Peer moderation of asynchronous online discussions: An exploratory study of peer e-moderating behaviour

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This study explored patterns of e-moderating behaviour students performed when they were assigned as peer moderators of asynchronous online discussions in a reciprocal manner. Eighty-four students from an undergraduate blended course were observed during a 7-week-long online discussions. Using quantitative content analysis peer moderators' interventions were analysed based on Smet, Keer, Wever, and Valcke's (2010) scheme. The descriptive results show information exchange and knowledge construction supports were of continuous importance. Finally, a cluster analysis identified three distinct patterns of e-moderating behaviour: low-level moderators, mid-level moderators, and high-level moderators. The clusters differed in types of e-moderating support as well as their patterns of participation. High-level moderators dominated knowledge construction support and showed high level of online participation. Mid-level moderators dominated information exchange support and exhibited a moderate level of participation. Socialisation support and low level of participation were characteristics of low-level moderators. We further examined how these approaches were related to peer moderators' perceptions of online discussions and academic performance. The results indicate that high-level moderators scored highest on all aspects of perceptions of online discussions and outperformed peer moderators in the other clusters with regard to academic performance.

Introduction

Many universities and colleges around the world have desired to enhance student enrollment by broadening learning opportunities utilising online and blended courses (Hew, Liu, Martinez, Bonk, & Lee, 2004). The main discussion of contemporary education is on the social nature of learning and most importantly interactions among learners (Palincsar & Herrenkohl, 2002). A discussion forum is an asynchronous tool utilised either as a main means of communication and interactions in distance education (e.g., Lee & Tsai, 2011), or used as a complementary method in face-to-face (F2F) teaching (e.g., Zhan, Xu, & Ye, 2011). With few drawbacks, it offers many advantages, including promoting self-regulated learning, facilitating collaborative knowledge construction and supporting critical thinking skills (Wang & Woo, 2007; Yeh, 2010). Advantages such as these will be achieved if students are willing to participate and expend remarkable mental effort in collaborative learning activities. However, low participation rates in online discussions are a widespread problem (Hew & Cheung, 2008; Xie, Yu, & Bradshaw, 2014). One important means of fostering students' participation is through online facilitation, which can be done by an instructor (instructor moderation) or by students (peer moderation) (An, Shin, & Lim, 2009). Peer moderation is a kind of collaborative learning in which "people from similar social groupings who are not professional teachers help each other to learn, and learn themselves by teaching" (Topping, 1996, p. 322). In recent years, studies on peer moderation have received increased attention (e.g., Hew & Cheung, 2011; Xie et al., 2014). There is ample evidence in different contexts that peer moderation is as effective as instructor moderation (e.g., Hew, 2015; Hew & Cheung, 2008; Weidner & Popp, 2007).

Vygotsky (1978) emphasised that knowledge is interpersonal before it becomes intrapersonal, and in order to foster the construction of the former, social interaction is crucial. Consequently, peer collaboration can be regarded as an important benefit of collaborative learning in general and of peer moderation in particular. Furthermore, the zone of proximal development (ZPD), which is an underlying concept of a social learning perspective (Vygotsky, 1978), focuses on "the distance between the actual developmental level as determined

by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Jaramillo, 1996, p. 139). It pertains to peer moderation since this type of collaborative learning is characterised by the adoption of specific roles, where one partner clearly takes a direct pedagogical role by creating learning opportunities in the group through questioning, clarifying, and active scaffolding (McLuckie & Topping, 2004; Roscoe & Chi, 2008). Using peer moderation as a strategy helps students regulate their own discussion behaviour – and indirectly that of their group members – based on the collaborative processes they are engaged in (King, 2007; Strijbos, Martens, Jochems, & Broers, 2004). Peer moderators' regulation fits in with the view of scaffolding proposed by Pata, Sarapuu, and Lehtinen (2005), reflecting on the provision of assistance to students on an as-needed basis with the fading out of assistance as competence or mastery increases. Hence, it was no surprise, many have suggested the use of peer moderation as an alternative to teacher moderation (Ng, Cheung, & Hew, 2009; Seo, 2007; Xie et al., 2014).

Furthermore, a broad body of peer moderation research has suggested the assigning of students in the role of peer moderator has an influence on their motivation (e.g., Xie & Ke, 2011), cognitive achievement (e.g., Zha & Ottendorfer, 2011), and participation (Xie et al., 2014) in asynchronous online discussions (AODs). However, these studies are predominantly effect studies and narrow in their ability to explain how peer moderation works and what e-moderating or tutoring behaviour can be expected in peer-moderated AODs. Specific process-oriented research on peer moderators' behaviour in online settings remains rather limited (Roscoe & Chi, 2007). An exception is the empirical work by De Smet, Van Keer, and Valcke (2008), who described three different tutor styles within the context of an online cross-age peer tutoring. Utilising Salmon's (2000) e-moderating framework, the tutor styles were motivators, informers, and knowledge constructors. Moreover, they performed clustering on six classification measures, including tutors' five moderating behaviours in the AODs and the total number of messages posted during the discussions. Since selection of classification measures is critical for the clustering analysis (Gore, 2000), more research is needed to expand upon prior study. The current study aims to explore whether it is possible to discern a similar pattern or typology in AODs using reciprocal peer moderation and having more classification measures. In addition, examining students' perceptions of online discussions is relevant and important because it can affect students' desire to participate in AODs. Over the years, more educational studies have linked students' perceptions of online discussions to participation in AODs (Lee, 2013). Furthermore, there are several studies that support the view that a positive correlation exists among the students' participation (total number of messages posted and total system access) and students' learning achievement measured by end-of-semester grade (Morris, Finnegan, & Sz-Shyan, 2005; Palmer, Holt, & Bray, 2008; Shaw, 2013; Strang, 2011). Generally, active learners in online courses outperform less active learners in their final course grades (Wilson, Pollock, & Hamann, 2007). The current study builds on these trends by not only classifying different patterns of e-moderating behaviour in AODs, but also by adding students' perceptions of online discussions and academic performance measured by the final course grade to determine the differences between groups (clusters).

Classifying students' e-moderating behaviour would help us understand attributes and limitations of peer moderation as a strategy in online courses. Furthermore, comparisons of e-moderating behaviour and profiles of learners between different groups will explain which e-moderation behaviour and characteristics are desirable in AODs. This knowledge can be used as an important reference for optimising prospective peer moderators' training. To fully explore and understand students' e-moderation behaviour and the patterns of their interventions, we observed students acting in the peer moderator role in a reciprocal manner over a period of 7 weeks.

Theoretical framework

In a peer moderation or tutoring program, learners perform particular roles as *tutors* (moderators) and *tutees* (De Backer, Van Keer, & Valcke, 2012). Roscoe and Chi (2007) classified peer tutoring based on knowledge gaps among students and age in two types: cross-age tutoring and same-age tutoring. In cross-age tutoring, more advanced or knowledgeable learners tutor the novices or younger students. In same-age tutoring,

students are of a similar age, grade or class (De Backer et al., 2012). Same-age tutoring is often reciprocal, where learners take turns tutoring each other (Roscoe & Chi, 2007; Topping, 2005). Following Roscoe and Chi's (2007) classification, the peer tutoring in our study consisted of same-age peer tutoring or moderation. Since all learners were from the same class group with comparable expertise and development levels and had no prior knowledge concerning the course topics (meaning there are no "more capable peers" among them), the *reciprocal peer moderation* was adopted. In this respect, reciprocal peer moderation had specific advantages, which evolved from moderating (tutor) and being taught (tutee). As mentioned above, peer moderators could take ownership not only of their own learning in discussion but also that of their peers (Falchikov, 2001). However, research has suggested that students acting as peer moderators benefit most from the process and obtain greater content-specific gains than tutees (Cheng & Ku, 2009). When acting as peer moderators, students were assigned the responsibility of facilitating successful online discussions. Consequently, they tried to learn the materials in order to be more knowledgeable in the subject matter. It is noted that, within the scope of this study, the students' enactment of the moderator's role was the special focus.

E-moderation

During the last decade, various publications have offered pedagogical frameworks for e-moderators (e.g., Bonk, Wisher, & Lee, 2008; Palloff & Pratt, 2003; Salmon, 2000). These pedagogical frameworks generally aim to conceptualise the role of moderators (teachers or students) in the context of computer-supported collaborative learning. In this respect, Salmon (2000) proposes a five-step model (*access and motivation, socialisation, information exchange, knowledge construction, and development*) containing the consecutive tasks of e-moderators in a hierarchical format. This model has been widely used as a guideline for peer moderators of online discussions (Seo, 2007) and for training student tutors in discussion groups (De Smet et al., 2008).

According to Salmon (2000), in the first stage of moderation (access and motivation), the concern of e-moderators is on the readiness of the participants to learn in a digital environment. In this respect, they focus on greeting and welcoming learners and providing computer-related support on how to get online.

There is strong evidence that a pleasant and constructive atmosphere is fundamental for learning in online environments (Hew & Hara, 2007). Zaccaro and Bader (2003) emphasised that rapport building during the early stages of collaborative work would lead to the formation of groups with a shared sense of purpose and values. Therefore, the priorities for the second stage (socialisation) are displaying empathy and getting to know one other. E-moderators in this stage help to establish a feeling of community by guaranteeing students that everyone is respected.

The most prominent objective at the third stage (information exchange) is learning. The role of e-moderators is providing learners with direction and posting a great number of messages. As mentioned by Seo (2007), e-moderators' messages should help students focus on the problems or tasks, by providing task-related information and clarifying topics.

At the fourth stage (knowledge construction), task-related engagement and social negotiation are the central objectives. The overall concern of this stage is building common understanding and sharing ideas. In AODs, knowledge is constructed by participants through exploring issues, taking positions, discussing their positions, reflecting and re-evaluating their positions (De Smet et al., 2008). To facilitate online discussions, the e-moderators may ask questions, keep the debate on track, reformulate input, and summarise what has been mentioned thus far.

Central to the final stage (development) is taking responsibility for one's own learning through reflection. In this regard, participants are encouraged by e-moderators to amend their own thinking and explore their critical thinking abilities. The more students reconsider and rethink their contributions, the more stage five can be achieved. What is important is that all of these supports should be initiated, guided and encouraged through peer interventions. Moreover, Salmon's (2000) taxonomical model is dynamic and context-based, where the

e-moderator's facilitation depends on the task characteristics, the moderators' characteristics and skills (e.g., technical and online communication skills and comprehension of online processes), and students' needs and acts (De Smet et al., 2008). For these reasons, observing learners' moderating behaviour in AODs of different contexts is beneficial in determining which tutoring behaviour occurs or does not occur, and recognise which ones are desirable for peer moderators in the same context.

Examining patterns of student e-moderation in AODs

As evident above, e-moderation is a multidimensional concept that has two main attributes: context-dependent and dynamic. Moreover, e-moderation is dependent on individual traits, particularly those of moderators (Lycke, Stromso, & Grottum, 2003). In this respect, examination of students' e-moderating behaviour in different contexts can identify patterns that may indicate qualitatively and quantitatively different approaches to e-moderation than those mentioned in different studies (De Smet et al., 2008). Cluster analysis is one statistical technique for detecting such patterns, a useful approach that has been used in building and understanding peer tutors' tutoring style in AODs (De Smet et al., 2008). In cluster analysis, learners are progressively grouped together on their similarities across a set of variables, so that individuals within a cluster are relatively homogeneous based on multivariate similarities than those of other clusters (Aldenderfer & Blashfield, 1984; Gore, 2000). For example, De Smet et al. (2008) identified three types of tutoring patterns that represent qualitatively and quantitatively different approaches to e-moderating supports: *motivators* (high amount of access and motivation support and low presence manifested through the number of messages posted during online discussions), *informers* (more presence and information exchange support, but similar amount of other e-moderating activities), *knowledge constructors* (most presence and high amount of knowledge construction support, approximately similar amount of other e-moderating supports). Focusing specifically on network-based role play, Pata et al. (2005) found two distinct groups of scaffolding styles: *active tutoring style* – those who performed frequent scaffolding activities that led the decision-making process by keeping the initiatives; and *passive tutoring style* – those who performed less-frequent process and content scaffolding acts.

Conceptually, online tutoring styles can be articulated in studies in the field of *student learning styles* (e.g., Fahy & Ally, 2005) and *approaches to teaching* (Kember, 1997), where apparent styles have been recognised. Approaches in the teaching literature have contrasted the *facilitator*, *delegator*, *personal model*, *expert*, and *formal authority* as teacher teaching styles in the classrooms (Grasha, 2002). While these prior works shed light on the dynamics of peer moderation and teaching styles in varying educational contexts, further investigations are needed to understand peer interventions in AODs moderated by same-age students in a reciprocal manner and to explain and accommodate their differences in the organisation of teaching practices (De Smet et al., 2008). Specifically, the current study adds to the understanding of student moderators' approaches to e-moderating by identifying collections of behaviours that constitute distinct tutoring patterns. Two research questions guided this study:

(1) What patterns of e-moderating behaviour do students engage in as they moderate AODs in a reciprocal manner?
(2) Through comparing different clusters, what are the differences between students' perceptions of online discussions and academic performance in the course?

Methodology

Course context

The current study was conducted with 84 sixth-year educational science students taking the undergraduate-level blended course at Universiti Putra Malaysia, Malaysia. It was an 11-week course offered during the 2013–2014 first semester utilising PutraLMS (the learning management system). It required students to participate in three F2F working sessions and online group discussions as the primary instructional strategy.

Participants

Among the 84 undergraduate students, 65 (77.38%) of the participants were female while 19 (22.62%) were male. The age of the participants ranged from 29 to 51 years old. The ethnic composition of the participants was predominantly Malays (90.48%, $N = 76$), three Chinese (3.57%), three Indians (3.57%) and two of other ethnic backgrounds (2.38%). Students were reported to have high (52.38%) and moderate (45.24%) confidence levels in the usage of technology to complete the coursework. All participants had experienced studying in online courses using PutraLMS, with 65.48% of the participants having taken between 1 and 5 courses; 21.81% between 6 and 10 courses, and the rest (12.71%) more than 10 courses.

Procedures

During the first session of the course which was held on-campus, students were required to fill in the consent form in order to participate in this study. Using the random function in Excel ® 2007, 84 students who agreed to participate were divided into 12 groups of seven students, which remained constant during the course. This group was deemed to be of adequate size, as suggested by Collison, Elbaum, Haavind, and Tinker's (2000) study. Students participated in the 7-week online discussions, which accounted for 20% of their final course grades. Discussion topics were similar in terms of the level of complexity. Each week, the online discussion forum for each group was fully moderated by randomly assigned peer moderators with no instructor support. Generally, during the online discussions students served in the role of both peer moderators and tutees in a reciprocal manner. This study used reciprocal peer moderation strategy for two important issues: Peer moderation could not be conducted for all students at the same time but assigned to them at different times, and university regulations stressed on equal instructional quality for all students. So, these conflicts were resolved by adopting a reciprocal peer moderation strategy to ensure that, at the end of the study, all students were presented with the same type of instructional approaches. All activities in the online discussions in the course were recorded in PutraLMS system, where the instructor created empty forums at the beginning of the semester. Generally, the initiation and development of discussion threads depended on the peer moderators.

The peer moderator's role was scripted and modelled by providing two guidelines instructing students on how to perform their duties. The first guideline was based on the 6-step peer tutor training approach by De Wever, Van Keer, Schellens, and Valcke's (2010); the other was based on the 5-step e-moderation model by Salmon (2000) and a set of sample sentences based on a large body of literature (De Smet et al., 2008; Hew & Cheung, 2008; Smet et al., 2010). There were two types of evaluations to assess the content and face validity of the two functional guidelines: subject matter experts and pilot test. One week before the onset of weekly online discussions, students who were randomly assigned as peer moderators received an email with details of a discussion topic and two validated functional guidelines, the same for all assigned peer moderators for the same week. Peer moderators were not allowed to create new threads, and were advised to post the topic approximately one day after they received the email. Students were asked to complete their perceptions of the asynchronous online discussions (PAOD) questionnaire three times (at the beginning, the middle, and the conclusion of the course). Mean scores for each aspect were utilised to evaluate overall learner perceptions of the online discussions.

Measurements

Coding scheme on types of e-moderation behaviour

To determine types of e-moderation behaviour, students' discussion transcripts when assigned as peer moderators ($N = 84$) were copied on to a separate Word document to be analysed through quantitative content analysis technique. This was done throughout the 7-week online discussions. Quantitative content analysis method focuses on coding a large amount of data in which statistical tests are then performed (De Wever et al., 2010). The Smet et al. (2010) instrument which originated from the 5-step model by Salmon (2000) was used to measure peer moderators' e-moderation behaviour. The *unit of meaning* in a message was used as the unit of analysis because moderating is a multidimensional activity, and contributions of peer moderators can reflect varied categories within a single message.

To apply inter-rater reliability of the content analysis, in addition to the researcher, two coders analysed the entire posts of peer moderators, independently. Following Strijbos, Martens, Prins, and Jochems's (2006) suggestions, a procedural distinction was made between segmentation and coding process. First, coders received training on the segmentation procedure followed by training on the application of the 17 subcategories in the instrument. The 5 hours' training resulted in a high (*kappa* = 0.85) level of inter-rater reliability (Neuendorf, 2002). It is worth noting that when allocating a code to the various units of analysis, the complete discussions between peer moderators and tutees were taken into account. By doing so, the complete ongoing interactions provided the context in which peer moderators' behaviours were studied. Table 1 describes the coding categories with examples of raw data for each category.

Table 1
E-moderation coding scheme

Category	**Indicator of peer moderator's behaviour**	**Examples**
Access and motivation	Clarifying the peer moderator role	- I am Madihah, the leader for this first week. Be present by tonight so we can present the project.
	Being accessible to computer-related problems	- Please upload your PDP using the attachment icon.
	Encouraging participation	- I believe that you all have good views to share in the issue. So make it open to all.
Socialisation	Informal conversation	- I miss it again this time. I have to take my child to the clinic. The three of them had a fever in one time.
	Express of appreciate	- Thank you and congratulations on your advice and good reviews. A rapid response to the views and friends suggestion. CONGRATULATIONS.
	Showing commitment	- Forgive me my friends if I add too much on your comments.
Information exchange	Modelling the contents by expressing personal belief or value	- The next objective of the ICT awareness campaign conducted in school is to build a strong network between the school and parents.
	Bringing in other content information	- Here, apart from raising funds, we can find information on the importance of increased effectiveness of ICT use in PdP.
	Organisational management and planning	- I discussed Prof. and he said to work hard as we only have two weeks left to finish discussion. It is better to discuss the Analysis stage of the ADDIE model.
	Breaking up the learning task	- Since there are no more time on this topic, as a strategy, before anything discuss "Building a Computer Lab" or "Developing or Upgrading the Computer Lab".
	Explaining the learning task	- What my friend Aida said means that for guiding and educating teachers in the use of ICT in teaching and learning we need expertise.
Knowledge construction	Asking for content explanation and clarification	- So, I would like to ask something: is setting up a second computer lab in school considered an upgrade or a new proposed project?
	Asking to summarise	- After went through all of the views and opinions made by you guys here, here I list down all program objectives that we have chosen: 1. To … 2. To…
	Giving feedback about learning and	- Allow me to comment on the views of my

	social processes to both the individuals and the group	friend, Datin Salmah. Indeed, a network needs to exist between teachers and parents.
Development	Call for further reflection	- If parents see that the use of ICT in PDP is negatively influencing their children, will they support what we are doing?
	Elaboration	- Having above-mentioned thoughts in mind, please discuss the importance of ICT in not schools but also in organisations.
	Playing devil's advocate. For example, positing what-if questions.	- If we were children, do still we expect the same sorts of vehicles?

Survey on students' perceptions of online discussions

The PAOD questionnaire developed and validated by Lee (2013) was used to measure students' perceptions of online discussions. The questionnaire was translated back-to-back into Malay language to avoid students not accurately answering the instrument because of language difficulties. Moreover, the items were modified to suit the learning needs of the educational technology subject. Survey items were categorised into five domains:

- Cognitive (five items, Cronbach's $\alpha = 0.98$)
- Affective (five items, Cronbach's $\alpha = 0.96$)
- Skill I [reading and writing skills (two items, Cronbach's $\alpha = 0.91$)]
- Skill II [(critical thinking and analytical skills (two items, Cronbach's $\alpha = 0.96$)]
- Efficacy (three items, Cronbach's $\alpha = 0.83$).

All the items were answered on a 5-point Likert scale ranging from 1 = *strongly disagree* to 5 = *strongly agree* (with 3 as *neutral*). Examples of the items are "Online discussions help clarify some instructional technology concepts" (cognitive); "I enjoy participating in online discussions" (affective); "Online discussions improve my ability of social science writing" (skill I); "Online discussions improve my analytical skills" (skill II); and "I am satisfied with my own performance in online discussions for this course" (efficacy).

Participation

In the context of this study, participation is conceptualised in terms of two types of behaviour: *quantity participation* and *participation patterns*. Quantity participation refers to the visible records in an AOD system (the number of messages posted and message length; writing or posting behaviour) and invisible records (the number of messages read, number of logins, and length of readings; reading or non-posting behaviour). Participation patterns refer to the structure and composition of the relationships in online discussions. Social network analysis (SNA) is the analytical method for detecting participation patterns in online discussions (e.g., Hakkarainen & Palonen, 2003; Lipponen, Rahikainen, Lallimo, & Hakkarainen, 2003). SNA examines "the interpersonal transactions that constitute the social structure of a group" (Friedkin & Slater, 1994, p. 139). This study extended the prior works and used quantity posting and non-posting behaviour along with participation patterns as the measurement of individual participation. To measure participation patterns, the *centrality* of each student was measured. Centrality is the extent to which a person is in the centre of a network. The most common measure of centrality is the degree centrality, which is a simple tally of the number of ties outgoing from a person (outdegree) or incoming to a person (indegree) (Friedkin & Slater, 1994).

To easily measure the quantity of students' participation, a PHP script was developed by the researcher, and two groups of quantitative data were extracted and exported from the online discussion system. As SNA and measurement of participation patterns, structured query language (SQL) queries were performed to extract peer-to-peer interaction data with timestamps from the online discussion database. The resulting records were kept in Microsoft Excel® 2007 and then an actor-by-actor matrix known as the *sociomatrice* (Hanneman & Riddle, 2005) for each week was developed using the pivot table feature of Microsoft Excel®. Sociomatrices

were then imported to UCINET® 6.258 (Borgatti, 2002), which is an SNA package for performing data analysis. Using UCINET, indegrees and outdegrees were computed. In this study, indegree was conceptualised as the degree to which an individual received messages or replies (attractiveness), and outdegree was conceptualised as the degree to which an individual sent messages to different members of the group (diversity). In total, four indicators of online participation were used: number of post (quantity posting), number of non-posting login (quantity non-posting), and indegree and outdegree (participation patterns).

Academic performance

In this study, academic performance was measured in terms of the final course grade. This was determined at the end of the semester by the course instructor and through the accumulation of a midterm and final examination grades and discussion participation.

Research design and data analysis

An ex post facto (after-the-fact) research design was utilised in this study to indentify students' e-moderating behaviour that happened inherently with no experimental treatment. Quantitative data were collected through the coding of students' posts on discussion boards based on the coding scheme developed by Smet et al. (2010). Descriptive analysis showed the number of e-moderation supports enacted by peer moderators on the discussion boards. Since there was no consensus among researchers in regards to the number of relevant clusters, Ward's (1963) hierarchical clustering technique and the squared Euclidean distance were utilised to define the distance between clusters for possible solutions. Moreover, due to comparability of the scale measurement of all variables (classification measures) the data were not standardised prior to using the squared distance measure. Determination of the leveling-off point, where additional groups would not have meaningful differences between them for clustering solutions, was done by the examination of scree plot. More specifically, this study examined the clustering of the 84 students when the peer moderator role was enacted across 9 variables, including the frequencies of peer moderators' contributions in the five stages of e-moderating (access and motivation, socialisation, information exchange, knowledge construction, and development) and participation (number of post, number of non-post login, indegree, and outdegree). The differences between the clusters regarding students' perceptions of online discussions and final course grades were then compared by using the ANOVA tests and post-hoc analyses (Tukey's HSD criterion). All the analyses were performed using SPSS v. 22.

Results

Descriptive results

For the 7 consecutive topics, each lasting 1 week, peer moderators posted 623 messages (M = 10.08, SD = 2.82). Within the 623 messages, the coders recognised 2727 units of meanings (M = 6.49, SD = 6.20). Of the 2727 units of meanings, 362 units (M = 4.31, SD = 2.98), 436 units (M = 5.19, SD = 3.65), 902 units (M = 10.74, SD = 7.46), 830 units (M = 9.88, SD = 7.62), and 197 units (M = 2.34, SD = 2.09), were coded as access and motivation, socialisation, information exchange, knowledge construction, and development supports, respectively. Figure 1 displays a schematic overview of the occurrences of the five steps of e-moderation behaviour by peer moderators. In general, the high proportions of peer moderators' behaviour focused on information exchanges and knowledge constructions. Of the units of meaning within peer moderators' postings, 30.44% were focused on asking different types of questions and in trying to facilitate tutees' knowledge construction. At the same time, 33.08% of units of meaning were focused on planning, separating, and explaining the learning content, bringing in additional sources, and modelling the discussion. Peer moderators showed clear social commitment in 15.99% of units of meaning in their postings. About 13.27% and 7.22% of units of meanings in peer moderators' postings were coded as access and motivation, and development, respectively.

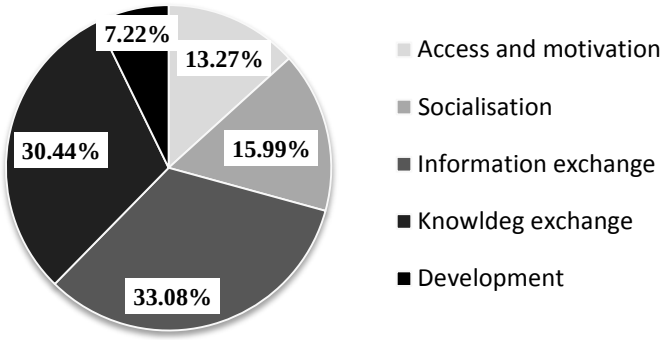

Figure 1. Percentages of the occurrence of the different levels in e-moderation within peer moderators' posts

Patterns of e-moderating behaviour

On examination of the scree plot (Figure 2), the flattening between three and four clusters indicates that the three-cluster solution best captured meaningful similarities and differences among peer moderators. Moreover, when moving from three clusters to two clusters, the agglomeration schedule indicates a large increase in the distance coefficients. Therefore, a three-cluster was chosen based on the three-cluster typology of De Smet et al. (2008), and consequently three e-moderating profiles were identified, consisting of 35.71%, 36.90%, and 27.39% of the peer moderators.

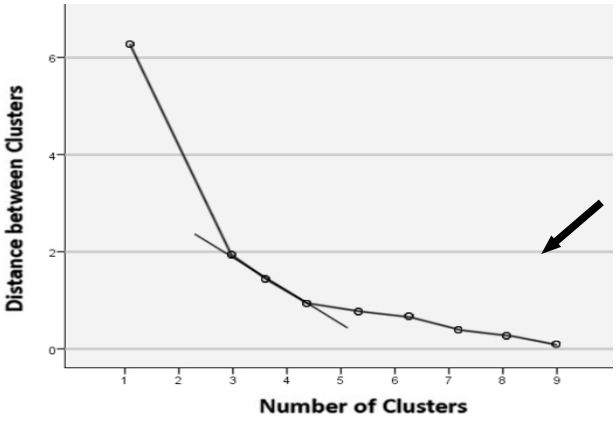

Figure 2. Scree plot for cluster analysis

Table 2 displays the mean scores and standard deviations of the nine classification variables for each cluster. The profiles, labelled as *low-level moderators* (LLM), *mid-level moderators* (MLM), and *high-level moderators* (HLM), are displayed in Figure 3. Results indicate that peer moderators' behaviour differed both qualitatively and quantitatively.

Table 2
Means and standard deviations of the classification variables per cluster

Classification variable	Cluster 1 = Low-level moderators (*N* = 30)	Cluster 2 = Mid-level moderators (*N* = 31)	Cluster 3 = High-level moderators (*N* = 23)
Access and motivation	5.97 (3.35)	3.81 (2.65)	2.83 (1.70)
Socialisation	8.33 (3.00)	3.52 (2.50)	3.35 (2.64)
Information exchange	5.40 (3.55)	15.52 (5.12)	11.26 (7.45)
Knowledge construction	5.57 (5.73)	6.64 (4.38)	19.87 (2.32)
Development	0.87 (0.94)	1.94 (1.48)	4.83 (1.64)
Number of posts	4.77 (2.27)	6.71 (3.22)	11.83 (5.21)
Number of non-post logins	5.10 (3.63)	6.00 (2.91)	9.13 (4.73)
Indegree	3.43 (2.47)	4.48 (3.50)	8.69 (4.74)
Outdegree	3.70 (2.34)	4.42 (2.60)	8.43 (5.25)

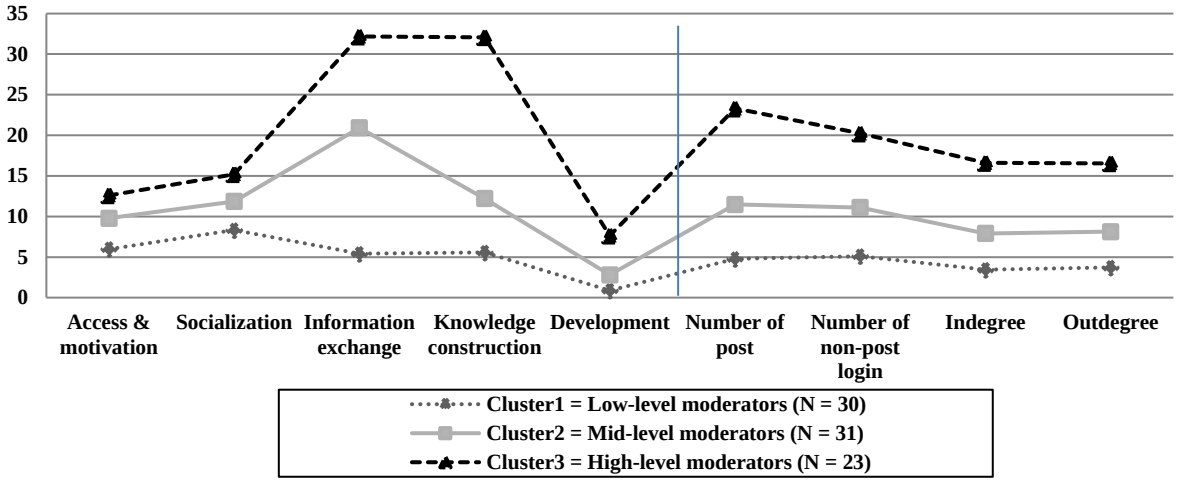

Figure 3. Means of the nine classification variables per cluster

As shown in Table 2, cluster 1 had the lowest level of participation, cluster 2 ranked higher, and cluster 3 provided the highest levels of participation. Cluster 3 had the lowest number of peer moderators, cluster 1 had more, and cluster 2 had the most. All three clusters showed unique patterns in terms of e-moderation behaviour. Cluster 1 consisted of 35.71% of the peer moderators whose contributions were mostly focused on lower-order e-moderating supports, with a high proportion of contributions invoking access and motivation and socialisation. They participated less frequently in online discussions than moderators of the other groups. Furthermore, their postings reflecting information exchanges and knowledge constructions occurred less frequently than the other two clusters. Thus, they were labelled as low-level moderators. This shows that in AODs, a percentage of peer moderators who were less motivated in participating, might be less active in performing higher-order e-moderating supports.

Cluster 2 and 3 consisted of mid- to high-participating peer moderators. Cluster 2 was characterised by a high proportion of information exchange e-moderating support and low proportions of access and motivation and socialisation contributions than cluster 1. This indicates that these peer moderators noticed the need to evolve from the earlier stages of e-moderation supports into the personal exchange stage. They illustrated the content with examples and their personal points of view, added alternative sources to the discussion, planned the discussion activities, and unravelled and explained the learning tasks. However, using distinction between explicit (modelling) and indirect e-moderation (coaching), it was found peer moderators in this cluster used supports centred on explicit e-moderation only. Thus, cluster 2 was considered MLM.

A distinctive characteristic of learners in cluster 3 was their contributions focusing on knowledge construction support. Further, they had higher frequency of information exchange support and lower levels of socialisation and access and motivation supports than cluster 1. Other notable differences were the highest level of development support and evolution from the model to coach aspect of e-moderation. These moderators had the highest centrality scores compared to the other clusters.

Multivariate analysis of variance (MANOVA) was conducted to assess if there were differences between the three clusters on a linear combination of e-moderating behaviour and participation indicators. The assumption of homogeneity of variance was checked and met. As shown in Table 3, significant differences were found between clusters (Wilks' $\lambda = 0.10$, $F_{(18, 146)} = 17.93$, $p < 0.001$, partial $\eta^2 = 0.69$).

Follow-up ANOVAs also indicate significant cluster effects: access and motivation ($F_{(2, 81)} = 9.52$; $p < 0.001$, partial $\eta^2 = 0.19$), socialisation ($F_{(2, 81)} = 31.05$; $p < 0.001$, partial $\eta^2 = 0.43$), information exchange ($F_{(2, 81)} = 26.75$; $p < 0.001$, partial $\eta^2 = 0.40$), knowledge construction ($F_{(2, 81)} = 78.14$; $p < 0.001$, partial $\eta^2 = 0.66$), development ($F_{(2, 81)} = 57.09$; $p < 0.001$, partial $\eta^2 = 0.58$), number of post ($F_{(2, 81)} = 25.80$; $p < 0.001$, partial $\eta^2 = 0.39$), number of non-post login ($F_{(2, 81)} = 8.09$; p = 0.001, partial η2 = 0.17), indegree ($F_{(2, 81)} = 15.20$; $p < 0.001$, partial $\eta^2 = 0.27$), and outdegree ($F_{(2, 81)} = 13.65$; $p < 0.001$, partial $\eta^2 = 0.25$). The partial η^2 indicates that the clusters explain respectively 19%, 43%, 40%, 66%, 58% of the occurrence of peer moderators' contributions with regard to access and motivation, socialisation, information exchange, knowledge construction, and development; and 39%, 17%, 27%, and 25% of peer moderators' participation throughout the discussion themes, including number of posts, number of non-posting login, indegree and outdegree, respectively. Table 3 summarises the results of post-hoc analyses.

Table 3
Significant differences of the post-hoc analyses between clusters across classification variables

Classification measure	**Multiple comparisons**			
	Clusters	Mean difference	Standard error	*p*
Access and motivation	1-2	2.16	0.70	0.007
	1-3	3.14	0.75	0.000
Socialisation	1-2	4.82	0.70	0.000
	1-3	4.98	0.75	0.000
Information exchange	1-2	-10.12	1.39	0.000
	1-3	-5.86	1.50	0.001
	2-3	4.25	1.49	0.015
Knowledge construction	1-3	-14.30	1.25	0.000
	2-3	-13.22	1.24	0.000
Development	1-2	-1.07	0.35	0.008
	1-3	-3.96	0.37	0.000
	2-3	-2.89	0.37	0.000
Number of post	1-3	-7.06	1.00	0.000
	2-3	-5.12	0.99	0.000
Number of non-post login	1-3	-4.03	1.03	0.001
	2-3	-3.13	1.03	0.009
Indegree	1-3	-5.26	0.99	0.000
	2-3	-4.21	0.99	0.000
Outdegree	1-3	-4.73	0.96	0.000
	2-3	-4.01	0.95	0.000

Students' perceptions of online discussions and academic performance

Students' perceptions of online discussions were elicited three times: at the beginning of the course, mid-point, and end of the course. Table 4 describes survey responses of each cluster. ANOVAs on all perceptual factors revealed significant differences between clusters:

- Cognition ($F_{(2, 81)}$= 50.38, $p < 0.001$, partial $\eta^2 = 0.55$)
- Affection ($F_{(2, 81)} = 19.02$, $p < 0.001$, partial $\eta^2 = 0.32$)
- Skill I ($F_{(2, 81)} = 26.35$, $p < 0.001$, partial $\eta^2 = 0.39$)
- Skill II ($F_{(2, 81)} = 53.43$, $p < 0.001$, partial $\eta^2 = 0.57$)
- Efficacy ($F_{(2, 81)} = 5.48$, $p = 0.006$, partial $\eta^2 = 0.12$).

Tukey post-hoc tests indicate that HLM gave higher scores on all perceptual factors than MLM and LLM. MLM also perceived online discussions more effective than LLM. There were no statistically significant differences between MLM and LLM on cognition ($p = 0.27$), skill I ($p = 0.63$), skill II ($p = 0.41$), and efficacy ($p = 0.99$) perceptions. The results reveal that HLM perceived online discussions as more helpful for learning (i.e., cognition), writing and reading skills' gains (skill I), critical and analytical skills gains (skill II), and were satisfied with their performance or that of others in online discussions (efficacy).

Further ANOVA analyses on students' final course grades revealed significant differences between clusters ($F_{(2, 81)} = 37.09$, $p < 0.001$, partial $\eta^2 = 0.48$). A Tukey post-hoc test indicates that HLM outperformed the other two clusters of peer moderators in terms of final course grade. Moreover, significant difference between MLM and LLM was found in the comparison.

Table 4
Differences between clusters regarding perceptions of online discussions and final course grade

	Clusters			***F***	**Post-hoc analysis**
	Low-level moderators	Mid-level moderators	High-level moderators		
	Mean (SD)	Mean (SD)	Mean (SD)		
Cognition	2.52 (1.01)	2.86 (0.92)	4.75 (0.38)	50.38**	3 > 2, 1
Affection	2.58 (0.85)	2.95 (1.18)	4.39 (0.66)	19.02**	2 > 1, 3 > 1
Skill I	2.83 (1.19)	4.14 (0.82)	4.70 (0.54)	26.35**	3 > 2, 1
Skill II	2.28 (1.07)	3.06 (1.03)	4.69 (0.70)	53.43**	3 > 2, 1
Efficacy	3.67 (0.82)	3.69 (0.97)	4.35 (0.60)	5.48**	3 > 2, 1
Grade	50. 33 (8.70)	57.48 (9.00)	69.65 (5.68)	37.09**	3 >2, 1; 2 > 1

**$p < 0.01$

Discussion

The present study aimed at exploring the different patterns of tutoring or e-moderating behaviour among undergraduate students who performed the peer moderators' role reciprocally in AODs in a blended course. Guidelines were given to peer moderators to model appropriate tutoring behaviours. From the descriptive results, it can be argued that peer moderators performed a blend of e-moderating activities. However, knowledge construction and information exchange were dominant e-moderating approaches, in opposition to the rather limited occurrences of moderation support focusing on personal development. Similar to the study by De Smet et al. (2008), three distinct clusters emerged from the analysis, indicating quantitatively different approaches to e-moderating (as classified by Salmon, 2000) and participation during online discussions. Furthermore, comparable clusters were found along perceptions of online discussions and final course grade.

As to the clarification of the first cluster or LLM profile, low frequencies of higher-order–oriented supports were identified, including information exchange, knowledge construction, and development. Peer moderators participated minimally in online discussions; they sent fewer messages, logged into the system less, and

attracted fewer incoming responses due to the lack of diversity in their postings. This group scored lowest in all aspects in the perceptions of online discussions and performed lowest in their course grades than peer moderators in the other two groups. The behaviour pattern for members of LLM cluster was similar to De Smet et al.'s (2008) motivators, who enacted a high proportion of contributions reflecting access and motivation and with the least presence score (manifested in terms of the number of posts), and Pata et al.'s (2005) passive scaffolding students, whose approaches to moderating online discussions were characterised by less frequent process and scaffolding content. Similarly, the findings of this study support those by Lee (2013) whose students' perceptual aspects – cognition, affection, skill II, and efficacy – correlated with students' participation rates and final course grades in online discussions. LLM who scored lowest in all perceptual factors did differ significantly from the other clusters in their participation rates and final course grades.

Peer moderators of cluster 2 (MLM) showed approximately similar profiles as LLM in terms of participation. They dominated in enacting information exchange support. They tried to take a modelling approach and provided learners with directions and their own opinions. As the comparisons of peer moderators' perceptions of online discussions shows, one reason they posted more messages focusing on their opinions was that they might have perceived online discussions were more helpful for skills development (both reading-writing skills and critical and analytical skills) than LLM. The attributes of MLM align with Baran and Correia's (2009) practice-oriented group, whose peer moderators were active and concentrated more on exchanging their points of view. Perhaps having an information exchange–oriented moderating style helped students improve their grades. In other words, higher achieving students were better moderators focusing more on information exchange–oriented moderation than simply motivation- and socialisation-oriented interventions.

The most desirable e-moderating pattern, the HLM, was demonstrated by 27.39% of the peer moderators who had high values on most variables. Notably, they enacted higher-order e-moderating support stimulating knowledge construction, participated intensively in online discussions, were prominent members of their group (outdegree), and attracted more incoming messages (indegree). HLM shared similar characteristics with De Smet et al.'s (2008) knowledge constructors' group, including a high percentage of posts and more frequent contributions focusing on knowledge construction. In a similar way, this pattern of the peer moderators was similar to Kopp, Matteucci, and Tomasetto's (2012) experienced e-tutors cluster. They mentioned that experienced e-tutors considered cognitive activities as important for effective online collaborations, were more familiar dealing with dysfunctional social situations, and participated more in their online courses. Moreover, this finding was closely similar to the study by Pata et al. (2005), who distinguished between active and passive scaffolding groups. Active scaffolding groups enacted higher cognitive content and higher-order skills more frequently than the passive scaffolding cluster. However, the dominant occurrence of knowledge construction in HLM in this study contradicts the findings by Maor (2008), who highlighted the predominance of direct interventions (information exchange) by experienced e-tutors.

The HLM group scored higher in all constructs of perceptions of online discussions and outperformed peer moderators in the other two groups. It could be said that students' perceptions of online discussions seemed to be important specifically on the aspects of how they could handle and support their AODs and how they could participate and perform. Using cluster analysis, Lee (2013) found that students who scored higher in all constructs of perceptions on online discussions outperformed students in the other two groups and sent more messages with references. These findings suggest a high perception of online discussions was associated with better-quality e-moderations, such as knowledge construction, development and information exchange, findings that echoed what Xie and Ke (2011) advocated. Moreover, De Smet et al. (2008) asserted that "each new discussion theme requires a mixture of all types of peer tutor support as distinguished in the e-moderating model of Salmon (2000)" (p. 219), confirming the fact that HLM with higher perceptions found the importance of each moderation behaviour in the process of group work and dealt better with the difficulty to exceed the lowest phases of the e-moderating model in their moderation weeks. The major impact of quality-moderation, participation, and perceptions was gaining better course grades.

Implications

The study's findings suggest several implications and recommendation for teaching practice. First, because the higher-order e-moderating supports can be seen as critical thinking skills, it seems that peer moderators who adopted high perceptions were likely to enact these higher-order skills in their e-moderation supports and tended to gain better grades. Teachers may provide purposeful training for students and develop appropriate views of online discussions to promote or encourage students to apply appropriate supports. Moreover, if the goal is to have active moderation from peers, it would be plausible to give extra points to extrinsically motivate them. For instance, instructors may provide a rubric to evaluate moderators' performance, such as whether they performed all e-moderation supports. If they did not, they would lose points for no active engagement. This is good, as peer moderators do not usually moderate discussions.

Limitations and directions for future research

There were some limitations of this study that might have influenced the results and need to be addressed in future studies. First, all participants included in this study were in a particular setting with an education major. Moreover, the particular course being examined was a blended one which contained both F2F and online components. Future researches could try to replicate the findings with participants from other fields of study, a larger population, fully online courses, or subject pools with greater demographic diversity. Second, this study utilised only quantitative approach in collecting data. Quantitative content analysis needs to be triangulated with qualitative data such as think-aloud protocols to validate it. With regard to online participation, we also used only a quantity approach. Future research should also include the quality of students' online participation (e.g., knowledge construction and cognitive achievement) when measuring participation. Thirdly, the moderators in the current study received guidelines using Salmon's (2000) e-moderation model and De Wever et al.'s (2010) peer tutor training procedures to facilitate their groups' discussions. Subsequent research should also determine the impact the different types of guidance may have on patterns in e-moderation supports. Fourth, cluster analysis is sensitive to the number of classification measures. Although no clear-cut rule of thumb exists in deciding the number of variables to include in a cluster analysis, Gore (2000) mentioned that there are advantages with studies that have been guided by theories in determining the most critical and meaningful variables. This study included e-moderating behaviour classified in Salmon's (2000) model that was validated in prior research. Most importantly, participation of peer moderators was included in the analysis. Future research may want to include peer moderators' profiles such as age, self-efficacy, goal orientations, habit of mind, and gender in clustering of peer moderators. Moreover, following Aldenderfer and Blashfield's (1984) suggestion, cross-validation of clustering solution is important for its generalisability. Stability of the cluster structure of this study would be ensured if similar clusters re-emerge in the analysis of other samples.

Conclusions

From the information obtained from the clustering, a desirable e-moderating pattern was identified: more frequent contributions stimulating knowledge construction support, higher participation rates in terms of posting, non-posting and interactivity and higher scores on all perceptual aspects of online discussions. Consequently, better grade performance was gained. Regretfully, a majority of peer moderators did not perform these behaviours. The low participation and high proportion of contributions regarding access and motivation and socialisation (LLM) and information exchange (MLM) might be related to the duration of the peer-moderated discussions. The activity time span is critical when considering effective peer-moderated AODs. Most studies used a 1-week discussion format (Baran & Correia, 2009; Hew & Cheung, 2008; Xie et al., 2014), and they suggested that the length of discussion activities in role-based online discussions needs to be extended to 2 weeks in order to give assigned members the chance to effectively internalise and exercise their role (Hancock, 2012). In addition, guidelines might have been too confined to motivate a subgroup of peer moderators to go beyond a certain type of e-moderating support. Further, in order for peer moderators to perform higher-order e-moderating supports, more participation is recommended. To gain better final course grades students need to develop appropriate perceptions of online discussions. The study results provide

evidence that students in the high- to low-level clusters pursued different profiles. With HLM being the highest-level perception, learners tended to participate more and became the central members of the group and gained the best grades. With LLM being the lowest-level perception, students tended to be reluctant to participate and aligned themselves with new members in online discussions, and hence gained lower grades.

To sum up, this study defines the perceptions of peer moderators on the basis of their competencies in fostering learning activities with specific support methods. Perceptions of peer moderators seemed to make a difference in their e-moderating behaviours, meaning that e-moderation interventions of peer moderators with more positive perceptions of online discussions should evolve from talk elucidating the lowest phases in Salmon's (2000) model to contributions, thus enhancing knowledge construction.

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