



Analysing peer feedback in asynchronous online discussions: A case study

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Abstract

Peer feedback is referred to as comments provided by one student to another with the intention to aid their peers' progress in learning. The responses or feedback provided by peers has been recognised as an integral part of the learning process in online learning environments. However, the research on using peer feedback to stimulate students' higher level of thinking, especially at the secondary school level, in asynchronous online discussions is rather limited. Hence, this is a gap that the researcher attempts to address in this study. A case study was conducted among Economics students from an all-girls high school located at the northern part of Malaysia. The findings show that the most common type of feedback provided by students in the four AODs was categorised at cognitive dimension, with the affective and the metacognitive dimensions following behind. Even though most of the students had positive perceptions toward peer feedback of their learning in AODs, the findings show that there was a lack of constructive feedback found in AOD forums. Therefore, based on the findings of this study, some recommendations for future research have been proposed.

Keywords Peer feedback · Asynchronous online discussions · Economics · High school

1 Introduction

Peer feedback is referred to as comments provided by one student to another (Liu and Carless 2006) with the intention to aid their peers' progress in learning (van der Boom et al. 2007; Zhang et al. 2014). The feedback given by peers can be in the form of opinions, corrections, suggestions, and ideas to each other (Richardson et al. 2007a). Peers are not to criticize one another in learning activities. Instead, they are required to listen to others' opinions to fill in missing details, ask questions to seek clarification on

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anything confusing, and show appreciation for their peers' experiences and perspectives (Ching and Hsu 2013; Demirbilek 2015).

There are a number of positive effects on adopting peer feedback as indicated in the prior research on online discussions. Firstly, receiving peer feedback allows students to validate ideas, identify issues, and gain mutual support in their learning journey (Ertmer et al. 2007; Richardson et al. 2007b). By critically considering a peer's feedback, students often return to their own ideas with new perspectives for revision, leading to an improvement to the original ideas (Liu and Carless 2006; Noroozi and Hatami 2019). In addition to the benefits of receiving peer feedback, the findings from prior research (Richardson et al. 2007a, b) show that students may also obtain benefits through the process of giving peer feedback. This is probably because the process of providing feedback to peers helps students articulate and reflects on their own learning and understanding of the subject matter (Ching and Hsu 2013).

By providing constructive feedback, students are also offered the opportunity to reflect more critically on the quality of their ideas as well as the ideas of their peers (Demirbilek 2015; López-Pellisa et al. 2020; Lundstrom and Baker 2009; McCarthy 2017). Secondly, peer feedback has positive effects on influencing students' participation and engagement in online discussions (Xie 2013). This is because peer feedback encourages students to revisit, reinforce and reflect on their previous learning materials as they recall what they had learned to provide feedback to their peers. Next, sharing opinions with peers is regarded as helpful in building friendships and increasing social presence in online discussions (Zhang et al. 2014). By engaging students in the feedback process, they believe that their peers will be there to respond to their postings. Therefore, they tend to wait for their peers to provide further feedback. As such, the use of peer feedback leads to greater levels of interaction within the student cohort and interaction with the content of the discussion postings.

Thirdly, the research findings of Xie, Yub, Bradshaw's (2014) study suggest that peer feedback is another important factor that affects students' motivation. This is because students are likely to consider online learning interesting and hence become more efficacious to perform the learning tasks when the quality of their work is recognised by peers. Thus, the recognition of a student's popularity by his or her peers is an important impetus to increase students' involvement in learning activities. Additionally, the study conducted by Xie (2013) further claims that the greater frequency, volume and immediacy of peer feedback can motivate students to perform and complete their learning tasks as quickly as they could because they also expect their peers to offer feedback on their work in a similar manner. This view is supported by Zhang et al.'s (2014) finding that peer feedback is generally taken as evidence of attention from the other students to their own feedback. The attention of their peers becomes sources of motivation. Therefore, the students tend to perform their tasks diligently in order to attract and maintain their peers' attention.

Apart from that, the findings from the study done by Ertmer et al. (2010) reveal that students' confidence and comfort with participating in online discussions tend to increase when they became more involved in the peer feedback process. This could be related to the fact that the peer feedback process prompts them to consider the relevance of their posts before submitting online. Peer feedback thereby increases their confidence if they could contribute relevant ideas to the discussions in order to gain higher ratings from their peers.

Additionally, peer feedback has great potential to affect student learning at a higher cognitive level (Demirbilek 2015; Gielen and Wever 2012) as providing comments involves evaluative and reflective activities in which students are required to critically evaluate the appropriateness of peers' application of knowledge, elaborate and justify their own thinking (Ching and Hsu 2013; Faridah et al. 2020). In their interviews with students on how the peer feedback process could impact their learning and CT processes, Lin et al. (2001) find that the peer feedback is conducive to developing students' higher levels of thinking as they are required to review, evaluate, question ideas, suggest modifications, and even reflect on how well one's own work is compared with others.

Lastly, it is believed that peer feedback leads to a reduction in an instructor's workload (McCarthy 2017; Richardson et al. 2007a, b). This is because not all instructors might have the capacity to devote the large amounts of time and energy needed to monitor discussions, especially in a large class, as facilitating and managing online discussions usually require instructors to review students' posts, keep the discussion on-track, etc. (Hew 2015; Seo 2007; Zydney et al. 2012). Therefore, one possible solution is to capitalize on peer feedback as an instructional strategy in online discussions (Ertmer et al. 2010).

While the responses or feedback provided by peers has been recognised as an integral part of the learning process in online learning environments, the research on how students from primary and secondary settings (K-12) provide feedback to peers in the asynchronous online discussions (AODs) is rather limited. This study therefore intends to examine whether the types of feedback that students provide to peers is possible to stimulate students' higher level of thinking in an economics classroom. In this study, the term of peer feedback is interpreted as a response or comment that is used by the receiver to improve their learning.

2 Literature review

Previous studies (Chen and Tsai 2009; Cheng and Hou 2015; Tsai and Liang 2009) have highlighted that the content of peer feedback could comprise three types of feedback: cognitive, metacognitive, and affective feedback. There are some studies that analyse the types of feedback that students provide and use to respond to peers in AOD learning environments.

For example, Cheng and Hou (2015) conducted a study that investigated the types of feedback that 65 freshmen and sophomores offered to peers when appraising each other's video-editing project. The quantitative content analyses of peer feedback found that positive affective feedback (e.g. supportive comments or praise) was the most frequent responses given by the students as compared to cognitive-oriented and metacognitive-oriented feedback. However, as the activity progressed, the participants' exhibition of cognitive and metacognitive thinking in their feedback, as well as negative affective feelings increased.

The same results appear in a study by Tsai and Liang (2009) which required 36 pre-service teachers (majoring in preschool education) to provide three-rounds of peer feedback to help each other develop a scientific teaching plan. Qualitative content analysis of peer feedback demonstrates that affective-oriented comments occurred most

frequently in feedback provided by the participants. By making cross-round comparisons by each category, the findings show that participants might engage in cognitive processing first when appraising their peers' work (first round). Then, the participants would extend metacognitive thoughts (second round); and, finally, they would express more affective responses toward peers' work at the final round of the activity.

Nevertheless, the findings reported by the previous studies (Cheng and Hou 2015; Tsai and Liang 2009) seem to contrast with the study conducted by Chen and Tsai (2009), whose study involved 52 Taiwanese in-service mathematics and science teachers enrolled in an educational research course. In this study, students were requested to offer three rounds of peer feedback to develop educational research proposals. The findings of the study reveal that metacognitive-oriented comments were of the highest frequency compared to cognitive-oriented and affective-oriented comments. These results imply that the peers were generally involved in highly metacognitive reflective thinking when providing feedback to their peers.

In sum, these findings seem to imply that the three cohorts (undergraduate students, pre-service and in-service teachers) offered different types of feedback to their peers during the process of appraising their peers' work. Furthermore, the students mostly provide affective feedback rather than the feedback in the cognitive or metacognitive feedback dimension.

3 Research questions

To conduct the present study, the research questions to be addressed are as below:

1. What types of feedback do students provide and use to respond to peers in the AODs?
2. What are students' perceptions of peer feedback about their learning after participating in the AODs?

4 Research design

A case study approach was adopted in the current study. The participants were 31 Grade 11 (aged 16 years old) students who were studying in an Economics classroom at an all-girls high school in the northern part of Malaysia. Participation in this study was based on informed consent. Since the students involved in this study were less than 18 years old, written letters seeking parental permission were distributed to them prior to the commencement of the study. Despite the use of computer not being new to the students, this was their first exposure to using an AOD forum in an Economics classroom.

5 Procedure

The study was conducted over a period of eight weeks, with three lessons held each week, and 40 min allocated for each lesson. The 31 participants were randomly

assigned to six groups with each group consisting of five to six participants. Four different discussion topics were posted on the AOD forum for participants to complete throughout the study. All groups were given the same topics of discussion. To ensure that students had enough time to think about or reflect on their own responses and the comments of others, they were given a fortnight to carry out each discussion. At the end of the research study, all participants were requested to complete the questionnaire after AOD activities.

The *Knowledge Forum* was used as the online asynchronous venue for the discussions. The AOD forums were designed to engage students in case study discussions. The forum discussions only focus on several particular issues within the selected topic of “Market Equilibrium”. The expected student learning outcomes include: (1) analyse real economic issues through the application of the concepts of market equilibrium; (2) evaluate the perspectives and arguments made by economic agents or group members; (3) synthesize information into a new way in order to generate new ideas, suggestions or solutions to real life local economic problems.

6 Measures

The content of peer feedback was measured through the coding scheme as proposed by Cheng and Hou (2015). A survey questionnaire was used to measure participants’ perceptions toward peer feedback on their learning in the AODs.

6.1 The coding framework for categorising the content of peer feedback

To explore the quality of feedback that participants provide and use to respond to peers in the AODs, a coding scheme, including *affective*, *cognitive*, and *metacognitive* dimensions, proposed by Cheng and Hou (2015), is used to analyse the content of peer feedback. The development of Cheng and Hou’s (2015) coding scheme was based on Tsai and Liang’s (2009) framework. The coding scheme is developed for analysing the behaviours of the students during an online peer assessment activity (assessment on each group’s video-editing project). Because the process of the online peer assessment activity conducted in Cheng and Hou’s (2015) study could be considered a form of peer discourse via online forums, the framework can therefore be accepted as a pedagogical basis for the coding scheme.

In Cheng and Hou’s (2015) study, they classified peer feedback into three dimensions as listed in Table 1. The framework consists of 11 statements in which three statements related to the affective perspective; five statements in regard to the cognitive perspective; and three statements pertaining to the metacognitive perspective. The affective dimension includes all statements containing support for one’s ideas or emotional responses to the feedback made by peers. The cognitive dimension refers to all statements containing personal opinion, questions about peers’ comments, evaluation of peers’ knowledge and skills, and provides guidance or concrete suggestions for the issue discussed. The metacognitive dimension involves all statements focusing on reflections on peers’ feedback and monitoring and regulation of self-feedback. Because the research context of

this study is different from Cheng and Hou's (2015) study, slight modifications are made based on the coding scheme to suit the context of the current study. For example, in the affective dimension, this study revised the statement "Simply expressing one's negative feelings about the work" in category of Opposing (A2) as "Simply expressing one's negative feelings about the contributions made by peers". Similarly, the statement in the category of Suggestion (C4) for cognitive dimension was also revised. The definition of feedback for each category in the affective, cognitive, and metacognitive dimensions are presented in Table 1.

6.2 Peer feedback perceptions questionnaire (PFPQ)

For investigating participants' perceptions toward peer feedback on their learning in AODs, a survey questionnaire which is developed by Strijbos et al. (2010) is adopted with minor modifications in the current study. The instrument is used to measure peer feedback perceptions in terms of fairness (FA), usefulness (US), acceptance (AC), willingness to improve (WI) and affect (AF). The questionnaire items were measured using a 10 cm bi-polar scale ranging from 0 (fully disagree) to 10 (fully agree). The questionnaire consists of 18 items in which four of the scales (FA, US, AC and WI) consist of three items. AF is measured with six items; three measuring positive affect and three measuring negative affect.

The instrument is further validated by Strijbos, Pat-El, and Narciss's (Strijbos et al. 2010) in their study among 1535 pre-university and secondary education

Table 1 The framework of categorising the content of peer feedback

Dimension	Category	Definition
Affective (A)	Supporting	A1 Statements containing clear support and praise (i.e. showing praise and supporting one's ideas)
	Opposing	A2 Simply expressing one's negative feelings about the contributions made by peers
	Others	A3 Irrelevant to affective feedback
Cognitive (C)	Personal opinion	C1 Offering general advice or personal perspectives without providing solid evidence or concrete directions
	Question	C2 Questioning direction or introducing concepts, content, or frameworks
	Analysis and evaluation	C3 Assessing, appraising, or verifying one's knowledge and skills
	Suggestion	C4 Providing concrete directions, concepts, or strategies for the improvement of others' contributions toward the issue discussed
	Others	C5 Irrelevant to cognitive feedback
Metacognitive (M)	Reflecting	M1 Challenging, reflecting on, or reacting to peers' feedback
	Redefining or revising	M2 Redefining or revising the feedback generated by oneself
	Others	M3 Irrelevant to metacognitive feedback

Adopted from Cheng and Hou (2015)

students from 130 schools. The participants were asked to rate their perception of the feedback as if they had received the feedback themselves. The validation of the instrument was conducted through confirmatory factor analyses using Structural Equation Modelling (SEM). The results of the study suggest that fairness (FA), usefulness (US) and acceptance (AC) appeared constituent parts of fourth factor labelled ‘Perceived Adequacy of Feedback’ (PAF), which in turn positively predicts willingness to improve (WI) and affect (AF). The analyses reveal that the feedback perceptions in terms PAF, WI and AF can be captured adequately and robustly with this multidimensional questionnaire.

The scale reliabilities were in the range of $0.7 \leq \alpha < 0.8$, showing acceptable internal consistency for assessing the participants’ attitudes. In this study, the substance of all items was not changed, but they were slightly modified to suit the context of the current study. A description of questionnaire items is shown in Table 2.

Table 2 Peer feedback perceptions questionnaire

Scale (Code)	Cronbach’s α	Item
Fairness (FA)	0.71	I would be satisfied with the received (given) peer feedback I would consider the received (given) peer feedback is fair I would consider the received (given) peer feedback is justified
Usefulness (US)	0.89	I would consider the received (given) peer feedback is useful to my learning in AOD learning environment I would consider the received (given) peer feedback is helpful to my learning in AOD learning environment The received (given) peer feedback would provide me a lot of support to my learning in AOD learning environment
Acceptance (AC)	0.55	I would accept the received peer feedback I would dispute the received peer feedback I would reject the received peer feedback
Perceived Adequacy of Feedback (PAF)	0.89	FA+AC+US items
Willingness (WI)	0.71	I would be willing to use the received peer feedback to improve my performance I would be willing to invest a lot of effort in my learning in AOD learning environment I would be willing to work on further and go back over material covered on other areas of the subject
Affect (AF)	0.67	I would feel ... if I received the peer feedback on my ideas in AODs
Positive	0.73	satisfied confident successful
Negative	0.73	offended angry frustrated

Adopted from Strijbos et al. Dunnebieer (2010)

7 Data collection and analysis

The online discussion transcripts form the primary source of qualitative data whereas quantitative data is represented by the questionnaire responses. The qualitative data was analysed using a content analysis method. A message was selected as a unit of analysis. The main idea of the message is referred to as the “message unit”. This is consensus with Merriam’s (2001) viewpoint, who claims that meaning should be the main focus in communication.

In order to estimate the consistency of the coding, two coders were involved in the analysis process. The two coders coded the data separately. The first coder was the teacher researcher who taught the participants involved in this research study, while the second coder was a graduate who held a Bachelor degree in English for Professionals. Any divergent opinions concerning the categorization were compared and discussed by both coders until a 100% mutual agreement was reached. Both coders categorised all of the feedback and sum up the frequencies (number) in each feedback category of each AOD for each group discussion. After the coding, the overall distribution of the coded feedback was indicated in tabular form.

On the other hand, participants’ perceptions were obtained through a survey questionnaire. The surveys were completed online and took approximately 10–15 min to complete. All participating students were asked to indicate their level of agreement with each statement on a 5-point Likert Scale ranging from 1 = “Strongly disagree” to 5 = “Strongly agree”. Descriptive statistics based on the five-point Likert Scale were calculated for the survey items in the Peer Feedback Perceptions Questionnaire (PFPQ).

8 Findings

8.1 The types of feedback that students provide and use to respond to peers in the four AODs

Table 3 presents the overall distribution of the coded peer feedback in the four AODs. In total, there were 364 pieces of peer feedback contributed by the students during the course of the research study. From the 364 messages, 187 pieces of peer feedback were found in the first AOD. It is clearly seen that the students tended to be more active and motivated to participate in the first discussion and had more momentum and excitement in their first exposure to using *Knowledge Forum* for the online discussion activities. However, this figure drops drastically to 102, 38 and 37 in the second, third and fourth discussions respectively. This considerably low level of participation could be attributed to the students being busy studying and preparing for their final examinations. Hence, they spent less time participating in the discussions online.

The content of the peer feedback was analysed and classified to the *affective*, *cognitive*, and *metacognitive* dimensions. Among these three dimensions of peer feedback, the most common type of feedback provided by students in the four AODs was categorised at *cognitive* level (82.6%), with the *affective* (12.3%) and the *metacognitive* (4.9%) dimensions following behind. Feedback in the *cognitive* dimension was more inclined to provide personal opinions (37.6%) and the cognitive feedback of questioning (35.2%) rather than evaluation of peer’s solutions (1.9%)

Table 3 Distribution of coded peer feedback in the four case study discussions

Dimension	Category		AOD 1	AOD 2	AOD 3	AOD 4	Total	Percentage (%)
Affective	Supporting	A1	31	7	2	2	42	11.5
	Opposing	A2	3	0	0	0	3	0.8
	Others	A3	0	0	0	0	0	0
Cognitive	Personal opinion	C1	83	35	11	8	137	37.6
	Question	C2	56	31	18	23	128	35.2
	Analysis and evaluation	C3	4	3	0	0	7	1.9
	Suggestion	C4	4	15	5	3	27	7.4
	Others	C5	0	0	1	1	2	0.5
Metacognitive	Reflecting	M1	6	11	1	0	18	4.9
	Redefining or revising	M2	0	0	0	0	0	0
	Others	M3	0	0	0	0	0	0
	Total		187	102	38	37	364	100

and specific suggestions for improving peers' contributions (7.4%). In the affective dimension, most of the students' feedback primarily focused on supporting peers' ideas (11.5%). In the metacognitive dimension, the feedback given by students focused mostly on challenging or reacting to peers' comments.

Focusing on the peer feedback in the *cognitive* dimension, the results in Table 4 show that C1 (Personal opinion) forms the bulk of the feedback that students used in response to their peers in the first and second discussions, comprising 44.4% and 34.3% of the total feedback respectively (see Fig. 1). However, the rate of peer feedback in this category showed a slight decrease from 28.9% to 21.6% and ranked the second highest in third and fourth discussions respectively.

Previous studies (Cohen and Spencer 1993; Ekahitanond 2013) state that the process of providing feedback requires students to express their opinions with logical, clear, and specific reasons or examples allowing for opportunities to engage in higher level thinking. However, the results show that only 32.2% of the students were able to develop reasoned feedback by providing evidence or an example to support their positions. In contrast, the majority of students' (67.8%) CT was at surface level as their feedback or comments primarily shared ideas without any further explanation.

On the contrary, the cognitive feedback of questioning (C2) was the second most frequent type of the feedback that students used to respond to their peers in the first and second case study discussions. The percentages of student feedback categorised in C2 also showed a steady increase from the beginning (29.9%) to the end of the discussion (62.2%). According to Fig. 1, it was the most frequent type of feedback provided by the students in third and fourth discussions.

The content analysis of the peer feedback showed that *questions about viewpoints or perspectives* were the type of feedback frequently (57.7%) observed in the four AODs. Unfortunately, the use of this questioning technique was merely focused on eliciting different ideas or viewpoints from the group members. Therefore, the high frequency of such questioning technique in students' feedback messages does not mean the

Table 4 Content analysis of peer feedback in the category of C1 (personal opinion)

Theme	Evidence	Researcher's inference	Source
Personal opinion ($n=137$)			
• lower-level thinking	<p><i>Additionally, consumer purchasing power is also low. (S16, AOD 1)</i></p> <p><i>I feel that the price of stationery increases is due to the expectation of the price of stationery to drop in the future. (S18, AOD 1)</i></p> <p><i>This is because if the price drops in the future, profit will also decrease. (S22, AOD 1)</i></p>	<ul style="list-style-type: none"> • express opinions with little details or explanations (58.7%; $n=80$) • repetition of ideas (4.1%; $n=6$) 	
• higher-level thinking	<p><i>In my way of thinking, the increase in sugar prices will cause consumers to reduce sugar intake in daily life. Hereby, the rate of diabetes among people can be reduced. (S30, AOD 3)</i></p> <p><i>When the demand of stationery decline, the private sector will lower the price of stationery so that the equilibrium of price in the market is achieved. Image -> https://image.slidesharecdn.com (S24, AOD 1)</i></p> <p><i>Weather is one of the factors that cause oil shortages in market. For example, flood caused the destruction of palm oil plantation.(S14, AOD 1)</i></p>	<ul style="list-style-type: none"> • unclear or illogical statements (5.0%; $n=7$) • express opinions with logical, clear, and specific reasons (26.4%; $n=36$) • express opinions with evidence (0.8%; $n=1$) • express opinions with example (5.0%; $n=7$) 	<p>Ekahitanond (2013); Cohen and Spencer (1993)</p>

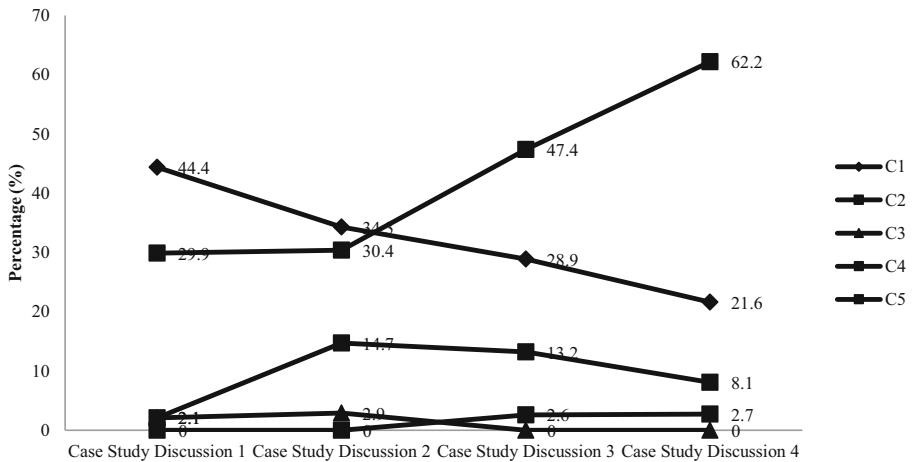


Fig. 1 The percentage of coded peer feedback within the cognitive dimension

discussion was in-depth or the students forthcoming. Conversely, *questions for clarification* and *questions that probe reasons and evidence*, which constituted 29.9% and 12.4% of the total feedback respectively, were commonly used to draw more critical responses from group participants, thus stimulating students to think at higher levels (Tables 5, 6 and 8).

Additionally, there was an increase in the percentage of student feedback categorised as C3 (Analysis and evaluation) from the first (2.1%) to second (2.9%) case study discussions. However, no representation of the feedback in this category was found in the last two topics of discussion. The reason for so could be due to the process of consolidating discussion points and assessing the quality of peers’ contributions was a

Table 5 Content analysis of peer feedback in the category of C2 (question)

Theme	Evidence	Researcher’s inference	Source
Question (n=128)			
	<i>I need to understand - How can individual tastes and preferences cause vegetable prices to rise?</i> (S30, AOD 4)	• Questions for clarification (29.9%; n=38)	Cheong and Cheung (2008); Yang (2008);
	<i>Why is the proposed action important for consumers and markets?</i> (S25, AOD 1)	• Questions that probe reasons	Yang et al. (2013); Yang et al. (2005)
	<i>Why is the proposed action important for consumers and markets?</i> (S25, AOD 1)		
	<i>Can you give examples on how giving punishment, penalties, suspend business license and jail sentence can solve this problem?</i> (S24, AOD 1)	• Questions that probe evidence (12.4%; n=16)	
	<i>In your opinion, what is the way to deal with this problem?</i> (S24, AOD 3)	• Questions about viewpoints or perspectives (57.7%; n=74)	

Table 6 Content analysis of peer feedback in the category of C4 (suggestion)

Theme	Evidence	Researcher's inference	Source
Suggestion ($n=27$)			
• lower-level thinking	<i>The government must enforce the law to prevent greedy merchants increase sugar prices.</i> (S18, AOD 3)	• propose solutions without providing specific directions for improvement (76.0%; $n=21$)	
• higher-level thinking	 the government <i>should set a higher basic salary to encourage adolescents to engage in the agricultural industry.....</i> (S30, AOD 4)	• provide
	alternative perspectives for further improvement of others' contributions (24.0%; $n=6$)	Alqassab et al. (2016)	

time-consuming task. In addition, the students were also busy to prepare for their final examinations. Therefore, they were less willing to spend more time for searching the outside materials or additional information to support their positions.

In total, there were only seven peer feedback messages that contain an analysis or evaluation of peers' responses to the issue discussed. The scarcity of this type of feedback probably was due to a lacking in student's ability to compare, integrate, and discern ideas that come from a diversity of views on the issues that were discussed. The results also further reveals that they were not able to use the references or information to support the accuracy and reliability of their arguments. Thus, the findings may indicate that the feedback that students used to respond to peers hardly reached to higher levels of thinking. The following statement provides an example of how a student provided a direction to peer for improving her suggestion:

We must solve the problem now and instead of thinking about the future that has not yet come. The comprehensively use of computers or the internet in education would take a long time to implement. (S15, AOD 1).

Within the category C4 (Suggestion), the percentage of student feedback increased significantly from the first (2.1%) to second (14.7%) case study discussions. However, the percentage of feedback in this category dropped after the second AOD and was the lowest (8.1%) in the last topic of discussion. These results show that although 24.0% students were able to offer alternative solutions or suggestions for the improvement of peers' contributions, most of the feedback (76.0%) that students provided to peers was confined to general strategies without any further exploration. The results seem to imply that the students' thinking was predominantly at lower level as feedback with clear directions or strategies for the improvement of peers' responses was not frequently observed.

Feedback that was not relevant to the cognitive components was also found in this study, occupying as high as 2.7% of the feedback postings in the fourth case study discussion. This result probably occurred because the students may start to lose their

interest towards the discussion activities after the second AOD. Therefore, they appeared to have become less motivated to participate critically and aggressively. As a result, most students did not treat the discussion seriously especially in the last two topics of discussion.

In terms of the feedback content from the *affective* dimension ($n = 44$), A1 (supporting) was the most common type of feedback provided by students in the four AODs. However, the percentage of feedback coded in this category decreased gradually from 16.6% in the first case study discussion to only 5.4% in the fourth case study discussion. According to Richardson et al. (2007b), peer feedback can be another way to foster high-level thinking as students will need to provide reasons when they either agree or disagree with peers' responses.

As indicated in Tables 7, 41.5% of students were able to provide a logical statement of agreement with supporting reasons, as well as offer an additional idea or strategy for further improvement of their peers' contributions. Nevertheless, 56.2% of the content of peer feedback was oriented toward providing a simple agreement unaccompanied by explanation or justification, indicating that most students were relatively less likely to achieve high levels of CT.

In addition, the figures also show that the students did not prominently provide feedback opposing another's ideas or responses. The percentage of the peer feedback categorised in A2 (Opposing) was only 1.6% in first case study discussion and reached 0.0% in the remaining AODs (Fig. 2).

Furthermore, the findings also indicate that the number of statements with simple disagreement was greater than the number of statement with disagreement accompanied by supporting reasons. The lack of reasoned *opposing* feedback reflects that the students' CT was predominantly at lower level.

Within the *metacognitive* dimension, M1 (challenging, reflecting on, or reacting to peers' feedback) was the only type of feedback that students used to respond to peers during the four case study discussions ($n = 18$). As illustrated in the Fig. 3, there was an abrupt increase in the rate of student feedback in this category from the first (3.2%) to the second case study discussion (10.8%). However, the percentage dropped dramatically to 2.6% in discussion three and eventually dropped to 0.0% in the last topic of discussion.

Analysis shows that students commonly used this type of feedback to help peers articulate their initial ideas further. For example, S29 from group 6 replied that:

..... then how to make sure that the spot check could warn the seller to decrease the prices effectively? About the surprise inspection operation, can u talk more about this? What if the government servants take bribes and hide the seller's crime which is increase the prices without following the laws? (AOD 3)

Furthermore, it was found that no feedback was identified in the categories of M2 (redefining or revising) and M3 (irrelevant to metacognitive feedback). These results suggest that the students were not likely to lead the peers to redefine, regulate, or revise their original ideas to better quality. Even though challenging or reflecting on peers' feedback could stimulate students' thinking and evaluate their understanding of the subject matter by being critically challenged by others (Yang et al. 2005), such

Table 7 Content analysis of peer feedback in the category of A1 (Supporting)

Theme	Evidence	Researcher's inference	Source
Supporting ($n=41$)			
• lower-level thinking	<p><i>I agree. (S16, AOD 1)</i></p> <p><i>Yes. This is one way to lower the price of stationery. (S22, AOD 1)</i></p> <p><i>I agree with your opinion, but if people are using 'ball pen' how they can 'refill' their pen because in the market there is no selling 'refill ink' for 'ball pen'. (S14, AOD 1)</i></p> <p><i>or butter that does not contain sugar. (S19, AOD 2)</i></p>	<ul style="list-style-type: none"> • simply agree (41.5%; $n=17$) • simply agree and repetition of information (9.8%; $n=4$) • agree by questioning peer to explain further (4.9%; $n=2$) 	
• higher-level thinking	<p><i>I agree with S12's views. In addition to increasing the quantity of stationery and local products as well as reduce the number of imported products, the government also has to provide subsidies and tax exemptions to all people. (S14, AOD 1)</i></p> <p><i>Wikipedia it said that palm oil can withstand deep frying at higher temperatures and is resistant to oxidation compared to others vegetable oils. For example, corn oil, sunflower oil, peanut oil and many more. Besides that, palm oil is good for health. Buying more palm oil that is made by our own country also can improve the economy of our country. (S13, AOD 2)</i></p>	<ul style="list-style-type: none"> • agree by providing additional ideas to improve others' contribution (2.4%; $n=1$) • agree by providing strategy for the improvement of others' contribution (9.8%; $n=4$) • agree with supporting reason (31.7%; $n=13$) 	Ertmer et al. (2007)

Table 8 Content analysis of peer feedback in the category of A2 (Opposing)

Theme	Evidence	Researcher's inference	Source
Opposing ($n=3$)			
• lower-level thinking	<i>I don't agree with you.</i> (S3, AOD 1)	• simply disagree (33.3%; $n=1$)	
	<i>I do not agree with your opinion. You said price increases cannot be borne by users but why as a student who has no income can afford it?</i> (S8, AOD 1)	• disagree by questioning peer to explain further (33.3%; $n=1$)	
• higher-level thinking		<i>about the determination of the percentage increase in the price of goods is not the producer's responsibility instead it is government's responsibility. Manufacturer has no right to set the price at will</i> (S3, AOD 1)	• disagree with
	supporting reason (33.3%; $n=1$)	Richardson et al. (2007b)	

feedback was scarcely observed in students' postings. Therefore, higher levels of thinking were more difficult to achieve.

8.2 Students' perceptions toward peer feedback and teacher facilitation of their learning in AODs

In total, 100% participants ($n=31$) completed the questionnaire and all questionnaire respondents participated in at least one of the AODs during the 8-week case study discussions period.

There were 18 items used to explore students' perceptions of peer feedback on their learning in AODs in the form of five point Likert Scale statements. Descriptive analysis of survey data shows that a majority of students were satisfied (74.2%) with the feedback they received from peers in the AODs, and most of the students indicating that the feedback they received was fair (67.8%) and justified (70.9%). Besides, a majority of students also strongly agreed and agreed that receiving feedback from peers in AODs was useful (64.5%), helpful (64.5%), and supported (61.3%) their learning. More than half of the students (54.8%) indicated that they accepted most of the feedback they received. Similarly, a minority of students would reject (12.9%) and dispute (29.0%) most of the feedback they received.

A large proportion of students (74.2%) agreed that they were willing to use the received feedback to improve their performance, while 48.4% indicated that they were willing to invest a lot of effort in their learning through the reception of peer feedback, and most students (64.6%) reported that they were willing to further improve their work and refer to the materials covered on other areas of the subject after received the feedback from peers. Lastly, many students indicated that they often felt satisfied

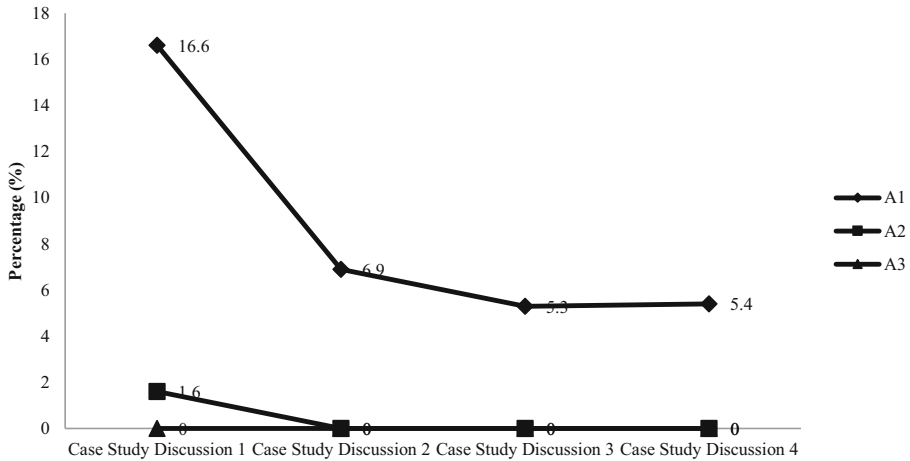


Fig. 2 The percentage of coded peer feedback within the *affective* dimension

(61.3%), confident (45.1%), and successful (54.9%) when received peer feedback on their contributions during the AODs; whereas the students also disagreed that they often felt offended (48.4%), angry (67.7%), and frustrated (45.1%) when they received feedback from their peers in AOD forums. In sum, most students have highly positive perceptions of their learning in AODs using peer feedback.

9 Discussion and conclusion

The responses or feedback provided by peers has been recognised as an integral part of the learning process in online learning environments. However, the research on how students from primary and secondary settings (K-12) provide feedback to peers in the AODs is rather limited. This study therefore intends to examine whether the types of

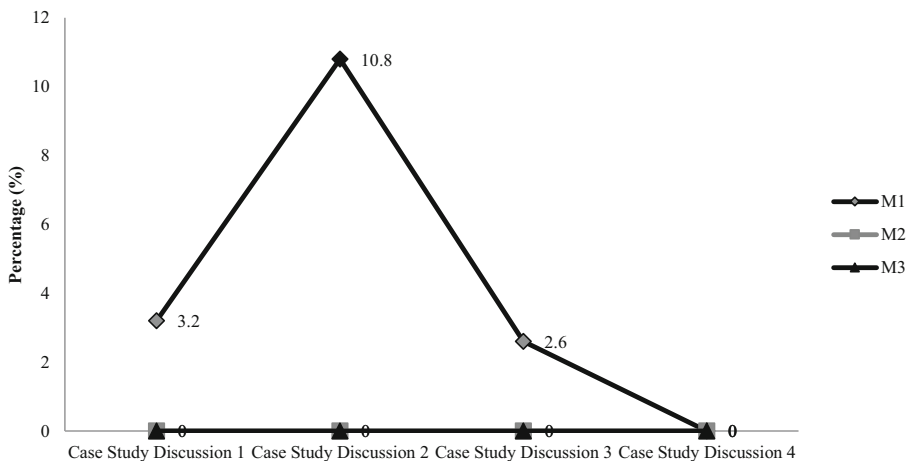


Fig. 3 The percentage of coded peer feedback within the *metacognitive* dimension

feedback that students provide to peers is possible to stimulate students' higher level of thinking in an economics classroom.

The adoption of peer feedback strategy in this study served to aid students' progress in learning and allowing for opportunities to engage in higher level thinking. When examining the types of feedback that students provided and used to respond to peers in the AODs, the findings show that the most common type of feedback provided by students in the four AODs was categorised at *cognitive* dimension (82.6%), with the *affective* (12.3%) and the *metacognitive* (4.9%) dimensions following behind. This seems contradictory to some previous research findings (Cheng and Hou 2015; Tsai and Liang 2009) that report that the students mostly provide *affective* feedback rather than the feedback in the *cognitive* or *metacognitive* feedback dimension.

Even though the survey data reveals that most of the students had positive perceptions toward peer feedback of their learning in AODs, the findings show that there was a lack of constructive feedback found in AOD forums. In other words, the feedback that students received in AODs was generally superficial. There are a few reasons that could account for these findings: First, students may have been unsure of how to provide feedback or responses because they were not properly trained prior to providing feedback to their peers. The results, which also correspond to previous studies (Li et al. 2010; McCarthy 2017) findings, reflect that students may lack the skills in providing useful and constructive feedback due to a lack of expertise within a given subject area. Thus, receivers of peer feedback may not learn much from receiving low quality comments.

Second, some students may feel hesitant about giving feedback as they are reluctant to criticize the works of their peers. Similar findings were also found in Ertmer et al. (2007) study where they found out that this could be due to the students fear of their peers reacting defensively to criticism. Another reason that students may not have demonstrated improvement in the quality of their postings during the peer feedback process relates to the questioning techniques used. In this study, many questions posed by students as cognitive feedback were not particularly conducive to high-level responses. For example, students tended to ask their peers to clarify or elaborate their personal ideas or viewpoints on the economics issues being discussed (e.g., what will happen, how is the solution, why are you saying that). While these types of questioning techniques might be expected to engender responses related to the *comprehension* or *application* level, they would not stimulate peers' thinking at a higher level (such as analysing, evaluating, or creating).

In sum, while above-mentioned studies suggest that peer feedback has many positive outcomes, there are some challenges to implementing peer feedback. However, in spite of these challenges, its greater immediacy, frequency and volume may compensate the lack of high quality of peer feedback (Miao et al. 2006; Topping 1998).

10 Limitations

As with any research, a few limitations exist in this study and warrant some attention. The first limitation is that a case study was adopted as the current research was conducted in a classroom where random assignment was neither possible nor practical to exercise. The lack of random assignment may reduce the internal validity of the

study and limit the generalizability of the results to a larger population. In addition, a convenience sample was selected in this study. Therefore, it cannot be assumed that the AOD forums examined in this study are representative of any other forum involving other students.

11 Recommendations for future research

It was found that the peer feedback strategy is less effective in stimulating students' higher level of thinking in this study as most students were more inclined to provide surface level feedback. Therefore, based on the findings of this study, the following recommendations are put forward for consideration when engaging students, especially at the secondary school level, in asynchronous online learning environments that incorporate peer feedback:

1. Provide more time up front to explain the rationale and the benefits of peer feedback to students prior to commencement of the AOD activity (Xie 2013) in order to help them understand peer feedback is not to criticize one another but the intention is to aid their peers' progress in learning activities (Ching and Hsu 2013; Demirbilek 2015).
2. Provide guideline or scaffolds on how effective peer feedback can be provided to peers (Tsai and Liang 2009). For instance, students can always begin with positive affective feedback and followed by offering the directions or suggestions on how peers' contributions can be further improved. The appropriate guidance (scaffolding) may greatly help students generate more constructive feedback (Zhang et al. 2014).
3. Train students to give feedback and use trial practices prior to implementing the peer feedback process (Alqassab et al. 2016; Tsai and Liang 2009). The training activity may guide students on how to construct meaningful feedback using appropriate question prompts. This may help the students to gain positive perceptions and confidence towards peer feedback in facilitating their learning (Khasminder and Tan 2016).
4. Monitor the peer feedback process (Richardson et al. 2007a) and involve the teacher when necessary. This may ensure that the process runs smoothly and at the same time assure students that they can benefit from peer feedback (Khasminder and Tan 2016).
5. Inform students that the feedback they provide is anonymous so that they can provide ratings without feeling pressure from peers (Richardson et al. 2007b). The use of peer ratings to recognise a particular individual's contributions in AODs will motivate students to be involved the in learning activities (Xie 2013).

Additionally, there is no known research that determines whether students' educational levels and academic maturity affect the quality of peer feedback. More in-depth interviews with selected participants could also be conducted to determine the specific strengths and weaknesses of the feedback process.

Finally, given that peer feedback is likely to become an increasingly important part of the online learning process (Armellini and Stefani 2016), it is crucial that teachers

have a greater understanding of the challenges involved in deploying peer feedback as a strategy to promote students' higher level of thinking in an AOD learning environment.

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