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Online peer feedback patterns of success and failure in argumentative essay writing

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ABSTRACT

In peer feedback literature, little is known about the patterns of success for peer feedback activities in online learning environments. This study aims to explore the peer feedback patterns of successful, less successful, and unsuccessful higher education students for argumentative essay writing. In this exploratory study, 330 higher education students were asked to perform three tasks in three consecutive weeks. In the first week, they were asked to write an argumentative essay. In the second week, students provided two sets of feedback on their peers' argumentative essays based on the given criteria. In the third week, students were asked to revise their argumentative essay based on the received feedback. The findings revealed that unsuccessful and less successful students significantly received more affective and descriptive feedback from their peers, while successful students received more feedback related to the identification of the problem from their peers. Furthermore, descriptive and constructive features of feedback were predictors of students' success in the improvement of argumentative essay writing. The findings of this study provide practical implications for the effective design of peer feedback strategies for improving students' argumentative essay writing in online learning environments.

Introduction

As in higher education, the class sizes continue to grow every year (Shi, 2019), it becomes more difficult for educators to provide one-by-one feedback (Noroozi & Hatami, 2019). This means that for classes with a large number of students, feedback from educators is not practically feasible due to a high workload (Er et al., 2020). In such situations, peer feedback can be used instead of teacher feedback as an effective instructional strategy (Ruegg, 2015; Tian & Zhou, 2020). Using peer feedback as a process-oriented pedagogical activity in classrooms can provide students with a challenging and collaborative learning environment to learn from one another (Kollar & Fischer, 2010; Nicol et al., 2014). In the peer feedback process, students are expected to critically review their peers' work, identify gaps and problems, and suggest points for improvements in an emotionally friendly way (Latifi et al., 2021; Liu & Carless, 2006; Topping, 2009). This process for peer feedback implies that quality feedback can contain affective features such as encouraging words in order to prevent emotional conflicts. Peer feedback can also contain feautures that help with identifications

of problems in the work and suggestions for improvements (Nelson & Schunn, 2009; Wu & Schunn, 2020a). A review of prior studies reveals that using peer feedback in higher education can result in students' learning (e.g. Gielen et al., 2010; Reinholz, 2018), improving critical thinking skills (e.g. Ekahitanond, 2013; Novakovich, 2016), increasing engagement (e.g. Devon et al., 2015; Fan & Xu, 2020), motivation (e.g. Hsia et al., 2016; Zhang et al., 2014), and satisfaction (e.g. Donia et al., 2021; Zhang et al., 2014).

Recently, one of the areas in which peer feedback has been commonly used is for improving students' writing performance (e.g. Huisman et al., 2018; Tian & Zhou, 2020), especially in argumentative essay writing contexts (e.g. Latifi et al., 2020, 2021; Latifi & Noroozi, 2021; Noroozi et al., 2016, 2020). Being able to write a good argumentative essay is a critical skill for higher education students but also a complex and challenging learning activity (Fan & Chen, 2019; Ferretti & Graham, 2019; Wingate, 2012). Studies have shown that students lack argumentation knowledge or even with the existence of such knowledge they have challenges in transforming such knowledge into application in their essays (Latifi et al., 2021; Noroozi et al., 2016). This indicates that writing a high-quality essay is not easy for students and studies have shown that educators are not satisfied with the quality of students' argumentation competence in essay writings (e.g. Latifi et al., 2021; Noroozi et al., 2016; Qin & Karabacak, 2010). In the literature, peer feedback strategies were found as an effective learning activity in higher education for the sake of improving students' argumentative essay writing skills (Latifi et al., 2020, 2021; Latifi & Noroozi, 2021; Noroozi et al., 2016; Noroozi & Hatami, 2019; Valero Haro et al., 2020). For example, Latifi and Noroozi (2021) used a supported peer feedback tool to improve students' argumentative essay writing performance. This supported peer feedback guided students to engage in the learning process by allowing them to review the quality of peers' essays, discover gaps in their essays, and recommend suggestions for improvements based on the given criteria (Latifi et al., 2021; Lizzio & Wilson, 2008; Noroozi & Hatami, 2019; Topping, 2009).

Despite peer feedback advantages for improving students' essay writing performance, this learning activity is typically seen as a complex learning activity that requires deep cognitive thinking skills (Latifi et al., 2021; Liu & Lin, 2007; van Popta et al., 2017). Prior studies have shown that even when the peer feedback is supported by appropriate instructional strategies, students may still struggle with engaging in deep cognitive thinking skills during peer feedback processes which in turn may cause some students to be less successful or even unsuccessful regarding their writing performance (Huisman et al., 2018; Noroozi et al., 2020). Such a situation happens especially when students find the feedback quality of their peers at a low level (Dominguez et al., 2012; Misiejuk et al., 2021). This implies that the features and the types of feedback received from peers play a key role in the uptake of the feedback by the students (Nelson & Schunn, 2009). This can become more complicated if we perform peer feedback activity in online learning settings where there is an opportunity for anonymous feedback which can influence feedback providers' honesty, level of criticism, and also emotional responses from the feedback receivers (Aghaee & Hansson, 2013; Coté, 2014; Noroozi et al., 2020), In addition, in online learning settings, students could feel more free to provide feedback as they can have access at anytime from anywhere (Du et al., 2019).

In general, the success of feedback mainly depends on its quality (Carless et al., 2011; Er et al., 2020; Hattie & Timperley, 2007; Shute, 2008). For feedback to be effective, it should contain features such as affective statements (e.g. praise or compliment), a summary explanation of the work, identification and localization of the problem(s), and solutions to the identified problem(s) and action plans for further improvements (Lu & Law, 2012; Patchan et al., 2016; Wu & Schunn, 2021). If the received feedback lacks quality features such as identification of the problems in the essay and suggestions for improvements, the feedback tends to be neglected rather than implemented by students (Dominguez et al., 2012; Patchan et al., 2016; Wu & Schunn, 2020b). That is why in some studies even though all students have been asked to provide feedback based on the same feedback criteria on their peers' essays, some students have failed to provide high-quality feedback which in turn resulted in poor argumentative essay quality (e.g. Noroozi et al., 2016, 2020).

The review of the literature suggests that although quite a large number of studies have focused on investigating the effects of peer feedback activities on students' learning performance (e.g. Huisman et al., 2018; Gielen et al., 2010; Latifi et al., 2021; Noroozi et al., 2016), only a few studies have aimed to explore the impacts of the nature and quality of peer feedback on students' uptake of peer feedback in the learning process and performance (e.g. Misiejuk et al., 2021; Nelson & Schunn, 2009; Patchan et al., 2016; Wu & Schunn, 2020b; 2021). For example, Nelson and Schunn (2009) found that if students provide a summary of a peer's performance, locate the problem in the peer's performance, and suggest solutions to this problem, therefore, the feedback receiver can better understand the provided feedback and is more willing to implement it. Similarly, Wu and Schunn (2021) revealed that receiving feedback with specific solutions is associated with the actual implementation of the feedback. Although prior studies highlight the role of different feedback features in uptaking feedback and improving learning performance, they did not provide insights into the differences in performance patterns between successful and less successful students with regard to the nature and quality of the received peer feedback, particularly in the context of argumentative essay writing in online settings. The literature does not provide a clear understanding of the received feedback pattern of successful, less successful, and unsuccessful students' when it comes to argumentative essay writing. Therefore, this study was conducted to gap the literature in this regard by exploring the online received peer feedback patterns of success and failure in argumentative essay writing contexts. Discovering such patterns of success and failure would help educational designers to come up with appropriate strategies that could guide students to engage in a desirable type of peer feedback process which in turn helps students achieve intended learning outcomes. Thus, this study was conducted to further explore and address these issues by answering the following research questions:

- RQ1. How do peer feedback patterns of successful, less successful, and unsuccessful students differ in online learning environments for argumentative essay writing?
- RQ2. Which types of peer feedback features can predict students' success and/or failure in online learning environments for argumentative essay writing?

Materials and methods

Participants

This exploratory study took place in the 2020–2021 academic year with 330 higher education students at a medium-sized university in the Netherlands in the domain of life sciences. However, only 284 students fully completed the study (Female = 195, 68%, Male = 89, 32%;) from five different courses at bachelor (N = 148, 52%) and master (N = 136, 48%) levels. The selected courses were from different course domains including Course A (Social Sciences – N = 56, 20%, Female = 27, Male = 29), Course B (Plant Sciences – N = 29, 10%, Female = 20, Male = 9), Course C (Health & Social Sciences - N = 47, 16%, Female = 31, Male = 16), Course D (Environmental Sciences – N = 101, 36%, Female = 70, Male = 31), and Course E (Food Sciences – N = 51, 18%, Female = 37, Male = 14). All participants were informed that their data will be used anonymously. Students were assured that no one would be able to relate the results to any particular student. Students were given the option to leave the study and to ask for omitting their collected data. Finally, students gave consent to collect and use their data for research purposes. Ethical approval was received from the Social Sciences Ethics Committee of the home university for this research.

Procedure

A module called "*Argumentative Essay Writing*" was designed and embedded in an online learning platform called Brightspace in the selected courses. The module was followed in three consecutive

weeks and in each week students performed one task. In week one, students were provided with an introduction to the module, and then they were asked to write an argumentative essay on one of the offered three topics (task 1). The topics for each course were as follows: Course A (children and video games, genetically Modified Organisms, and climate change), Course B (the use of RNAi-based biopesticide, ban of glyphosates, and use of gene drives for agricultural pest control), Course C (sugar tax, COVID-19 vaccines, and brain drain), Course D (the long-term impacts of Covid-19 on the environment, the role of private actors in funding local and global biodiversity, and bans on the use of single-use plastics), and Course E (scientists with links to food industry should not be involved in risk assessment, powdered infant formula should be sterile, and preparation is the responsibility of the caregiver). Students were given an equal opportunity to select one among three topics based on their preferences. The reason behind such a choice was to decrease any potential bias regarding students' domain-specific knowledge on a specific topic as some students could have extensive content knowledge in one specific topic, while others may have not. In week two, students were asked to provide feedback on two argumentative essays of their peers based on the criteria embedded in the online learning environment (task 2). By using the FeedbackFruits tool, students were assigned automatically and randomly to provide two sets of feedback on their peers' argumentative essays. FeedbackFruits is an external EdTech tool embedded in Brightspace to drive students' engagement through different peer collaboration strategies. This tool has many functionalities including peer review, assignment review, automated feedback, etc (Noroozi et al., 2022). In week 3, students were requested to revise their essays according to the two feedback sets received from their learning peers (task 3).

Measurements

Students' argumentative essay performance
A coding scheme developed by Noroozi et al. (2016) was used in this study to analyze the quality of students' argumentative essays. This coding scheme was built on the elements of high-quality argumentative essay writing (e.g. Noroozi et al., 2016) including eight elements: (1) introduction on the topic, (2) taking a position on the topic, (3) arguments for the position, (4) justifications for arguments for the position, (5) arguments against the position (counter-arguments), (6) justifications for arguments against the position, (7) response to counter-arguments, and (8) conclusion and implications. The coding scheme is scored from zero (the lowest quality level) to three (the highest quality level) for each element (see Table 1). All the points obtained by students for these elements were summed up together and indicated students' overall score for the quality of the written argumentative essay. Students' argumentative essays were assessed in two steps as the original argumentative essay and the revised essay. Five coders with education expertise contributed to code the quality of written argumentative essays. Since there were more than two coders, Fleiss' Kappa statistic was used to determine the inter-rater reliability between coders (Fleiss, 1971), and the agreement was found to be 75% (*Fleiss' Kappa = 0.75 [IC 95%: 0.70-0.81]; z = 26.08; p < 0.001*) indicating significant agreement between the coders.

Quality of students' received peer feedback
The authors developed a coding scheme to assess the quality of students' peer feedback performance based on a review of relevant recent studies (e.g. Nelson & Schunn, 2009; Patchan et al., 2016; Wu & Schunn, 2020b). This coding scheme analyzes the features of peer feedback which includes three elements: (1) affective (inclusion of positive emotions such as praise or compliments and negative emotions such as anger or disappointments) (2) cognitive (description: summary statement of the essay), (identification: identification and localization of the problem in the essay), and (justification: elaborations and justifications of the identified problem), and (3) constructive (inclusion of recommendations but not action plans for further improvements) (see Table 2). The feautures of this coding scheme was scored from zero (poor quality) to two (good quality). All the given points were summed up and represented the students' overall score for the quality of received peer

Table 1. Coding scheme details to analyze the quality of students' argumentative essay.

Variables	Points	Labels	Descriptions
Introduction on the topic	0	Not mentioned at all	Introduction on the topic is not presented at all.
	1	Just mentioned	Introduction on the topic is just presented, but not elaborated and justified.
	2	Mentioned and elaborated	Introduction on the topic is presented and elaborated, but not justified.
	3	Mentioned, elaborated, and justified	Introduction on the topic is presented, elaborated, and justified.
Taking a position on the topic	0	Not mentioned at all	Position on the topic is not presented at all.
	1	Just mentioned	Position on the topic is just presented, but not elaborated and justified.
	2	Mentioned and elaborated	Position on the topic is presented and elaborated, but not justified.
	3	Mentioned, elaborated, and justified	Position on the topic is presented, elaborated, and justified.
Arguments for the position	0	Not mentioned at all	No argument in favor of the position is presented.
	1	Mentioned to a small extent	Only one argument in favor of the position is presented.
	2	Mentioned to a moderate extent	Only two arguments in favor of the position are presented.
	3	Mentioned to a great extent	More than two arguments in favor of the position are presented.
Justifications for arguments for the position	0	Not justified at all	Justification for arguments for the position is not presented at all.
	1	Justified to a small extent	Only one argument for the position is justified.
	2	Justified to a moderate extent	Some but not all arguments for the position are justified.
	3	Justified to a great extent	All arguments for the position are justified.
Arguments against the position (counter-arguments)	0	Not mentioned at all	No argument against the position is presented.
	1	Mentioned to a small extent	Only one argument against the position is presented.
	2	Mentioned to a moderate extent	Only two arguments against the position are presented.
	3	Mentioned to a great extent	More than two arguments against the position are presented.
Justifications for arguments against the position	0	Not justified at all	Justification for arguments against the position is not presented at all.
	1	Justified to a small extent	Only one argument against the position is justified.
	2	Justified to a moderate extent	Some but not all arguments against the position are justified.
	3	Justified to a great extent	All arguments against the position are justified.
Response to counter-arguments	0	Not mentioned at all	Response to counter-arguments is not presented at all.
	1	Just mentioned	Response to counter-arguments is just presented, but not elaborated and justified.
	2	Mentioned and elaborated	Response to counter-arguments is presented and elaborated, but not justified.
	3	Mentioned, elaborated, and justified	Response to counter-arguments is presented, elaborated, and justified.
Conclusion and implications	0	Not mentioned at all	Conclusion and/or implications are not presented at all.
	1	Just mentioned	Conclusion and/or implications are just presented, but not elaborated and justified.
	2	Mentioned and elaborated	Conclusion and/or implications are presented and elaborated, but not justified.
	3	Mentioned, elaborated, and justified	Conclusion and/or implications are presented, elaborated, and justified.

feedback. Since each student received two sets of feedback, the average score from the two sets of feedback was considered as the overall score for the quality of received peer feedback. The same five coders participated in the coding process of the received peer feedback. The inter-rater reliability between the coders was 65% (*Fleiss' Kappa = 0.65 [IC 95%: 0.66-0.84]; z = 16.42; p < 0.001*) indicating a good level of agreement between the coders.

Table 2. Coding scheme to analyze features of received peer feedback.

Nature of feedback	Feedback features	Points	Label	Description
Affective		0	Poor – discouraging	The comment included discouraging and negative emotions such as anger or disappointments
		1	Average – neutral/not mentioned	The comment did not include either negative or positive emotions
		2	Good – encouraging	The comment included encouraging and positive emotions such as praise or compliments
Cognitive	Description	0	Poor – not mentioned	The comment did not include a summary statement such as description of content or taken action
		1	Average – mentioned to small extent	The comment included a summary statement such as description of content or taken action but to a small extent
		2	Good – mentioned to a large extent	The comment included a summary statement such as description of content or taken action to a large extent
	Identification	0	Poor – not mentioned	The comment did not include explicit identification of problem
		1	Average – mentioned but not localized	The comment included identification of problem without localization of identified problem
		2	Good – mentioned and localized	The comment included explicit and localized identification of problem
	Justification	0	Poor – not mentioned	The comment did not include elaborations and justifications of identified problem
		1	Average – mentioned, elaborated, but not justified	The comment included elaborations but not justifications of identified problem
		2	Good – mentioned, elaborated, and justified	The comment included elaborations and justifications of identified problem
Constructive		0	Poor – not mentioned	The comment did not include any recommendations or action plans for further improvements.
		1	Average – only recommendation is mentioned	The comment included recommendations but not action plans for further improvements.
		2	Good – both recommendation and action plan are mentioned	The comment included recommendations and action plans for further improvements.

Analysis

In this study, we first controlled the effects of students' education level and course domain on the relationship between the independent grouping variable and the continuous dependent variables. Second, based on the improvements from pre-test to post-test, we used a percentile rank measurement to categorize students into three groups including successful (students whose progress in argumentative essay writing from pre-test to post-test was higher than 67th percentile) (N = 105, 39%), less successful (students whose progress in argumentative essay writing from pre-test to post-test was between 33th to 67th percentile) (N = 62, 22%), and unsuccessful students (students whose progress in argumentative essay writing from pre-test to post-test was between less than 33th percentile) (N = 110, 39%).

Then, the MANCOVA test was conducted to compare the differences in the quality of received peer feedback features of the successful, less successful, and unsuccessful students. Since the sample sizes were unequal, we used the Tukey–Kramer test to determine the pairwise comparisons. Multinomial logistic regression was conducted to predict students' success in argumentative essay writing from pre-test to post-test based on the received peer feedback quality. In addition, homogeneity and normality tests had to be administered. As a result, the Levene test was used to determine group homogeneity, and the Kolmogorov–Smirnov test was used

to determine data normality. It was determined that the groups were homogeneous and the data were normally distributed ($p > 0.05$) after assessing the scores using the Levene and Kolmogorov–Smirnov tests.

Results

RQ1. How do peer feedback patterns of successful, less successful, and unsuccessful students differ in online learning environments for argumentative essay writing?

The results showed that unsuccessful, less successful, and successful students differ in terms of mean quality scores of their received peer feedback (Pillai's Trace = 0.07, F(10, 532) = 1.98, $p < 0.05$, $\eta2 = 0.04$). This difference was mainly due to the affective, descriptive, and identification of the problem features of feedback. Unsuccessful students received more affective and descriptive feedback types than successful students. Less successful students received more affective peer feedback than successful students. Successful students received more feedback related to the identification of the problem than unsuccessful students (see Table 3).

RQ2. Which types of peer feedback features can predict students' success in online learning environments for argumentative essay writing.

The results showed that students' improvements in argumentative essay writing can be predicted by the received peer feedback features ($\chi^2 = 33.26$, $p < 0.05$). Descriptive and constructive features of received feedback were predicters students' success in argumentative essay writing (see Table 4).

Table 3. Differences among successful, less successful, and unsuccessful students in terms of mean scores for received peer feedback quality.

Variables		Group	Peer feedback received quality Mean	SD	pairwise comparisons	Difference between among unsuccessful, less successful, and successful statistics
Affective		Unsuccessful	1.64	0.17	Successful < Unsuccessful **	F (2, 269) = 5.1, $p < 0.01$**, $\eta2 =$ 0.03
		Less successful	1.63	0.17	Successful < Less successful *	
		Successful	1.57	0.17		
		Total	1.61	0.17		
Cognitive	Description	Unsuccessful	1.32	0.33	Successful < Unsuccessful **	F (2, 269) = 4.80, $p < 0.01$**, $\eta2 =$ 0.03
		Less successful	1.28	0.35		
		Successful	1.18	0.34		
		Total	1.26	0.34		
	Identification	Unsuccessful	0.53	0.29	Successful > Unsuccessful *	F (2, 269) = 2.92, $p < 0.05$*, $\eta2 =$ 0.02
		Less successful	0.58	0.32		
		Successful	0.65	0.41		
		Total	0.59	0.35		
	Justification	Unsuccessful	0.04	0.08		F (2, 269) = 2.01, $p = 0.13$
		Less successful	0.06	0.09		
		Successful	0.08	0.13		
		Total	0.06	0.10		
Constructive		Unsuccessful	0.79	0.34		F (2, 269) = 1.61, $p = 0.20$
		Less successful	0.87	0.32		
		Successful	0.87	0.36		
		Total	0.84	0.34		

($P < 0.01$)**, ($P < 0.05$)*

Discussion

In this study, we explored the patterns of the received peer feedback for successful, less successful, and unsuccessful students in an online learning setting within a higher education context. The results of the first research question have led us to know what are the features of the received feedback that cause distinctions among successful, less successful, and unsuccessful students for the argumentative essay writing performance. It was found that affective and descriptive feedback types did not contribute to students' success for argumentative essay writing task. However, when students recieved feedback related to the identification of the problem, they could improve their argumentative essays. These findings are consistent with and supported by previous research indicating that the effectiveness of peer feedback depends on its type and feature (see Carless et al., 2011; Hattie & Timperley, 2007; Shute, 2008; Wu & Schunn, 2020a). For example, Wu and Schunn (2020) found that affective feedback plays a less important role compared to constructive feedback in the improvement of the work. Similarly, Hattie and Timperley (2007) and Nelson and Schunn (2009) reported that feedback with only emotionally positive words is less effective than suggested, justified, and constructive feedback. In another study, van der Pol et al. (2008) found that the feedback that did not include revision suggestions is less likely to be implemented.

In addition, some other scholars found the feedback that is elaborated and justified is effective in improving the work because this type of feedback is better perceived by peers (Lizzio & Wilson, 2008; Strijbos et al., 2010). Likewise, Gielen et al. (2010) found that students who received justified comments in feedback performed better in their revised work. This can be due to the convincing role of justification of the problem in the feedback that can clarify why this particular part of the work needs to be revised. In other words, students who explain and justify their ideas can help their peers better understand the problems and errors in their essays.

All these findings suggest that peer feedback should not only focus on the affective part but mainly focus on the cognitive and constructive part. However, these findings do not suggest that feedback should not contain affective or emotional words, but rather cognitive and constructive.

Table 4. Multinomial logistic regression the essay writing improvement and received peer feedback quality.

Improvement categories	Peer feedback features		B	SE	Exp (B)	95% CI for Exp (B) Lower bound	95% CI for Exp (B) Upper bound
Less successful	Affective		0.30	1.19	1.34	0.14	13.97
	Cognitive	Description	−0.97	0.60	0.37	0.12	1.24
		Identification	0.11	0.64	1.12	0.36	3.60
		Justification	0.80	2.41	2.23	0.03	260.19
	Constructive		−1.18	0.98	0.30	0.05	2.12
	Course	Course A	−0.08	0.70	0.92	0.23	3.66
		Course B	−0.25	0.67	0.77	0.20	2.88
		Course C	−0.04	0.54	0.96	0.33	2.77
		Course D	0.03	0.50	1.03	0.38	2.78
	Educational level		−0.07	0.35	0.92	0.46	1.84
Successful	Affective		−1.40	1.08	0.25	0.03	2.09
	Cognitive	Description	−1.58	0.54	0.20**	0.07	0.61
		Identification	−0.07	0.57	0.93	0.34	2.71
		Justification	2.75	2.09	15.78	0.42	1085.633
	Constructive		−1.76	0.87	0.17*	0.03	0.99
	Course	Course A	−0.31	0.62	0.73	0.21	2.50
		Course B	−0.51	0.58	0.60	0.18	1.88
		Course C	−0.27	0.48	0.76	0.29	1.97
		Course D	−0.09	0.45	0.90	0.37	2.19
	Educational level		−0.03	0.31	0.96	0.52	1.78

Note: Model $\chi^2 = 33.26$; $P < 0.05$, −2 log likelihood = 557.28, Pearson $\chi^2 = 548.97$, $p > 0.05$; Deviance $\chi^2 = 557.28$, $p > 0.05$; Pseudo R^2 (Cox and Snell = 0.11, Nagelkerke = 0.12, McFadden = 0.05).
Improvement categories: dependent variable; Peer feedback features: independent variable
The reference category is: unsuccessful

Affective feedback can provoke peers' emotional reactions and may affect their willingness to uptake the received feedback (Sargeant et al., 2006).

The findings of this study also showed that, in general, students provided more affective feedback compared to cognitive and constructive feedback. These findings are consistent with the findings of Cheng and Hou (2015) and Tsai and Liang (2007). Similarly, Foo (2021) found that students' feedback lacks constructive solutions for further improvements. A plausible reason to explain this finding is that providing cognitive and constructive feedback requires students to have high-cognitive thinking skills to critically evaluate and analyze the quality of the essay, see the problems, and creatively offer recommendations for further improvements (Lafiti et al., 2021). In addition, to evaluate the quality of the essay, students need to have a high level of domain-specific knowledge, so they can provide cognitive and constructive feedback (Valero Haro et al., 2019, 2020; van Zundert et al., 2012). Similarly, Li et al. (2010) and McCarthy (2017) explain that students may not have the necessary skills to provide constructive feedback due to a lack of content knowledge. This suggests that to assist students to provide cognitive and constructive feedback, they should be supported in the peer feedback process in different ways including providing some educational support on how to provide quality feedback and also supports on how to get the required domain-specific knowledge on the topic to be able to evaluate the quality of the essay.

Furthermore, we found that students' success in essay writing was predicted by descriptive and constructive features of received peer feedback. This indicates that students who received a summary statement of their essay and points for improvement from their peers were more likely to improve their essay in the revised version. This is in line with the prior studies that highlight the importance of descriptive and constructive features of feedback for peers' work improvement (Winstone et al., 2016; Yuan & Kim, 2015). For example, Gielen et al. (2010) showed that feedback with clear suggestions results in better learning outcomes. In line with this study, Lu and Law (2012) pointed out that high-quality feedback entails a summary of the work and suggestions for improvements. These results indicate that both descriptive and constructive feedback features play a key and effective role in student success in peer feedback performance.

Conclusion, limitations, and future research

This study contributes to extending our knowledge of students' peer feedback process and performance and provides insights into how successful, less successful, and unsuccessful students differ in their peer feedback performance for argumentative essay writing. This study revealed that the nature of received feedback plays a critical role in students' success in argumentative essay writing. Feedback with descriptive information (cognitive feedback) and suggestions for further improvements (constructive feedback) was found to be more effective in improving students' argumentative essay writing. This study suggests that for a good performance in argumentative essay writing, students should be encouraged to provide more cognitive and constructive feedback than affective feedback. Despite the effectiveness of the cognitive and constructive feedback, students typically tend to provide more affective feedback. This implies that students should be supported in to provide higher-order types of feedback.

In this study, students had a choice to select one topic among three offered topics. It is possible that the selection of a topic based on students' choices may have influenced the findings of this study. Therefore, the findings of this study should be interpreted with respect to this matter. For future studies, we suggest exploring how different topics may result in different received feedback patterns and uptake among successful, less successful, and unsuccessful students. In addition, although we explored what features of the received feedback can predict students' success or failure in their argumentation performance in essay writing in the present study, we did not explore the role of provided feedback features in students' argumentative essay writing. It would be interesting to explore this in future studies and compare the effectiveness of the received and provided feedback features on students' performance in argumentative essay writing. This can

provide insights into the role of the assessor and assessee in the feedback process and its impacts on students' performance in the context of essay writing in higher education.

Prior studies suggest that students' performance in peer feedback can be influenced by their gender identity (Noroozi et al., 2020), self-efficacy (Wang & Wu, 2008), motivation (Tseng & Tsai, 2010), and cultural background (e.g. language, nationality, and religion) (Tsemach & Zohar, 2021). In addition, since peer feedback is an internal and social process (Huisman et al., 2018), interpersonal factors including perceptions of feedback, trust, psychological safety, and social interdependence can also affect students' argumentation performance. For future studies, we suggest considering these elements in studying the receiving and/or uptake of peer feedback among unsuccessful, less successful, and successful students.

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Statements on open data, ethics, and conflict of interest

The data presented in this study is available upon request to the first author. Furthermore, upon request, the link to the various modules of the Brightspace environment can be provided by the first author with a username and password. Ethical approvals of this study were guaranteed by the hosting institution. All the information collected from this study has been kept confidential. Students were informed in advance that the data from this experiment will be used for research purposes. In addition, the authors declare that they have no conflict of interest to disclose.

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References

Aghaee, N., & Hansson, H. (2013). Peer portal: Quality enhancement in thesis writing using self-managed peer review on a mass scale. *The International Review of Research in Open and Distributed Learning*, *14*(1), 186–203. https://doi.org/10.19173/irrodl.v14i1.1394

Carless, D., Salter, D., Yang, M., & Lam, J. (2011). Developing sustainable feedback practices. *Studies in Higher Education*, *36*(4), 395–407. https://doi.org/10.1080/03075071003642449

Cheng, K. H., & Hou, H. T. (2015). Exploring students' behavioural patterns during online peer assessment from the affective, cognitive, and metacognitive perspectives: A progressive sequential analysis. *Technology, Pedagogy and Education*, *24*(2), 171–188. https://doi.org/10.1080/1475939X.2013.822416

Coté, R. A. (2014). Peer feedback in anonymous peer review in an EFL writing class in Spain. *GIST Education and Learning Research Journal*, *9*, 67–87. https://doi.org/10.26817/16925777.144

Devon, J., Paterson, J. H., Moffat, D. C., & McCrae, J. (2015). Evaluation of student engagement With peer feedback based On student-generated MCQs. *Innovation in Teaching and Learning in Information and Computer Sciences*, *11*(1), 27–37. https://doi.org/10.11120/ITAL.2012.11010027

Dominguez, C., Cruz, G., Maia, A., Pedrosa, D., & Grams, G. (2012). Online peer assessment: An exploratory case study in a higher education civil engineering course. *2012 15th International Conference on Interactive Collaborative Learning, ICL 2012*, 1–8. https://doi.org/10.1109/ICL.2012.6402220.

Donia, M. B. L., Mach, M., O'Neill, T. A., & Brutus, S. (2021). Student satisfaction with use of an online peer feedback system. *Assessment & Evaluation in Higher Education*, *47*(0), 269–283. https://doi.org/10.1080/02602938.2021.1912286

Du, X., Zhang, M., Shelton, B. E., & Hung, J. L. (2019). Learning anytime, anywhere: A spatio-temporal analysis for online learning. *Interactive Learning Environments*, 34–48. https://doi.org/10.1080/10494820.2019.1633546

Ekahitanond, V. (2013). Promoting university students' critical thinking skills through peer feedback activity in an online discussion forum. *Alberta Journal of Educational Research*, *59*(2), 247–265. https://doi.org/10.11575/AJER.V59I2.55617

Er, E., Dimitriadis, Y., & Gašević, D. (2020). Collaborative peer feedback and learning analytics: Theory-oriented design for supporting class-wide interventions. *Assessment & Evaluation in Higher Education*, 169–190. https://doi.org/10.1080/02602938.2020.1764490

Fan, C. Y., & Chen, G. D. (2019). A scaffolding tool to assist learners in argumentative writing. *Computer Assisted Language Learning*, *34*(1–2), 159–183. https://doi.org/10.1080/09588221.2019.1660685

Fan, Y., & Xu, J. (2020). Exploring student engagement with peer feedback on L2 writing. *Journal of Second Language Writing*, *50*, 100775. https://doi.org/10.1016/j.jslw.2020.100775

Ferretti, R. P., & Graham, S. (2019). Argumentative writing: Theory, assessment, and instruction. *Reading and Writing*, *32*(6), 1345–1357. https://doi.org/10.1007/S11145-019-09950-X

Fleiss, J. L. (1971). Measuring nominal scale agreement among many raters. *Psychological Bulletin*, *76*(5), 378–382. https://doi.org/10.1037/h0031619

Foo, S. Y. (2021). Analysing peer feedback in asynchronous online discussions: A case study. *Education and Information Technologies*, *26*(4), 4553–4572. https://doi.org/10.1007/S10639-021-10477-4

Gielen, S., Peeters, E., Dochy, F., Onghena, P., & Struyven, K. (2010). Improving the effectiveness of peer feedback for learning. *Learning and Instruction*, *20*(4), 304–315. https://doi.org/10.1016/j.learninstruc.2009.08.007

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research*, *77*(Issue 1), 81–112. https://doi.org/10.3102/003465430298487

Hsia, L. H., Huang, I., & Hwang, G. J. (2016). Effects of different online peer-feedback approaches on students' performance skills, motivation and self-efficacy in a dance course. *Computers & Education*, *96*, 55–71. https://doi.org/10.1016/j.compedu.2016.02.004

Huisman, B., Saab, N., van Driel, J., & van den Broek, P. (2018). Peer feedback on academic writing: Undergraduate students' peer feedback role, peer feedback perceptions and essay performance. *Assessment & Evaluation in Higher Education*, *43*(6), 955–968. https://doi.org/10.1080/02602938.2018.1424318

Kollar, I., & Fischer, F. (2010). Peer assessment as collaborative learning: A cognitive perspective. *Learning and Instruction*, *20*(4), 344–348. https://doi.org/10.1016/j.learninstruc.2009.08.005

Latifi, S., & Noroozi, O. (2021). Supporting argumentative essay writing through an online supported peer-review script. *Innovations in Education and Teaching International*, *58*(5), 501–511. https://doi.org/10.1080/14703297.2021.1961097

Latifi, S., Noroozi, O., & Talaee, E. (2020). Worked example or scripting? Fostering students' online argumentative peer feedback, essay writing and learning. *Interactive Learning Environments*, 1–15. https://doi.org/10.1080/10494820.2020.1799032

Latifi, S., Noroozi, O., & Talaee, E. (2021). Peer feedback or peer feedforward? Enhancing students' argumentative peer learning processes and outcomes. *British Journal of Educational Technology*, *52*(2), 768–784. https://doi.org/10.1111/bjet.13054

Li, L., Liu, X., & Steckelberg, A. L. (2010). Assessor or assessee: How student learning improves by giving and receiving peer feedback. *British Journal of Educational Technology*, *41*(3), 525–536. https://doi.org/10.1111/j.1467-8535.2009.00968.x

Liu, E. Z. F., & Lin, S. S. J. (2007). Relationship between peer feedback, cognitive and metacognitive strategies and achievement in networked peer assessment. *British Journal of Educational Technology*, *38*(6), 1122–1125. https://doi.org/10.1111/j.1467-8535.2007.00702.x

Liu, N. F., & Carless, D. (2006). Peer feedback: The learning element of peer assessment. *Teaching in Higher Education*, *11*(3), 279–290. https://doi.org/10.1080/13562510600680582

Lizzio, A., & Wilson, K. (2008). Feedback on assessment: Students' perceptions of quality and effectiveness. *Assessment & Evaluation in Higher Education*, *33*(3), 263–275. https://doi.org/10.1080/02602930701292548

Lu, J., & Law, N. (2012). Online peer assessment: Effects of cognitive and affective feedback. *Instructional Science*, *40*(2), 257–275. https://doi.org/10.1007/s11251-011-9177-2

McCarthy, J. (2017). Enhancing feedback in higher education: Students' attitudes towards online and in-class formative assessment feedback models. *Active Learning in Higher Education*, *18*(2), 127–141. https://doi.org/10.1177/1469787417707615

Misiejuk, K., Wasson, B., & Egelandsdal, K. (2021). Using learning analytics to understand student perceptions of peer feedback. *Computers in Human Behavior*, *117*, 1–13. https://doi.org/10.1016/j.chb.2020.106658.

Nelson, M. M., & Schunn, C. D. (2009). The nature of feedback: How different types of peer feedback affect writing performance. *Instructional Science*, *37*(4), 375–401. https://doi.org/10.1007/s11251-008-9053-x

Nicol, D., Thomson, A., & Breslin, C. (2014). Rethinking feedback practices in higher education: A peer review perspective. *Assessment & Evaluation in Higher Education*, *39*(1), 102–122. https://doi.org/10.1080/02602938.2013.795518

Noroozi, O., Banihashem, S. K., Taghizadeh Kerman, N., Parvaneh Akhteh Khaneh, M., Babayi, M., Ashrafi, H., & Biemans, H. J. (2022). Gender differences in students' argumentative essay writing, peer review performance and uptake in online learning environments. *Interactive Learning Environments*, 1–15. https://doi.org/10.1080/10494820.2022.2034887

Noroozi, O., Biemans, H., & Mulder, M. (2016). Relations between scripted online peer feedback processes and quality of written argumentative essay. *The Internet and Higher Education*, *31*, 20–31. https://doi.org/10.1016/j.iheduc.2016.05.002

Noroozi, O., & Hatami, J. (2019). The effects of online peer feedback and epistemic beliefs on students' argumentation-based learning. *Innovations in Education and Teaching International*, *56*(5), 548–557. https://doi.org/10.1080/14703297.2018.1431143

Noroozi, O., Hatami, J., Bayat, A., van Ginkel, S., Biemans, H. J., & Mulder, M. (2020). Students' online argumentative peer feedback, essay writing, and content learning: Does gender matter? *Interactive Learning Environments*, *28*(6), 698–712. https://doi.org/10.1080/10494820.2018.1543200

Novakovich, J. (2016). Fostering critical thinking and reflection through blog-mediated peer feedback. *Journal of Computer Assisted Learning*, *32*(1), 16–30. https://doi.org/10.1111/jcal.12114

Patchan, M. M., Schunn, C. D., & Correnti, R. J. (2016). The nature of feedback: How peer feedback features affect students' implementation rate and quality of revisions. *Journal of Educational Psychology*, *108*(8), 1098–1120. https://doi.org/10.1037/edu0000103

Qin, J., & Karabacak, E. (2010). The analysis of toulmin elements in Chinese EFL university argumentative writing. *System*, *38*(3), 444–456. https://doi.org/10.1016/j.system.2010.06.012

Reinholz, D. L. (2018). Three approaches to focusing peer feedback. *International Journal for the Scholarship of Teaching and Learning*, *12*(2), 1–8. https://doi.org/10.20429/ijsotl.2018.120210.

Ruegg, R. (2015). Differences in the uptake of peer and teacher feedback. *RELC Journal*, *46*(2), 131–145. https://doi.org/10.1177/0033688214562799

Sargeant, J., Mann, K., Sinclair, D., Van Der Vleuten, C., & Metsemakers, J. (2006). Understanding the influence of emotions and reflection upon multi-source feedback acceptance and use. *Advances in Health Sciences Education*, *13*(3), 275–288. https://doi.org/10.1007/S10459-006-9039-X

Shi, M. (2019). The effects of class size and instructional technology on student learning performance. *The International Journal of Management Education*, *17*(1), 130–138. https://doi.org/10.1016/j.ijme.2019.01.004

Shute, V. J. (2008). Focus on formative feedback. *Review of Educational Research*, *78*(1), 153–189. https://doi.org/10.3102/0034654307313795

Strijbos, J. W., Narciss, S., & Dünnebier, K. (2010). Peer feedback content and sender's competence level in academic writing revision tasks: Are they critical for feedback perceptions and efficiency? *Learning and Instruction*, *20*(4), 291–303. https://doi.org/10.1016/j.learninstruc.2009.08.008

Tian, L., & Zhou, Y. (2020). Learner engagement with automated feedback, peer feedback and teacher feedback in an online EFL writing context. *System*, *91*, 102247. https://doi.org/10.1016/j.system.2020.102247

Topping, K. J. (2009). Peer assessment. *Theory Into Practice*, *48*(1), 20–27. https://doi.org/10.1080/00405840802577569

Tsai, C.-C., & Liang, J.-C. (2007). The development of science activities via on-line peer assessment: The role of scientific epistemological views. *Instructional Science*, *37*(3), 293–310. https://doi.org/10.1007/S11251-007-9047-0

Tsemach, E., & Zohar, A. (2021). The intersection of gender and culture in argumentative writing. *International Journal of Science Education*, *43*(6), 969–990. https://doi.org/10.1080/09500693.2021.1894499

Tseng, S. C., & Tsai, C. C. (2010). Taiwan college students' self-efficacy and motivation of learning in online peer assessment environments. *The Internet and Higher Education*, *13*(3), 164–169. https://doi.org/10.1016/j.iheduc.2010.01.001

Valero Haro, A., Noroozi, O., Biemans, H., & Mulder, M. (2020). Argumentation competence: Students' argumentation knowledge, behavior and attitude and their relationships with domain-specific knowledge acquisition. *Journal of Constructivist Psychology*, 123–145. https://doi.org/10.1080/10720537.2020.1734995

Valero Haro, A., Noroozi, O., Biemans, H. J., & Mulder, M. (2019). The effects of an online learning environment with worked examples and peer feedback on students' argumentative essay writing and domain-specific knowledge acquisition in the field of biotechnology. *Journal of Biological Education*, *53*(4), 390–398. https://doi.org/10.1080/00219266.2018.1472132

van der Pol, J., van den Berg, B. A. M., Admiraal, W. F., & Simons, P. R. J. (2008). The nature, reception, and use of online peer feedback in higher education. *Computers & Education*, *51*(4), 1804–1817. https://doi.org/10.1016/j.compedu.2008.06.001

van Popta, E., Kral, M., Camp, G., Martens, R. L., & Simons, P. R. J. (2017). Exploring the value of peer feedback in online learning for the provider. *Educational Research Review*, *20*, 24–34. https://doi.org/10.1016/j.edurev.2016.10.003

van Zundert, M. J., Sluijsmans, D. M., Könings, K. D., & van Merriënboer, J. J. (2012). The differential effects of task complexity on domain-specific and peer assessment skills. *Educational Psychology*, *32*(1), 127–145. https://doi.org/10.1080/01443410.2011.626122

Wang, S. L., & Wu, P. Y. (2008). The role of feedback and self-efficacy on web-based learning: The social cognitive perspective. *Computers & Education*, *51*(4), 1589–1598. https://doi.org/10.1016/j.compedu.2008.03.004

Wingate, U. (2012). 'Argument!' helping students understand what essay writing is about. *Journal of English for Academic Purposes*, *11*(2), 145–154. https://doi.org/10.1016/j.jeap.2011.11.001

Winstone, N. E., Nash, R. A., Parker, M., & Rowntree, J. (2016). Supporting learners' agentic engagement With feedback: A systematic review and a taxonomy of recipience processes. *Educational Psychologist*, *52*(1), 17–37. https://doi.org/10.1080/00461520.2016.1207538

Wu, Y., & Schunn, C. D. (2020a). The effects of providing and receiving peer feedback on writing performance and learning of secondary school students. *American Educational Research Journal*, https://doi.org/10.3102/%2F0002831220945266

Wu, Y., & Schunn, C. D. (2020b). When peers agree, do students listen? The central role of feedback quality and feedback frequency in determining uptake of feedback. *Contemporary Educational Psychology*, *62*, 101897. https://doi.org/10.1016/j.cedpsych.2020.101897

Wu, Y., & Schunn, C. D. (2021). From plans to actions: A process model for why feedback features influence feedback implementation. *Instructional Science*, *49*(3), 365–394. https://doi.org/10.1007/S11251-021-09546-5

Yuan, J., & Kim, C. (2015). Effective feedback Design using free technologies. *Journal of Educational Computing Research*, *52*(3), 408–434. https://doi.org/10.1177/0735633115571929

Zhang, H., Song, W., Shen, S., & Huang, R. (2014). The effects of blog-mediated peer feedback on learners' motivation, collaboration, and course satisfaction in a second language writing course. *Australasian Journal of Educational Technology*, *30*(6), 670–685. doi:10.14742/ajet.860