers and references can not offer adaptive assistances and satisfy individual student's needs. Another problem of online formative assessment systems is a low participation rate among students in such systems (Buchanan, 2000; Costal, Mullan, Kothe, & Butow, 2010; Henly, 2003). This significantly influences learning effects and in turn downgrades learning achievements. Thus, designing an appropriate auxiliary mechanism to address the above issues of online formative assessments is important (Costal et al., 2010).

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Nicol and Macfarlane-Dick (2006) pointed out peer interaction is one of prominent principles of good feedback practice in assessments. The peer interaction and collaboration can motivate student learning, provide individual assistances, and reduce student frustration (Shute, 2008). Student can receive substantive feedback through a socially interactive process (Pear et al., 2002). However, students need to know the social activities, knowledge degree, and contexts of others to increase knowledge sharing opportunities and to communicate and collaborate effectively (Hu, Kuhlenkamp, & Reinema, 2002). Social network awareness (SNA) has been used extensively as one of the strategies to address this issue (Cadima, Ferreira, Monguet, Ojeda, & Fernandez, 2010; Cho, Gay, Davidson, & Ingraffea, 2007; Cross, Parker, & Borgatti, 2002; El-Bishouty, Ogata, & Yano, 2007). SNA is used to be aware of the knowledge context and social context of the others (Zheng & Yano, 2007). Knowledge context, which reveals the peer candidate's knowledge expertise and experience, is used to match 'who knows what' in the knowledge dimension. Social context, which reveals the nimbus (i.e. willingness to help other) of the peer candidates, their social network tie, and social network position (i.e. central/peripheral positions in a network), is used to harmonize 'who is willing to collaborate. Being aware of both context information and the interactions among peers are deemed as scaffolds at stimulating students to reflect on learning, to imitate peers' actions, and to motivate coherent discussions.

However, most SNA studies either focus on being aware of peer's knowledge context (El-Bishouty et al., 2007; Yang, Chen, Kinshuk, & Chen, 2007) or on social context (Cadima et al., 2010; Chen, Hong, & Chang, 2008). Knowing who has expertise is a precursor to seek a specific helper out when we are faced with a problem. But, knowing what someone else knows is only useful if you can get access his/her thinking in a sufficiently timely fashion. This accessibility is heavily influenced by the one's social context within a community (Cross, Parker, Prusak, & Borgatti, 2001).

This work proposes online formative assessments with social network awareness to raise the opportunities of collaborative learning and participant rate within a community, and further investigates its effects on learning the course "Electronic Business." Students are able to be aware both peer's social context and knowledge context, facilitating students to select the appropriate helpers to ask for help when facing problems in online assessments. In addition to knowledge-context information which includes knowledge degree of candidates, this work particularly emphasizes social-context information which includes nimbus, centrality, and social distance, of a candidate. Using the proposed approach, this work realistically develops a Social Network Awareness for Formative Assessments (SNAFA) system, which allows students to effortlessly maintain both context awareness of peers and further presents them in text form and ego-centered sociogram. This work describes how to construct social network and reveal both context information, and also introduces the overall operation processes. The first investigation is to assess the effectiveness of the proposed SNAFA. The second issue focuses on investigating the impacts of social network position (i.e. centrality) of a help seeker within the SNAFA environment. This study tries to investigate these issues in a more extensive way, whose scope includes learning performance, message flow, and system utilization. Currently, the related studies investigating the impacts of centrality of a help seeker are relatively scant.

2. Background

2.1. The problems of online formative assessment

The objective of formative assessments is to provide feedback to students rather than to evaluate them for course grades. However, the workload of teachers in higher education increases year by year as the number of students becomes larger (Nicol & Macfarlane-Dick, 2006). It is difficult for teachers to provide feedback for every formative assessment, because they face many students, lengthy work, and strict schedule constraints (Buchanan, 2000; Wang, 2007). To solve the difficulties, some works have adopted online formative assessment system (Buchanan, 2000; Henly, 2003; Wang, 2008). The system can actually solve the above difficulties, but they usually provided only fixed/predetermined answers and references as learning feedback. For example, Henly (2003) used a commercial web-based formative assessment system, WebCT (http://www.webct.com), for dental education, in which students can access correct answers immediately after finishing their assessments. Buchanan (2000) developed a web-based formative assessment system, PsyCAL, for a psychology course. An important feature is that for each multiple-choice question answered incorrectly, the system provides a reference (appropriate explanation sections of textbooks) for students to further understand the reasons, instead of directly providing the correct answer. However, these predetermined feedbacks neither uncover individual needs nor provide adaptive assistances.

In addition, even given an online formative assessment system, the low participation rate among students is invariably low in tertiary education, which significantly influences learning effects and in turn downgrades learning achievements (Buchanan, 2000; Costal et al., 2010; Henly, 2003). Costal et al. (2010) indicated that a low participation rate is a critical concern to an online formative assessment in tertiary education. Henly (2003) reported that low ranking students, who are most likely to benefit from using an e-Learning system, were less likely to fully use online resources. Similarly, in the research of Buchanan (2000), only one tenth of undergraduate students had ever used an online formative assessment tool during a semester.

All in all, designing an appropriate auxiliary mechanism to address the above issues of online formative assessment (i.e. unable to provide individual assistance and a low participant rate) is an important direction for future research in this area (Costal et al., 2010).

2.2. Social network awareness (SNA)

Social network awareness (SNA) has been extensively used as one of the strategies to promote the opportunities of peer interaction and collaboration, and to support the co-construction of knowledge and the sharing of information (Cadima et al., 2010; Chen et al., 2008; Chen, Chen & Kinshuk, 2009; Dawson, 2008; El-Bishouty et al., 2007; Hu et al., 2002; Yang, Chen, & KinshukChen, 2007). Deeper mutual awareness of peer social context enables more fluid and expressive communication between individuals, resulting in a more effective coordination of ideas, opinions, and actions (DiMicco, Hollenbach, Pandolfo, & Bender, 2007; Erickson & Kellogg, 2000). However, most SNA related works focus on the awareness of either peer's knowledge context (El-Bishouty et al., 2007) or peer's social context (Cadima et al., 2010; Chen et al., 2008). The social-context studies mainly focus on being aware of peer's social status, including social network tie, social network position, and social interaction. For example, Cadima et al. (2010) developed an SNA system which only based on social network tie and social