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Designing and implementing peer formative feedback within online learning environments

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With increasing need to achieve appropriate balance between learning support and self-regulation within the context of online learning, formative feedback has been identified as a viable means to achieve meaningful engagement. Specifically, this study sought to establish how peer–peer formative feedback was facilitated in an online course and to what extent this engaged students in meaningful learning experiences. This case study entailed an in-depth investigation into the design and implementation of an online course in a New Zealand university. The studied course was part of a postgraduate programme in continuing (in-service) teacher education. The study adopted a case study methodology with a bias on qualitative techniques. Online observations, analysis of the archived course discourse and interviews were utilised as sources of data. The data from multiple sources were subsequently triangulated to corroborate the evidence. The findings indicate that peer formative feedback promoted active learners' participation and meaningful engagement. The findings further showed that opportunities for dialogic peer formative feedback promoted learning support and self-regulation.

Keywords: peer formative feedback; online learning; higher education; meaningful engagement; formative assessment

Introduction

As online learning (web-based distance education) continues to grow, researchers and educators are increasingly seeking innovative pedagogical strategies that can promote meaningful learning. Meaningful learning in this study is defined as learning that is robust and transferable to real-life professional practices and contexts (Gikandi, Morrow, & Davis, 2011). Online learning settings have distinct pedagogical demands as compared to face-to-face settings owing to the asynchronous nature of interactivity between the teacher and learners, and among learners (Naidu, 2007). This distinctive nature can hinder meaningful learning if inadequately addressed when designing online courses (Akyol, Garrison, & Ozden, 2009). Similarly, assessment in online settings is influenced by asynchronous interactivity because it may not be easy for the teacher to be able to monitor learners' progress toward specific learning goals (Gikandi et al., 2011; Vonderwell, Liang, & Alderman, 2007; Wolsey, 2008). This is because there is a likelihood of limited opportunities for informal observations and questions in online contexts that are typically available in face-to-face environments.

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Through ongoing monitoring of evidence of learning, the teacher can observe and identify patterns in students' progress and achievements, interpret them and make inferences about students' progress and required feedback (Gikandi et al., 2011). Therefore, ongoing support for scaffolding learning is desirable in online learning, and can be facilitated through proactively designing for sustained interactive collaboration and formative feedback among the teacher, individual learner and peers (Ludwig-Hardman & Dunclap, 2003).

A number of researchers have indicated that the growth of online learning in higher education has not been accompanied by a necessary shift in pedagogical approaches; which is apparently a challenge for educators because they tend to carry on with traditional pedagogical practices that do not fit online classrooms (Baran, Correia, & Thompson, 2011). This implies that, while the traditional role of teachers may be desirable in the online environment, the affordances and limitations of the new learning settings also call for teachers to apply new strategies in order to stimulate meaningful learning engagement. In the context of this study, meaningful learning engagement is conceptualised as active, collaborative and reflective discourse in ways that foster self-regulation.

In order to identify new strategies, empirical research indicates that the asynchronous interactivity that characterises online learning settings may necessitate a reconstruction of roles among the teacher and students (Vonderwell et al., 2007) in ways that foster learners' active participation within the learning and formative feedback processes (Gikandi et al., 2011). Palloff and Pratt (2007) went further, suggesting that learning together in interactive and collaborative learning can enable 'students to have the opportunity to extend and deepen their learning experiences, test out new ideas by sharing them within a supportive group, receive critical and constructive feedback' (p. 158). As these authors suggested, it may be desirable for educators to design learning environments in ways that stimulate online learners to engage actively and meaningfully with their peers. Gikandi et al. (2011) suggested that teachers may also need to foster a sense of shared purpose and responsibility, and design for strategies that facilitate opportunities for peer–peer formative feedback. In the same vein, self-assessment and peer feedback techniques can be developed and embedded in online discussions (Vonderwell et al., 2007).

Effective formative feedback can support students to progressively identify their strengths and weaknesses and refine their understanding by reviewing feedback which supports them towards engaged and self-regulated learning (Gikandi et al., 2011). Self-regulated learning refers to 'an active constructive process whereby learners set goals for their learning and monitor, regulate and control their cognition, motivation, and behavior, guided by their goals and the contextual features of the environment' (Pintrich & Zusho, 2002, in Nicol & Macfarlane, 2006, p. 202). Self-regulation potentially facilitates a learner- and assessment-centred focus which is desirable particularly in online learning environments where learners are expected to assume primary responsibility for their learning (Gikandi et al., 2011; Vonderwell et al., 2007).

Peer formative feedback has been recognised as one way of promoting dialogue and stimulating online learners to actively engage in formative assessment processes to support their learning (Gikandi et al., 2011). According to Gikandi et al., formative feedback in online settings is more effective when formative assessment is embedded within online courses in ways that foster interactive and collaborative learning.

Moreover, as Gikandi et al. (2011) suggested, achieving effectiveness in formative processes in online settings necessitates feedback to be deemed as constructive dialogue as opposed to a means of information transmission. This means that learners have an active role in constructing their own meaning from the feedback that they receive and using it to improve their work (Nicol & Macfarlane, 2006). This perspective also implies that 'feedback is not necessarily a reinforcer, because it can be accepted, modified, or rejected, and by itself feedback may not have the power to initiate further action' (Hattie & Timperly, 2007, p. 82). As these researchers suggested, an individual student not only needs to receive initial feedback from the teacher and peers but may also require adequate opportunities to engage in productive conversation about that feedback.

To that end, it may therefore be desirable to stimulate online learners as a source of peer feedback in order to promote active and meaningful engagement. However, innovative strategies in relation to sustaining interactive and reflective feedback processes may not be obvious in practice (Gikandi et al., 2011; Van der Pol, van den Berg, Admiraal, & Simons, 2008). Gikandi et al. (2011) pointed out that there is a need for more empirical studies exploring design and implementation of formative assessment processes in order to develop further knowledge. This is particularly relevant in this field of continuing teacher education with a focus on peer formative feedback in online contexts.

The current study therefore explored the design and effectiveness of peer–peer feedback in continuing teacher education within the context of online learning. Unlike previous studies, the researchers in this study aimed to go beyond exploring use of asynchronous discussion forums to elucidate other innovative strategies that may be used to promote online peer–peer formative feedback. This study focused on how the students as providers and receivers of peer feedback engaged meaningfully. The researchers therefore sought to elucidate what influenced the effectiveness of peer–peer feedback processes within a postgraduate online course by examining: (1) How was peer–peer formative feedback facilitated? (2) How (if evident) and to what extent did peer formative feedback enhance meaningful engagement?

The premise of peer formative feedback in online higher education

The emphasis on peer–peer formative feedback in higher education is underpinned by the need to stimulate students to take an active role in their learning and assessment processes (Sorensen & Takle, 2005; Vonderwell et al., 2007). Active engagement is more critical in online settings because students are expected to self-regulate and take primary responsibility for their learning (Baran et al., 2011; Gikandi et al., 2011).

> Online environment changes the fundamental nature of the interaction between the teacher, student, and content, requiring re-examination of the roles teachers take in enhancing students' learning … online learning emerges as an important role in guiding these student centred approaches … While there is still a strong focus on the responsibilities of teachers in online courses, the teacher moves from being at the centre of the interaction or source of information to the 'guide on the stage'. (Baran et al., 2011, p. 429)

Moreover, activating students as a source of constructive peer feedback conforms to the principles of effective feedback as identified by Nicol and Macfarlane (2006), whose model underlines effective formative peer–peer feedback as one of the

desirable elements in fostering meaningful dialogue, and reflective and self-regulated learning. They noted that peer feedback is valuable in fostering self-regulated learning because it exposes students to alternative perspectives on an issue or dilemma, and stimulates alternative strategies in generating solutions. Such alternative perspectives support students to revise or reject their initial perspectives, and construct new knowledge collaboratively through opportunities for negotiated meanings. Moreover, through reviewing peers' work and offering feedback, students can develop objective assessment of work in relation to expected outcomes; this, in turn, triggers self-assessment (Nicol & Macfarlane, 2006).

Sustained opportunities for peer–peer feedback can stimulate meaningful interactions with others and promote learning engagement (Gikandi et al., 2011). Previous empirical research has shown that interactive collaborations within asynchronous discussions have potential to enhance peer formative feedback processes (Vonderwell et al., 2007). The study by Vonderwell et al. shows that learners' active participation and sustained collaborations within online discourse stimulate shared and negotiated meanings by allowing students to first compose their individual perspectives before comparing them with the diverse perspectives of peers. This in turn can stimulate meaningful dialogue and critical feedback. Peer formative feedback has the potential to promote reflective dialogue as students seek to justify their responses to peers and/or as they articulate their position in justifying their ideas and actions in recognition of feedback from peers (Kelly, Gale, Wheeler, & Tucker, 2007; Sorensen & Takle, 2005; Tucker, Fermelis, & Palmer, 2009; Vonderwell et al., 2007).

Previous research also illustrates that peer formative feedback is a form of collaborative learning because it provides students with opportunities to interactively collaborate and potentially develop new knowledge (Van der Pol et al., 2008; Van Gennip, Segers, & Tillema, 2009; Vonderwell et al., 2007). This occurs as students share their understandings with peers in ways that that enrich individuals' meanings. For instance, Sorensen and Takle (2005) indicated that sustained interactive collaborations promoted mutual engagement and opportunities for ongoing formative peer feedback. In this way, students had opportunities to play an active role as knowledgeable participants within which they constructed new knowledge.

In the light of the insights emerging thus far, and as it will be detailed further in the findings, the teacher's pedagogical approaches in this study appeared to conform to the reviewed literature. The teacher's pedagogical design is largely consistent with the desirable design of online courses that is exemplified in the above literature. In particular, the design of the course revealed that the teacher proactively sought to offer opportunities for dynamic interactions and ongoing formative feedback that were operationalised through systematic utilisation of a variety of online tools and strategies. As it will emerge later in the findings, integration of peer formative feedback was recognised by the teacher of the studied course as a pedagogical strategy that could support achievement of the programme goals which included designing for authentic learning (Mackey, personal communication, 2010). In the context of this study, authentic learning referred to aspects that could stimulate students to reflect and make connections to real-life applications in ways that could support development of robust knowledge and skills that were transferable to their own professional practices and contexts.

Methodology

The current study adopted a case study methodology which provided an opportunity for in-depth understandings (Yin, 2009) with respect to how peer–peer feedback was facilitated in an online course, and its impact in supporting meaningful learning engagement. In order to adequately answer the research questions, this study adopted an interpretive approach to facilitate an in-depth exploration of a phenomenon that was characterised by human subjects within a naturalistic context (Creswell, 2003; Lodico, Spaulding, & Voegtle, 2006). The study therefore employed qualitative techniques in data gathering and analysis. The qualitative techniques were particularly useful in enabling the researcher to explicate the course participants' experiences and perceptions. It is therefore important to note that quantitative measures were not our key interest in this study because we considered this as superficial with respect to revealing the evidence of formative feedback, reflectivity and self-regulation as our key target variables.

Context of the study

This study was conducted within a New Zealand university. The studied course is typically offered in an online environment and mainly targets distance learners across New Zealand and overseas. It is offered as a partial requirement of a post-graduate diploma programme in ICT in education. The course was also being taken as part of a Masters degree in Education.

The course was hosted within the university learning management system, Moodle version 1.9. All teaching and learning processes were facilitated online (asynchronous mode). The studied course is referred to as 'the course' throughout this study to maintain anonymity.

Study participants

There were 17 participants comprising 16 students and the course teacher. The students were continuing graduate professionals who held previous qualifications and had been practising as teachers and/or worked in other educational sectors. These students differed in gender, age, which varied between 21 and over 50 years, and previous teaching experience, which was between 1 and over 15 years. For the purposes of this study and to ensure participants' anonymity, the student participants were identified as Student 1 to 11. Table 1 provides more information about the student participants. The online educator was both a key participant and a co-researcher in this study, and is referred to in this study as 'the course teacher or Teacher B'.

Data collection and analysis

Data were collected from multiple sources using various instruments including online observations, archived online discourse, and interviews. The interviews with the student participants were conducted after the end of the course. To ensure the validity and reliability of the research instruments, the interview guides were developed by the principal researcher, and subsequently peer-reviewed by experts and piloted with volunteers (who were not study participants). Another source of interview data were the transcripts of two interviews with the course teacher (at the beginning and end of the course).

Table 1. Overview of student participants and their demographic information.

Participant	Gender	Age	Place	Educational sector	Experience	Role	Courses taken	Load
1	Female	> 50	NZ	Secondary	> 15	Teacher: languages, mathematics	None.Taking three online courses concurrently	Full-time study (on study leave)
2	Female	31–40	NZ	Senior primary	11–15	Administrative role and teaching	Two and taking other two courses concurrently	Full-time (on study leave)
3	Female	31–40	Other	Primary	2–5	Teacher: ICT applications, ICT and pedagogy	One	Full-time study (on study leave)
4	Male	31–40	NZ	Secondary	1	Teacher: languages, mathematics and sciences	None	Part-time study; full-time work
5	Female	41–50	NZ	Primary	>15	Administrative	One	Part-time study; full-time work
6	Female	21–30	Other	Junior primary	2–5	Teacher: languages	None	Full-time study; no work
[7]	Female	31–40	NZ	Tertiary	2–5	Research consultant	None	Part-time study; full-time work
8	Female	21–30	NZ	Primary	1	Teacher: languages, mathematics, sciences	One	Part-time study; full-time work
9	Female	31–40	NZ	Learning support	6–10	Teacher: ICT	–	Part-time study; full-time work
10	Male	31–40	NZ	Secondary	6–10	Teacher: health and physical education	One	Part-time study; full-time work
11	Male	31–40	NZ	Tertiary	>15	Teacher: Business related	One	Part-time study; full-time work

Notes: Participants: Student 1...*n* (*N* = 11)
Gender: Either male or female
Age: Range in years
Place: Country in which participants currently practise
Educational sector: Education sector or level they work in which could be junior, primary, senior primary or tertiary
Experience: Years of teaching experience (current and previous)
Role: Current role and/or main teaching subjects
Courses taken: Previous online courses taken before this course
Load: Study mode

The online observations were carried out throughout the course duration. The archived online discourse was examined in depth to discern the aspects that supported peer–peer formative feedback, and to establish its impacts on students' learning as both providers and receivers of peer feedback. In examining the archived discourse for evidence, peer formative feedback was manifested by a response to an initial idea, question and/or as a response to preceding feedback as posted online by an individual student (as feedback receiver). Additionally, peer feedback was also demonstrated when the peer (as feedback provider) had recognised and understood the issue at hand, and provided constructive views that either clarified or answered a question, and/or views that expanded, agreed and/or disagreed with the recipient ideas.

The three sub-components of the archived online discourse were systematically examined in order to code the emerging instances of peer–peer formative feedback. For instance, 144 instances of formative peer feedback were coded from the content of the asynchronous discussion forums which emerged from two related sub-themes, namely initial peer feedback and recognition of peer feedback (feedback on feedback). The coding process was supported by Nvivo qualitative analysis software. Additionally, all the interviews transcripts were critically examined to draw out the aspects of peer–peer feedback emerging from the participants' viewpoints in relation to their experiences and perceptions as a result of engaging with peers within online discourse, and providing and/or receiving feedback.

The evidence obtained from multiple data sources was subsequently triangulated to establish convergence (similarities) and divergence (dissimilarities) across the analysed data (Creswell, 2008; Yin, 2009) and is presented in the findings section.

Findings

As noted earlier, the teacher's pedagogical design is largely consistent with the desirable design of online courses that is exemplified in the literature presented above. The teacher had planned and proactively sought to offer opportunities for dynamic interactions and ongoing peer formative feedback that were operationalised through systematic utilisation of a variety of online tools and strategies. As illustrated in the findings, designing for peer formative feedback was also deemed by the course teacher as a means to support the students to engage meaningfully and achieve expected outcomes. The teacher also expected that the course design would support her to capitalise on learners' diverse prior experiences and knowledge. Grounded in the teacher's belief, the design of the course incorporated embedded assessment that supported students to meaningfully engage with others, as revealed in the following excerpts.

> I have deliberately thought of the ongoing assessment activities as being situated in your own contexts and practices. (And expect that you will also be learning informally from colleagues and others outside the course at the same time.) … (Teacher B, online discussion forum, 20 May 2010)

> The authentic part in them [ongoing assessment activities] is probably participation component and action research project because that is where they put things in place and is very relevant to what they are doing in the [their own] classroom [as professional teachers] … But I also think all of it is quite authentic to what they are doing because they are getting feedback from their peers … (Initial interview with the teacher, March 2010)

From the findings, it is clear how peer formative feedback was facilitated in an online course and how this supported learning. The teacher in this course facilitated opportunities for peer–peer formative feedback by designing opportunities for ongoing monitoring, assessment of evidence of learning, and formative feedback. The analysis of data from various sources revealed three key strategies that the teacher utilised to facilitate the formative feedback processes. These included creative use of discussion forums features within the LMS applying the following strategies: active participation and collaborations within topical asynchronous discussion forums; open forums to share developing thinking and work-in-progress; and the forum for students to share their polished artefacts. The teacher's ongoing involvement also emerged as an integral aspect within peer–peer feedback processes. Each of these strategies and how this enhanced learning experiences is illustrated in the ensuing paragraphs.

Active participation and collaborations within the topical asynchronous discussion forums

Teaching and learning activities were mainly structured within threaded asynchronous online discussion forums which were characterised by interactive collaborations among the students, and between the students and the teacher. The active participation and interactions with peers within these discussion forums prompted students to share their perspectives and negotiate meanings which elicited constructive responses from/to peers, thus peer formative feedback.

Online observations revealed that ongoing documentation and sharing of student-created artefacts was a key feature that promoted meaningful interactivity. The sharing went beyond increasing social interactivity to prompt meaningful dialogue and constructive feedback among peers. Peer–peer formative feedback within the asynchronous online discussion forums emerged as the students articulated their thinking and peers responded to them with converging or divergent viewpoints on topical content.

Table 2 outlines the themes that emerged during the coding of content from the online discussion forums. As shown in Table 2, the initial themes emerging from the analysis of raw data from the online discussion forum reveal formative feedback and other valuable learning experiences. A total of 30 themes coded (see Table 2) from the online discussion forums were organised, based on the number of instances coded in relevant themes. The themes did not emerge in any given order during the coding process; they emerged randomly and cumulated over time. The themes were arranged in ascending order as shown in Table 2 for purposes of presenting the findings of this case study. It is also important to note that these initial themes were overlapping owing to their inherent relationships.

From the results, it is notable that the online discussions provided students with sustained opportunities to review peers' thinking and artefacts as they had the opportunities to refer back to previous contributions by self or others. In turn, the students were prompted to engage with the self as they reviewed and internalised the feedback from peers. Additionally, it allowed the students adequate time to review others' thinking and compose their ideas to offer deeply thought feedback.

Out of the six students interviewed, five confirmed that they valued the opportunities to revisit previous contributions when they wanted to reconstruct, confirm and/or enhance their understanding of the content. One of them noted:

Table 2. The most coded themes from the online discussion forums arranged in descending order with respect to the number of instances coded.

Theme ID	Name of the theme	Number of instances coded
1	Peer feedback as constructive responses from peers upon one's idea/work	116
2	Connecting ideas to broader real-life contexts and experiences	76
3	Recognition of the class as a learning community – common goal and practice, shared repertoire, sense of reciprocity – mutuality	69
4	Connecting ideas to own professional practices and experiences, and work context in relation to ICT integration	64
5	Articulating own developing understanding of content and perspective	54
6	Analysing the literature critically	48
7	Connecting ideas to the literature	40
8	Awareness and articulation of developing understanding and abilities in relation to practical application of ICT tools	38
9	Recognition of self as source of learning support	38
10	Articulation of how ICT tools can support learning – theirs (sharing their own experiences with the tools) and for their learners	29
11	Trying out and sharing own experiences and products with ICT tools – serves as a learning resource for others	29
12	Recognition of peer feedback – feedback on feedback	28
13	Teacher feedback as responses to student's question and/or teacher feedback prompted by her monitoring the student's progress and achievement	24
14	Recognition of peer learning support	20
15	Recognition of diversity among participants and interest to learn from this diversity	18
16	Cross-curriculum effect	16
17	Affective gestures and other experiences outside the class	15
18	Articulation of own perceptions and beliefs	14
19	Articulating own identity and aspiring changing identity individually and as a course community with common professional practice – change agent in relation to ICT integration in schools	12
20	Teacher as a co-participant	12
21	Appreciation of peers' work or contribution	10
22	Reference to previous contribution by self or others – manifest connection among the readings	10
23	Setting expectations and strategies on how to transfer what one is learning to own practice	10
24	Teacher recognition of student initiative to inject new resources within the discourse	9
25	Connecting ideas to own previous educational experiences	8
26	Recognition of teacher feedback	7
27	Setting own learning goals	7
28	Direct question to the teacher or request for support or guidance	6
29	Teacher scaffolding	6
30	Articulating own learning experiences within the online discourse in this course	5
	Total number of instances coded for all the themes	838

> Definitely I did go back to what others had contributed and reconstructed the reading and I actually went back to a couple of readings that were optional and I had not read but because somebody had said something about them this made me want to go and find out more. (Interview with Student 5)

The online observations showed that the opportunities to share individuals' views within the online discussions stimulated the students to narrate their prior experiences as both learners and experienced professionals. Sharing experiences occurred inherently as students articulated their individual perspectives and offered feedback to peers. The emergent perspectives revealed a sense of a community with common goals and practice, particularly as practising teachers. Of the 16 students, 15 were able to identify with peers' experiences, compared multiple perspectives and demonstrated capability to discern what was meaningful in their own contexts. Analysis of the online discourse further revealed that opportunities for collaboration and peer–peer feedback stimulated the students to connect their thinking to other broader contexts in ways that demonstrated deep learning and ability to relate learning to real-world contexts. The following excerpt reveals such aspects:

> I have found the first reading … to be very thought-provoking. I found myself cringing at times as I realized that a great deal of my teaching and assessment is based around the students being able to regurgitate what I have told them. For a while now I have realized this is pointless and that I am rewarding those students who can put my speech and words on their test papers … Also I am often concerned when my students want to learn about things that are not related to the assessment – sometimes I don't have a single period to spare in order to 'prepare' students for their exams … (Student 10, online discussion forum, 15 July 2010)

Analysis of students' exchanges within the online discourse showed that the peer–peer feedback processes also exposed the students to new perspectives and contexts. Notably, two of the six interviewed students recognised some new perspectives that were a great shift from their previous experiences. For example, one student explicitly expressed how this was valuable to their learning because it exposed them to new possibilities. The analysis of the online discourse showed that the students benefited from opportunities to interact with peers, and receive and/or provide feedback. These processes enhanced their confidence and stimulated them to explore new possibilities/tools. This is illustrated in the following sample excerpt:

> You got me motivated to use prezi… In the school that I worked we used ppts [PowerPoints] to teach … 3rd graders, but after a while they found this way of presentation kind of boring. So I took one of these presentations and 'converted' it to a prezi. Here is my first try… I can imagine using this tool … This way they can revise the material, but also develop other skills, such as organization, creativity and spatial skills … (Student 3, online discussion forum, 19 July 2010)

The five of the six interviewed students also noted that interacting with peers and sharing within collaborative online discourse stimulated them to try out new Web 2.0 tools and explore new possibilities.

Despite the evidenced positive experiences, active participation within the collaborative online discussions and peer feedback processes also emerged as a great challenge to one student. These difficulties were largely as a result of this student's learning style, which was greatly inclined to face-to-face interactions. It was particularly challenging for this student to flexibly adapt to the online learning setting. The teacher attempted to support this student by providing additional guidance and encouragement through private emails but this did not improve the situation. This

was further compounded by family commitments that distracted this student, who eventually chose to withdraw from the course. This student and the course teacher acknowledged these factors as a source of the noted learning difficulties. Evidently, this student's learning style did not fit online settings, and the necessity to blend online with face-to-face interactions to cater for different learning styles emerged overtly during the interviews.

> Normally students need to compare like what are the assignments and also you know because as we are to attend a real [face-to-face] class we talk to other students, we talk to the teachers so they have clear understanding about everything but for this paper you do not see each other … and you know at the end it is so independent … I am not saying it is not effective, it does not really work for me. It doesn't fit me as I am a visual learner, I learn things from what I see not from what I read or from what other people tell me, or talk to me. So if there was more face-to-face interaction maybe it could have helped. (Interview with Student 4)

The course teacher also noted that the students engaged meaningfully within the collaborative online discourse but in varying degrees as it would be expected in a typical classroom. However, the teacher also commented that some students can have challenges in relation to engaging with others online owing to their learning style and personal circumstances.

Use of open forum to share developing thinking and work-in-progress

Another element of peer formative feedback emerged within the open forum for sharing assessment-related issues which provided opportunities for shared understanding of assessment guidelines and analytical rubrics. This open forum facilitated peer feedback through stimulating the students to monitor their peers' developing understandings of expected outcomes, and in turn offering feedback. Additionally, the students were able to raise their concerns and seek clarity within this open forum. Students were also exposed to their peers' concerns which sometimes matched their own concerns. This is illustrated in this excerpt:

> It was very helpful to have what was in that [open] forum, some people used it more than others did … I often read their comments and it ended up answering my questions which was very good because I would think I was wondering about that too. I would ask a question and someone had asked about it as well so it was actually very good because you could see that if there were any new questions, you could see also think I missed that one as well and you could see that other people had not understood that one either and that was a good way of clarifying things. (Interview with Student 5)

The students were able to interact with others within this open forum and share their developing thinking. This in turn elicited feedback from both the teacher and peers in relation to accomplishing what was expected of them. For instance, this is what one of the students had posted in the open forum:

> I have attached my plan according to the guidelines posted for the action research. I will work with … but I also face the problem that the … Am I on the right track? Is this what others are doing? (Student 2, forum for sharing assessment-related issues, 13 September 2010)

Sharing and interacting with peers' polished artefacts

The peer formative feedback was also evident within the forum for sharing the action research project artefacts and peer–peer review. Based on the teacher's

guidelines, the students were expected to review and provide constructive feedback on their peers' artefacts. This provided them with an opportunity to expand their thinking as they composed or received critical comments from their peers. It also exposed students to diverse possibilities as they reviewed peers' thinking and/or artefacts. These elements of peer–peer feedback were also characterised by reflective articulations and meaning making. The excerpt below illustrates formative peer feedback to Student 8 on his artefact from the action research project activity:

> I had to Google Webspiration to take a look as I haven't seen this program before I don't think … I think is also a great way to … would you agree?.... Two of your comments stood out for me – that a small action research project could be informative and that you were now prepared to challenge yourself by thinking about using Webinspiration in an area outside of your expertise. … and was encouraged to see I could apply the ideas we have learnt into a new subject area. It forces you to consider technology from a different perspective which you might not otherwise see. You can then apply these new findings to your 'normal' context and extend your teaching there. (Student 7, action research project presentations and peer–peer feedback forum, 26 October 2010)

The value of peer formative feedback on individuals' artefacts was also confirmed during the interviews in which five of the six students expressed that this enriched their understandings and prompted them to reflect on their artefacts. They also noted that they gained new knowledge that was transferable to their own professional practice through engaging in peer–peer feedback processes. This is evident in the following sample excerpt:

> I gave action research feedback to three people or may be more on what they did and I hoped my feedback would be received not just as compliment but they could also see it as a means of something else that they might look at. So in giving feedback I felt also I was learning because when I was looking at their presentation I thought, that is another way that I could probably have used that tool in my own classroom, so it does have that effect, it has ripple effects. (Interview with Student 1)

During the end-of-course interview, the teacher also acknowledged that the students benefited from peer–peer formative feedback. She particularly expressed that these processes prompted students to reflect on their own thinking as well as broaden their perspectives as they interacted with peers' thinking and artefacts.

Another key outcome from peer feedback processes was the development of a supportive learning community in which the students increasingly self-regulated their learning and mutually provided peer learning support. This was manifested by how the students recognised themselves as a source of valuable support and feedback to their peers.

The teacher's engagement within the peer–peer feedback processes

The online observations and analysis of the course discourse revealed that the teacher played a critical role in facilitating and fostering peer–peer formative feedback. From the outset of the course, the teacher emphasised shared purpose and responsibilities with students in providing formative feedback to their peers; and explicitly recognised this as a key aspect within the learning processes. The teacher also guided the students on how to engage constructively within the online discourse and facilitated the students' participation within the discussions. She offered reflective summaries and examples and weaved the collaborative online discussions in ways that enriched the discourse with expansive ideas and probes.

The teacher's weaving was useful in expanding the dialogue, reinforcing peer–peer feedback and ensuring covering of relevant topical content. Reinforcing of peer–peer feedback stimulated students' thinking and fostered uptake of peer feedback. During the interviews, the teacher expressed that facilitating peer feedback processes also required her to be open-minded and take a deliberate risk with the strategy of shared responsibility with students within feedback processes. This was in particular because, unlike with pre-structured learning processes, it was hard to predict students' actions and experiences in order to support their learning needs and ensure efficacy within the collaborative discourse.

Discussion

The current study focused on understanding how peer–peer feedback was facilitated and to what extent this promoted meaningful engagement. It is clearly evident that use of multiple strategies (as presented in the findings section) offered adequate opportunities for peer formative feedback. The applied strategies synergistically interrelated to promote students' engagement in ways that stimulated interactive collaborations, and reflective and self-regulated learning.

One core aspect that facilitated peer formative feedback were the collaborative asynchronous discussion forums within which the students shared their understandings of the course content within a social context by articulating their own understandings and comparing their perspectives with those of peers, while receiving and/or giving feedback from/to peers. The findings revealed that feedback among peers was characterised by meaningful interactivity. That is, interactive collaborations within the online discussion forums prompted the students to share their thinking with others, evaluate diverse perspectives from peers and offer constructive responses to peers. This in turn supported the individual learner to build new interpretive frameworks through adopting perspectives that were meaningful to their own contexts, and thus construct new knowledge. The evidence obtained through this case study demonstrates that interactive collaborations within topical discussion forums enhanced students' understanding of the course content. Consistently with the literature, peer formative feedback and assessment was evidenced as a form of collaborative learning that provides students with opportunities to develop new knowledge as they compare their understandings (Sorensen & Takle, 2005; Van der Pol et al., 2008; Van Gennip et al., 2009; Vonderwell et al., 2007).

It is evident from the current findings that clear assessment guidelines and analytical rubrics played a key role in supporting students to monitor their peers' progress and provide valuable feedback. Notably, peer formative feedback was promoted by the open forum for sharing meaning of rubrics and other assessment-related issues within which students were able to constructively respond to their peers. The commonality of issues and concerns, and the sharing of the artefacts particularly the work-in-progress, allowed the students to monitor their peers' developing understandings in relation to the expected outcomes, which in turn prompted peer feedback. The students also identified with the peers experiencing similar issues and encouraged one another in ways that enhanced their confidence and motivation to persist. In these ways, the open forums enhanced feedback effectiveness and efficiency.

Peer formative feedback was also evident within the forums sharing action research project artefacts. This provided the students with opportunities to apply

rubrics to review peers' artefacts and provide constructive feedback to each other. This task promoted meaningful reflections and supported contextual learning as the students were able to discern from peers' artefacts aspects that were relevant to their own professional context. Moreover, peer–peer feedback promoted reflective thinking as the students sought to justify their comments within their feedback to peers. Additionally, the feedback that the students received promoted disposition towards self-improvement as they articulated their positions and justified their ideas and/or decisions in acknowledging peer feedback. This finding illustrates that opportunities to share and review peers' artefacts can promote reflective thinking and interactivity.

The findings of this case study illustrate productivity of peer formative feedback. Distinctive aspects of effectiveness of peer feedback were the responsiveness, meaningful interactivity and, more importantly, how the students recognised and valued their peers as source of valuable feedback. These aspects in turn promoted the uptake of peer feedback. The findings illustrate that the dynamic dialogue within feedback processes supported the students in this study to better understand and internalise the feedback that they received from peers in ways that persuaded them to perceive the feedback as valuable. This in turn stimulated individual students to actively construct meanings from the feedback and subsequently use it to improve their achievements in relation to the learning goals and expected outcomes. The eventual uptake of feedback by the intended receiver has been identified as a key characteristic that culminates in the productivity of formative feedback (Hattie & Timperly, 2007; Nicol & Macfarlane, 2006; Shekary & Tahririan, 2006; Van der Pol et al., 2008).

Another important finding in this study relates to the ways in which the quality of peer formative feedback was enhanced by adequate opportunities for students to revisit previous contributions (as initial ideas and/or feedback to/from peers) by self or peers. Such opportunities were well supported by the affordances of online settings (as compared to face to face) that enabled ongoing documentation and sharing of the course discourse. This greatly fostered adequacy, interactivity and uptake of peer–peer feedback through facilitating internal feedback (self-reflection) as students had sufficient opportunities to review and reflect upon the feedback they received from peers. Students also had sufficient time to review and rethink upon preceding contributions before responding to peers. This resulted in feedback that was deeply thought out, constructive and an iterative dialogic process that promoted reflective thinking and self-regulatory strategies. These benefits illustrate that ongoing documentation and sharing of artefacts enhance peer–peer feedback in ways that promote reflective dialogue and reification of shared experiences. However, it also became evident that, in online learning it is necessary to take into account that learners have varying learning styles and prior experiences that may culminate in learning difficulties. This suggests that teachers also need to focus on tailored learner support and create opportunities for learners to identify their learning needs, strengths and weaknesses.

This study also demonstrated that peer–peer feedback processes fostered self-assessment in which students were prompted to reflect upon their own learning as a result of interacting with peers' artefacts and in the processes of offering peer feedback. Evidently, the effectiveness of formative feedback emerged through peer–peer feedback processes that focused on both processes and products of learning, and supported development of self-assessment and regulation dispositions. This confirms the viewpoints of Gikandi et al. (2011) and Nicol and Macfarlane (2006) that

effective peer feedback can trigger self-assessment and support students to enhance their learning and achievements.

Another key finding relates to how the opportunities for peer feedback fostered the development of a robust and supportive learning community in which the students increasingly became mutually responsible for their own and peers' learning. Reciprocally, the emergent learning community fostered meaningful dialogue that immensely enriched the online discourse, and expanded opportunities for immediate and critical formative feedback. It became evident that the students engaged meaningfully with peer–peer feedback processes in ways that enhanced their ability to transfer their learning to real-life contexts. Moreover, the findings of this study indicate that interactive and reflective peer–peer feedback processes fostered personalised and transformative learning. Transformative learning was particularly manifested by how the students were able to critically reflect upon their learning, make contextualised connections and reflect upon how they were learning. These aspects concur with the viewpoints of Palloff and Pratt (2007) in emphasising the value of transformative learning in professional learning. Transformative learning involves a developmental process of altering particular perspectives, beliefs and perceptions that shape one's own existing identities The current findings also reinforce Mezirow's (1991) viewpoint that 'we often become critically reflective of our assumptions or those of others and arrive at a transformative insight, but we need to justify our new perspective through discourse' (p. 20). As the current findings indicate, such experiences support students to develop new (or improve) their competences and increasingly transform their identity as knowledgeable participants both individually and as a group. Transformative learning promotes 'empowerment as a process of being one's own mature and autonomous person' (Evans & Nation, 1993, p. 91). As identified by Kabes and Engstrom (2010), these aspects are critical in promoting meaningful learning particularly in teacher education. This is because teachers need to engage in reflective practices to support them to develop lifelong learning skills in the light of supporting their own students, especially in rapidly changing knowledge societies.

Conclusions and implications for practice

The findings of this case study illustrate creative utilisation of asynchronous discussions forums to structure the learning activities in ways that promote interactive collaborations and peer formative feedback. Notably, the use of open forums to share the meanings of learning goals and expected outcomes is also valuable in promoting peer formative feedback by stimulating students to monitor their peers' understandings and learning needs, and in turn provide feedback to each other. The findings also indicate that opportunities for ongoing documenting and sharing of artefacts can promote peer formative feedback in ways that foster meaningful interactivity and reflectivity. It is evident that ongoing and interactive peer–peer feedback processes can support students to develop reflective and self-regulated learning dispositions.

This case study provides empirical evidence and insights which indicate that enabling adequate opportunities for peer–peer feedback prompts students as a key learning resource in ways that promote learners' engagement with meaningful experiences. The illustrated experiences included interactive collaborations, reflective and self-regulated learning. Such experiences are critical for productive online

learning because they support development of robust knowledge, and enhance learners' ability to transfer their competences to real-life contexts. Based on the findings of this study, we conclude that conceptualisation of 'assessment for learning' in asynchronous learning environments calls for ongoing formative assessment and feedback that is structured in ways that actively engage the individual students with peers and the teacher.

The key implications for practice from this study are as follows:

The realisation of effective peer–peer feedback processes requires online educators to adapt learner- and assessment-centred approaches

The findings of this case study emphasise pedagogical designs that promote learner- and assessment-centredness in which teacher and students are prompted to share the responsibility of facilitating the learning and ongoing assessment. This implies that online educators need to capitalise on the potential of online affordances such as asynchronous discussion forums to facilitate collaborative learning and peer formative feedback processes. Creative use of other emerging ICT tools including the iPad, iPhone and social networking sites can also offer dynamic means to create effective learning environments in which learners are stimulated to actively engage and take primary responsibility for their own learning.

In facilitating peer–peer learning support, online educators should encourage active learning and recognise students as knowledgeable participants

In order to facilitate effective peer formative feedback that supports meaningful learning, it is important for online educators to provide learners with opportunities to apply their existing knowledge and experiences, and become a learning resource for themselves and their peers. It also requires educators to recognise the value of fostering shared purpose and ownership in ongoing monitoring and formative feedback processes in ways that promote shared authenticity within peer feedback processes. This conforms to previous research which identified that 'authenticity lies in the learner-perceived relations between practices they are carrying out and the use value of these practices' (Barab, Squire, & Dueber, 2000, p. 38). Shared authenticity is therefore an emergent experience that occurs as students engage in practices of value to themselves and to their learning community. This implies that it is vital for online educators to go beyond facilitating peer–peer feedback processes and underpin the design of online courses on shared meanings necessary for promoting shared authenticity.

It is also desirable to sustain immediacy of feedback in online settings as well as balancing this immediacy with a reasonable amount of time for the students to respond

The current findings exemplified this distinction. This balance is necessary for promoting deep inquiry, as learners need sufficient time to compose their thoughts and assess their understanding of content/issues before they respond or question other online participants. Moreover, in online learning, it is necessary to take into account that learners have diverse learning styles and prior experiences that may necessitate tailored support and mentoring.

Implications for future research

Acknowledging that this study was conducted within a specific university setting, there is a need to conduct further research in other settings characterised by more student diversity in terms of numbers and varying learning styles in order to confirm the positive findings from this study. This would contribute further understanding in relation to the best practices for effective peer formative feedback. Although this study mainly exemplified creative use of features embedded within the learning managements system, it would be timely to have further understandings on other effective strategies and tools for that can support effective peer feedback. Further studies can explore how other tools can be integrated, for instance, iPad, iPhone and social networking sites like Facebook and Twitter to enhance processes of peer–peer formative feedback within different disciplines and particular subject areas. Moreover, it is important to conduct further research to examine the optimal configurations for these tools in order for them to effectively facilitate meaningful peer interactions and feedback processes.

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