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Using feedforward to improve pre-service teachers' academic writing and critical thinking skills

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Introduction: Literature to date indicates that constructive, timely, and personalized instructor feedback to student work boosts their academic performance. Peer feedback has been investigated extensively for the past three decades and has demonstrated its effectiveness where students were trained to give quality feedback. Little, however, is known about the use of feedforward as a strategy that focuses on future assignments and paves the way to improved performance.

Methods: This study followed an action research design using a mixed-method approach to examine the impact of feedforward on developing pre-service teachers' performance on two main skills: critical thinking and academic writing. The teacher researcher followed the same cohort of 14 Emirati pre-service teachers' over two semesters and used a pre- and post-test to collect quantitative data and a survey to collect qualitative data. Findings in this research study reveal that when using feedforwarding on the same cohort of 14 pre-service teachers over the period of two academic semesters, their scores on the post-test for the two skills improved.

Results: This new strategy promoted their motivation to improve their performance on the next task and enhanced the quality of their work. Findings also highlight potential reasons that inhibited the participants' ability to create rich assignments that include content-specific vocabulary and to make connections with the course content.

Discussion: This study implies for curriculum designers at the K-12 level to integrate authentic tasks that engage students with real-world problems and train them on inferring information as a scaffold to the development of their critical thinking skills.

KEYWORDS

feedforward, English as Foreign Language, pre-service teachers, action research, critical thinking

Introduction

Feedback is considered an integral part of formative assessment as it helps both teachers and students understand their progress in their courses. Feedback is essential for teachers as it helps them identify the skills students need to know, their current status, and the targets they need to reach (Brookhart, 2017). While feedback requires interaction with students, the existing literature indicates that most of the time, the occurrences of interaction during feedback are very minimal; feedback is still viewed as a mono-directional response from teacher to student (Merry et al., 2013). This drawback is what directed educators to develop the concept of feedforward.

Although feedback and feedforward both help in the process of student learning and student progress (Higgins et al., 2001; Gavaldon, 2019), feedforward is intended to pave the way for improved performance in future assignments (Koen et al., 2012). The purpose of this type of

response is to help students avoid making mistakes in the first place, even before starting the new assessment. The benefits of this approach can be extended to other assignments as well. Many studies were conducted to investigate the effect of feedforward on student performance. For example, the analysis of a study conducted by Selvaraj et al. (2021) authenticated that teachers' feedforward as a form of feedback practice is pertinent in assuring that students are informed of their academic development.

In the context of higher education, using the strategy of feedforward is mostly for the purpose of minimizing failure by supporting students who might face many challenges that negatively impact their performance. A study conducted by Saeed and Mohamedali (2022) suggests that feedforward approaches allow students to increase their overall effort when attempting summative assessments and, thus, improve their performance, engagement, and retention. Specifically, when using this strategy with the pre-service teachers, it helped them not only to know how they were doing now but also equipped them with the necessary means to make progress in their academic writing and critical thinking skills. Critical thinking and despite being a skill needed to prepare students for future job demands, is hardly being taught in higher education mainly due to difficulties in implementing it in classrooms (Abasaid and Ferreira, 2022).

In the teaching preparation programs, Emirati pre-service teachers reported finding their teaching preparation programs difficult as they sensed a gap between their knowledge and the level of knowledge required, especially that the courses were delivered in English and required high levels of critical thinking and reflective skills (Hojeij and Baroudi, 2018). Furthermore, these pre-service teachers were expected to deliver high quality assignments written with specific academic writing standards which they were not used to at the K-12 level. These standards include using content-specific language, understanding of developmentally appropriate information about learner needs and differences, reflecting deeply, using constructive discussion of observed events, and being proficient in a wide range of content-specific vocabulary contributing to meaningful communication. To that end feedforward as a form of feedback was used as an intervention in this current study with a cohort of 14 Emirati female pre-service teachers at one teaching preparation program at a university in the United Arab Emirates (UAE). This study aims to answer the following questions:

(1) What is the effect of feedforward on pre-service teachers' critical thinking skills?
(2) What is the effect of feedforward on pre-service teachers' academic writing skills?

Literature review

Feedforward as a student-centered teaching strategy

The concept of formative feedback is based on the socio-cognitive perspective of learning and specifically on the notion of the Zone of Proximal Development (ZPD) created by Vygotsky (Vygotsky and Cole, 1978). This zone determines the difference or distance that exists between what a person can do or develop individually and what he/she can achieve with the help of another. Building bridges between the learner and an expert adult or another experienced person involved in the learning process facilitates this development (Price et al., 2010). If teacher feedback is grounded in positive and constructive comments which help the students restructure their ideas, if it is given soon after the learning event which is receiving feedback, and if the student perceives it as individualized, it can support to improve their learning in some ways, such as helping them see their strengths and weaknesses and it can also guide them toward critical thinking (Gavaldon, 2019). As such, engaging students in the feedback provided by the teacher would enhance its' quality (Carless and Winstone, 2023) and give a sense of gratification which will increase students' intrinsic motivation toward the task performed (Ryan and Deci, 2000).

Feedback is usually given through different mediums; however, students sometimes fail to engage with the feedback provided by their teachers, especially through traditional channels (Higgins et al., 2001). Feedback, in this case, is not looked at as an ongoing process of learning; it is often regarded as a task that is specific to a certain assessment. Literature about feedback -a student-centered strategy- is controversial as generally students felt no benefits associated with feedback if given after they received their grades and if the teacher's comments were generic in nature (Wolstencroft and De Main, 2021). To that end, Carless and Winstone (2023) suggested for teachers to improve their feedback literacy to create a partnership and shared responsibilities and goals with their students. In other words, teachers must always seek to listen to students' struggles with the feedback and students must always share their successes and challenges when using feedback information (Carless and Winstone, 2023).

On another note, students thought about their feedback as a loop that needs closing through the process of feedforward (Reimann et al., 2019). Hence, the importance and value of feedforward as it focuses on future rather than on past experiences (Koen et al., 2012). Feedforward should complement the formative feedback process through which students may know and understand the goals they must achieve (Duncan, 2007). In the UAE, however, findings of a study done by Myers and Buchanan (2022) revealed that a majority of students who engaged with the feedback as feedforward achieved better results, and this reinforced the students' engagement with the feedback given and led to greater take up in future assignments, thereby ameliorating their understanding of the feedforward process and its value for them.

Feedforward is considered as a student-centered tool as it engages students in their assignments and promotes problem-based learning (Moallem and Webb, 2016). However, there were challenges in the actual implementation of the approach itself. Evans (2013) explains how the demands on the lecturer to support student access to and engagement in feedback exchanges are vast and require accurate diagnosis of academic and social needs, empathy with and understanding of the student perspective, and possession of the commensurate skills to employ appropriate scaffolding tools. By developing a dialog about learning through feedforward, concurrent and feedback evaluation, instructors are able to make real-time adjustments to their teaching and respond flexibly and quickly to the challenges of student needs (Cathcart et al., 2014). In order for educators to implement learner-focused evaluation cycles, they need to develop confidence in gathering and responding to feedback, flexibility in their approach to curriculum design, openness in their

discussions with learners, and belief in education as a co-operative enterprise (Cathcart et al., 2014).

Impact of feedforward on students' academic writing skills

Carter et al. (2018) used feedforward as a strategy to give meaningful feedback to a big cohort of nursing students by using exemplars to improve their academic writing skills. The authors concluded that there were different approaches to using the exemplars by the students and that they valued those exemplars and considered them a useful teaching tool. However, these benefits did not always manifest themselves in the students' results. Other studies emphasized the value of using feedforward in enhancing the students' academic writing skills, e.g., (Deyi, 2011; Jones, 2011; Ghazal et al., 2018; Schillings et al., 2018). Although several feedback practices rely on oral or written feedback, according to Quinn (2022) even videos can be used to give feedforward to help the students improve their writing skills. In the study, Quinn (2022) mentioned that the students valued the use of examples in their feedback videos; others reported immediate improvement to their writing grades after viewing one or more videos. Therefore, it is obvious that using videos as a tool of providing feedforward helps to integrate into the feedback practice. Yu and Liu (2021) introduced an evidence-based framework to offer feedforward for students to improve their academic writing skills. This framework is based on the scaffolding teachers and peers provide to students across the technical, social-interactive and individual levels. It displays the vital knowledge students need to understand and use feedback to enhance their academic writing.

Students in general need academic writing skills, an essential means of communication, to be at a certain level (Sultan, 2013). Literature provided evidence on the use of several techniques that would boost students' academic writing skills. These techniques include 1- the use of exemplars or worked examples (Yucel et al., 2014; Carless and Chan, 2017), 2- the use of assessment criteria (Elander et al., 2006), 3- the implementation of training or instruction (Taras, 2001, 2003), 4- the use of different modes of feedback provision (Morris and Chikwa, 2016; McCarthy, 2017), 5- the role of feedback in revision of writing products (Jonsson, 2012), and 6- the role of self-and/or peer assessment (Taras, 2001, 2003), and 7- the importance of the writing process itself (Cloutier, 2016). Each of these techniques contributes to improved insight into the development of academic writing skills. However, one of the most powerful single influences on achievement is feedback (Hattie and Timperley, 2007). This study focuses on the impact of feedforward on specific academic writing skills of pre-service teachers. Some of these include the use of content-specific language, the understanding of developmentally appropriate information about learner needs and differences, the depth of reflection and the use of constructive discussion of observed events, and the use of a wide range of content-specific vocabulary used that contributes to meaningful communication.

Impact of feedforward on students' critical thinking skills

Critical thinking is defined by Scriven and Paul (2003) as the process to conceptualize, apply, analyze, synthesize, and/or evaluate information collected from observation, experience, feedback, reasoning, or communication, as a way to believe and act. Critical thinking includes attitude, value and character; in other words, the whole being (Ekahitanond, 2013). The critical thinking skills focused on in this study revolved around acquiring and utilizing information, making valid conclusions, and selecting and integrating the appropriate supporting materials through the constant feedforward feedback given periodically after every assignment. Hill and West (2019) stated that feedforward helped in enhancing the whole learning experience for students by facilitating their long-term development. In large classes, it becomes very difficult for a lecturer to provide personalized feedback to support every learner. However, a study conducted by Rodriguez et al. (2022) concluded that even when the lecturer did not give individualized and personalized feedback, the students received enriched formative feedforward, and their critical thinking skills improved progressively from one assignment to the next. The model used in this study was when the lecturer gave general comments to students as feedforward in combination with anonymous personalized peer. Each student appreciated the fact that they not only received feedback but also gave feedback to their peers which contributed to the progress of their critical thinking skills. Furthermore, a study done by Ekahitanond (2013) revealed that students' critical thinking skills and attitudes increased significantly and correlated positively to using peer feedback strategies to learn content.

Another study conducted by Gashan (2015) revealed that pre-service teachers had positive impressions about the value of teaching critical thinking despite the lack of confidence in their own abilities in it. They expressed uncertainty as to whether they had the necessary skills to promote critical thinking in their students. The same study by Gashan (2015) recommended that education preparation programs need to be reviewed, and specialized courses in critical thinking skills need to be incorporated. Pre-service teachers' knowledge about critical thinking should be enhanced to enable them to reflect on what skills they apply in their future teaching duties. In Australia, Bahr (2010) findings showed that nurturing pre-service teachers critical thinking skills is best done through teaching critical thinking. Hence, it is essential that faculty know what critical thinking is and how it can be implemented in the subjects that they teach (Bahr, 2010; Abasaid and Ferreira, 2022).

Methodology

Research design

This study followed an action research design using a mixed-method approach to investigate the problem and find effective solutions using a systematic approach (Stringer, 2007; Gay et al., 2009). This research design focuses on a specific situation (i.e., improving critical thinking and academic writing skills among pre-service teachers) and localized solutions (i.e., using feedforward). Teachers who are involved in action research are believed to improve the quality of teaching and learning inside their classroom mainly because they examine their teaching practices and find solutions to teaching and learning problems (Gay et al., 2009; McNiff and Whitehead, 2011). Hence, the teacher researcher followed a pre- and post-test approach to collect quantitative data and a survey approach to collect qualitative data to investigate the effectiveness of using

feedback as feedforward to improve Emirati pre-service teachers' academic writing and critical thinking skills.

Participants and procedures

This study followed the same cohort of 14 Emirati undergraduate female pre-service teachers and the same instructor for two semesters during the academic year 2021–2022. Participants were enrolled in the first Practicum course and then the second Practicum course in two consecutive semesters. At the beginning of the first semester, the teacher noticed that the low student performance on their reflections was mainly due to their limited academic writing and critical thinking skills. The different techniques and best practices included: discussions, peer feedback, collaborative projects, and problem-based learning. When these were made available to improve students' critical thinking skills, the instructor adopted the feedforward strategy for its benefits mentioned in the section above. Pre-service teachers were expected to carry out six classroom observations during the first semester and another six in the second semester. After each observation, participants were required to write a reflection in English that used analytical and critical thinking skills when reflecting about the teaching and learning environment.

Participants' ages ranged between 18 and 20. They were all Arabic speaking, and the majority (86%) had graduated from public schools that follow the Ministry of Education curriculum. The teacher, PhD in Education studies, has been teaching the same course at the same university for over 3 years. She at once identified the problem, implemented the use of feedforward on each of the pre-service teachers' reflections, and collected both numerical and qualitative data to explore its impact on developing participants' academic writing and critical thinking skills. Hence, pre-service teachers were provided with feedback on their reflections and were asked to improve their following reflection by taking this feedback into consideration. This feedforward strategy was implemented on the participants' 12 reflections throughout the two semesters.

Data collection

After obtaining the ethical clearance from the institutional review board at the beginning of the action research project, the teacher (who is also one of the researchers of this study) used the critical analysis and academic writing rubrics as the first tools to collect quantitative data throughout the first and second semester after each participants' submission of their written reflections. The critical thinking rubric and the academic writing skills rubrics were adopted from the Foundation for Critical Thinking (n.d.) and from the same university, respectively. The critical thinking rubric collects participants reflective skills based on different criteria (acquiring and utilizing information, making valid conclusions, and selecting and integrating the appropriate supporting materials). The academic writing skills rubric focused on the participants' use of content-specific language, developmentally appropriate information about learner needs and differences, depth of reflection and use of constructive discussion of observed events, and a wide range of content-specific vocabulary that contributes to meaningful communication. The two rubrics used to analyze participants reflective and academic writing skills were based on a scale ranging from 1 to 4, from not evident to exemplary.

The second tool is a qualitative survey developed by the teacher to collect participants' perceptions about the use of feedforward and how it assisted them to develop their academic writing and critical analysis skills. The survey, which included a total of 12 open ended questions, was distributed to participants in class at the end of the second semester. The surveys were anonymous, and the teacher assured participants that the purpose of the survey was to learn about the use of this strategy and its effectiveness to improve their learning and the participation and that it would have no impact whatsoever on their course grades. Survey questions were based on the themes generated from the literature, such as looking at things from a different perspective (Cathcart et al., 2014) and being effective in promoting problem-based learning (i.e., Moallem and Webb, 2016). Other questions were added to clarify a few criteria analyzed in the rubric. Two examples of these questions follow. # 1: Were you able to use the feedback given to help you find information that would help support your position when writing the next observation? Explain how. # 3: Did the feedback provide you with insight into making valid conclusions? How? These open-ended questions gave participants the freedom to express their opinions and add suggestions about the process of using feedforward. Data collected from both tools were combined and analyzed to answer the research questions.

Data analysis

The quantitative data was analyzed using a scale ranging from 1 not evident to 4 exemplary on the rubrics used in both semesters. Data was analyzed by extracting the means of each rubric criteria and comparing student scores at the end of the first semester with their scores at the end of the second semester. Percentages were also calculated to show the performance of participants based on the marks used in the rubrics. Paired sample T-test analysis was conducted through the Statistical Package for Social Sciences (SPSS) software to investigate if there is a significant change in participants' scores following the implementation of feedforward intervention on students' academic writing and critical thinking skills. The Pearson Correlation Coefficient was calculated to examine relationships between variables. As for the qualitative data, participants' responses on the surveys were analyzed through content analysis approach and used to make connections with the quantitative results to triangulate the results and increase reliability of the study findings (Creswell, 2014). The process of the content analysis approach began by having the researchers developed a pre-defined set of categories (i.e., looking at things from a different perspective, receiving constructive feedback, using feedback to find relevant information, using feedback to make valid conclusions). Then each researcher was assigned with set of texts and each one analyzed and coded the content of the text based on the pre-defined categories but also allowed flexibility to add emergent categories (i.e., motivation). Similar codes ones were merged to summarize the data and to identify similarities and differences in participants answers. The researchers met to agree on the final list of codes in order to increase the reliability of resultant codes (Creswell, 2014).

To increase the reliability of resultant codes and themes, the researcher sent various interview transcripts and the list of codes to

her coder colleague in order to obtain agreement on the final codes. All identified themes and sub-themes were organized in Table 1 below. These themes provided evidence that sustainable PDs support teachers in their roles and hence enhance the learning experience.

Results

Analysis of the quantitative data regarding the impact of feedforward revealed minor improvement in their critical thinking skills. The first semester results are calculated as the average of the first six reflections done and are considered as pre-test results to enable comparison between means between the first and second semesters. The total number of reflections for the first semester is $N = 84$ (14 pre-service students x 6 reflections). The results are as follow: 0% indicated (1—not evident); 14% indicated (2—emerging); 72% indicated (3--proficient); and 14% indicated (4—exemplary). At the end of Semester 2, the same critical thinking rubric used for the first semester reflections was used to grade participants' critical thinking skills in the last six reflections done and the scores ranged from 1 to 4. The total number of reflections for the second semester is $N = 84$ (14 pre-service students x 6 reflections). These scores, considered as post-test results were as follow: 0% indicated (1); 1% indicated (2); 79% indicated (3); and 21% indicated (4). The qualitative results validate this finding in particular when participants were asked about whether the feedback helped with looking at things from a different perspective while conducting their reflections. Nine out of the 14 participants said *yes*. One participant mentioned, "… the feedback given by the instructor on my reflections made me think as a teacher and use my thinking skills to find ways to better support the students." Another participant mentioned, "Now I know the correct way to write and show critical thinking skills when writing reflections."

When looking at the mean score of each criterion for measuring the critical thinking skills on the pre and post-test results (Tables 1, 2 below), it was evident that participants' scores improved on each criterion. The largest improvement is seen in the criteria related to "understanding the problem" and "concluding information" with a mean difference of 0.52 and 0.53, respectively. Students showed minimal improvement on one criterion namely "acquiring information" with a mean difference of 0.02 between the post and pre-test results.

A paired sample T-test showed a significant difference in participants' academic scores in the pre-test ($M = 2.84$, SD = 0.48) and post-test ($M = 3.08$, SD = 0.33), $t(13) = -2.74$, $p < 0.05$(two-tailed). Given the eta squared value of 0.33 we can conclude that there was a small effect, with a substantial difference in the critical thinking scores obtained before and after the intervention.

TABLE 1 Critical thinking pre-test mean and SD.

	Min	Max	Mean	SD
Understand problem	2.30	4.00	3.18	0.47
Acquire info	2.20	3.80	2.90	0.51
Utilize info	2.00	3.70	2.75	0.53
Conclude info	2.00	3.70	2.53	0.54

$N = 84$.

As for the impact of feedforward on participants' academic writing skills, the analysis of data revealed noticeable improvement. The pre-test results are the average of the first six reflections done. The percentage of pre-service teachers indicated: not evident (1), emerging (2), proficient (3), and exemplary (4) at the pre-test were 0, 40, 53, and 7%, respectively. The results of the post-test results at the end of Cycle 2 are the average of students' scores on the last 6 reflections done. The same academic writing rubric used for Semester 1 (pre-test) reflections was used to grade the academic writing skills in the last six reflections done with the scores ranging from 1 to 4. The percentage of responses indicted the following result: 0% indicated (1) 7% indicated (2) 73% indicated (3) and 20% indicated (4).

Qualitative results corroborate this finding, as 10 out of the 14 participants who completed the qualitative survey said that the feedback provided support to improve their writing in their next reflection. The feedback included valid examples and helped the participants to make valid conclusions. As one participant mentioned, "I had detailed feedback on every mistake I made and that allowed me to improve my next reflection and I got higher grades after fixing my mistakes." Another participant said, "I was able to provide good structural sentences that were relevant due to the feedback."

A paired sample T-test was conducted to evaluate the impact of the intervention on participants' academic writing scores. There was a significant difference in their academic scores on the pre-test ($M = 2.64$, SD = 0.63) and post-test ($M = 3.05$, SD = 0.45), $t(13) = -3.54$, $p < 0.005$ (two-tailed). The mean increase in the scores was −0.41 with a 95% confidence interval ranging from −0.67 to −0.16 after implementation of the intervention. Given the eta squared value of 0.95 we can conclude that there was a large effect, with a substantial difference in the academic writing scores obtained before and after the intervention.

When looking at the mean score of each criterion for measuring the academic writing skills on the pre and post-test results (Tables 3, 4 below), it was evident that students' scores improved on each skill except for the language criteria (mean difference = −0.34). The largest

TABLE 2 Critical thinking post-test mean and SD.

	Min	Max	Mean	SD
Understand problem	3.30	4.00	3.70	0.29
Acquire info	2.00	3.50	2.92	0.39
Utilize info	2.30	3.80	2.84	0.47
Conclude info	2.70	4.00	3.06	0.39

$N = 84$.

TABLE 3 Academic writing pre-test mean and SD.

	Min	Max	Mean	SD
Content	1.50	4.00	2.65	0.82
Knowledge	1.30	3.80	2.66	0.86
Depth	1.00	3.50	2.13	0.75
Language	2.70	4.00	3.57	0.39
Reference	1.70	4.00	2.96	0.70

$N = 84$.

improvement was seen in the content and depth criteria with a mean difference of 0.52 and 0.50, respectively.

When evaluating the models of each of the academic writing and critical thinking skills, the adjusted R square showed that for the first skill (academic writing) these variables: content, language, depth, and knowledge predict 99% of the total dependent variable. The independent variables "knowledge" and "depth" made the largest contributions to the model with, respectively, beta coefficients of $b = 0.38$ and $b = 0.31$.

As for the second skill (critical thinking), the adjusted R square showed that these variables: utilizing information, acquiring information, understanding the problem, concluding information, and references used explain 99% of the variance in students' skills. Utilizing information made the strongest contribution (beta = 0.42). All variables made statistically significant contribution to the prediction of the dependent variable critical thinking ($p < 0.05$) except for the use of references $p = 0.41$.

The clarity of the feedback and its consistency with the grades were important factors that increased participants' academic writing and critical thinking skills as reported by majority of participants. When asked about clarity of the feedback, participants responded:

> "Totally, now I know how to write and observe the right way."
>
> "…It helps me clarify and understand the questions."

As for the consistency of the grades with the feedback given, the participants said:

> "…The more I fixed my mistakes, the higher my grades got."
>
> "…The feedback was showing the improvement I made…."

TABLE 4 Academic writing post-test mean and SD.

	Min	Max	Mean	SD
Content	2.60	4.00	3.17	0.40
Knowledge	2.20	4.00	3.07	0.52
Depth	2.00	3.60	2.80	0.55
Language	2.20	4.00	3.23	0.49
Reference	2.00	3.80	3.07	0.63

$N = 84$.

Furthermore, 11 out of the 12 participants said that the feedback provided them with motivation to do better on the next reflection, and some mentioned that they were motivated to become creative in their writing. When asked how the feedback was motivating, participants said the following:

> "It felt easier to accomplish higher grades because of how detailed the feedback was."
>
> "…Because I know that every feedback will improve my next reflection assignment."
>
> "….Because the instructor gives feedback to make my writing better and I should write information that supports my examples and points."

When examining the relationships between the dimensions of critical thinking and academic writing skills, Pearson correlation coefficient results in Table 5 below showed high significant strong positive correlation with two dimensions in particular with the use of content-specific vocabulary ($r = 0.539$, $p < 0.05$) and with the use of references ($r = 0.569$, $p < 0.05$).

Discussion

Personalized and timely feedback is an instructional strategy that is positively correlated with students' performance (Matcha et al., 2019). This study focused on using feedforward to support pre-service EFL teachers' reflections and improve their academic writing and critical thinking skills over a period of two semesters. Quantitative and qualitative data were analyzed separately but results were combined to achieve the aims of this study and present an overall view of the topic. Findings revealed significant difference in participants' academic writing and critical thinking scores on the pre- and post-test; however, minor improvement is seen when students were evaluated based on the acquisition of the information criteria. This latter is an important skill that enables students to analyze the issue in-depth and make rational evaluations with coherent connections between ideas and the course content, and come up with evidence-based conclusions (Kopzhassarova et al., 2016). This finding also explains the minimal improvement seen in their pre and post-test scores on their overall critical thinking skills. Nevertheless, studies like Bahr (2010) and

TABLE 5 Relationships between the dimensions of critical thinking and academic writing skills.

		Content	Knowledge	Depth	Language	Reference
Understand Problems	Pearson Correlation	0.041	0.218	0.265	0.353	0.353
	Sig. (2-tailed)	0.891	0.453	0.360	0.216	0.216
Acquire Info	Pearson Correlation	0.183	0.374	0.461	0.539*	0.569*
	Sig. (2-tailed)	0.531	0.188	0.097	0.047	0.034
Utilize Info	Pearson Correlation	0.047	0.237	0.240	0.305	0.375
	Sig. (2-tailed)	0.873	0.415	0.408	0.289	0.186
Conclude Info	Pearson Correlation	0.367	0.385	0.501	0.464	0.376
	Sig. (2-tailed)	0.196	0.174	0.068	0.095	0.186

$N = 84$.

Gashan (2015) demonstrated the significance for participants to be engaged themselves in critical thinking tasks to be able to transfer them to their students. According to Dakkak (2011), the curriculum adopted at public schools does not feature dimensions of critical thinking and problem solving skills.

Previous studies concluded that if the feedback contains constructive and individualized comments, it would help students see their strengths and weaknesses and guide them to improve their critical thinking (Gavaldon, 2019); however, findings of this study were inconsistent. It is argued that critical thinking is a very difficult skill to teach at the higher education level if students had not been engaged in these tasks themselves at the K-12 level (Wagie and Fox, 2005). It is the vision of the UAE is to advance the quality of education and become a provider of first rate education; therefore, curriculum designers must reconsider the development of curriculum at the K-12 level to include authentic tasks that would engage students in critical thinking skills to help them become problem solvers and build strategies that would make them better at their workplace. Despite this argument, qualitative results of this study showed that feedforward as a new form of feedback motivated students to perform better on the next task and improved the quality of their reflections. This type of intrinsic motivation was highlighted in the self-determination theory of Ryan and Deci (2000) as a factor that would push individuals to "seek new challenges, extend and exercise one's capacities, to explore, and to learn" (p. 70). As a result, increasing students' motivation in the classroom would make them more productive, committed, and persistent in accomplishing the task and acquiring better results (Lin et al., 2003).

In the context of this study, 14 pre-service teachers observed teaching in action and each wrote a total of 12 reflections in English. Two rubrics were used to assess their academic writing skills and critical thinking skills. The clarity of the feedback, its consistency with the rubric, and the exemplars given by the instructor helped pre-service teachers make valid conclusions and guided them in their academic writing. As such, it is noteworthy to highlight that the use of exemplars when providing feedforward is a catalyst to improve their academic writing skills (Carter et al., 2018). Furthermore, findings of this study showed a significance of 0.95 with a substantial difference in participants' academic writing scores obtained before and after the intervention. This finding is aligned with previous findings of Deyi (2011), Ghazal et al. (2018), Jones (2011), and Schillings et al. (2018) reporting on the association of feedforward on the development of students' academic writing skills.

In this study, academic writing was evaluated based on several criteria, namely: using content-specific language, understanding of developmentally appropriate information about learner needs and differences, reflecting deeply and the using constructive discussion of observed events, using a wide range of content-specific vocabulary used that contributes to meaningful communication. Participants' scores improved on all these criteria except for the last one "using a wide range of content-specific vocabulary that contributes to meaningful communication." Having not acquired enough information about the topic negatively impacted students' ability to build content-specific vocabulary in order to create rich reflections and make connections with the course content. Motivation to read and strong English reading skills are two significant factors impacting the Emirati students' performance and success (Eppard et al., 2020).

This study results show that if we were to improve EFL undergraduate students' critical thinking and academic writing skills, feedforward as a new form of feedback would be a beneficial tool only when it is not used in isolation; it should be accompanied with other tools that support the development of the language and reading fluency. This is what would generate more interest in doing the necessary research in order to acquire the information and build content specific vocabulary. In the same context of this study, Eppard et al. (2020) found that Listening While Reading is a strategy that had a positive impact on undergraduate Emirati EFL students' reading rate and accuracy which, in turn, improved their comprehension skills and vocabulary and increased their motivation to read when compared with a control group who did not use the same strategy. Another associated strategy could be the use of classroom debates to increase students' engagement with the feedback and improve their critical thinking skills particularly in the online setting (Hysaj and Hamam, 2021). Another tool that could also be beneficial is the use of the peer feedback strategy, but only if students are provided with proper training on how to give effective feedback on formal English language structures and global errors related to the content and organization of writing (Hojeij and Baroudi, 2018). Hence, effective and high quality peer feedback would increase students' performance as they approach the writing process from two different perspectives, as writers and as reviewers (Hojeij and Baroudi, 2018). It would also create awareness of their own writing strengths and weaknesses and raise ownership and autonomy (Gavaldon, 2019).

Implications, limitations and recommendations

This study implies the use of feedforward as new form of feedback is a tool to improve EFL pre-service teachers' academic writing and critical thinking skills provided it is constructive, clear, and rich with worked examples. Most of the time instructors complain that the time constraint deters their capacity to provide detailed and timely feedback (Henderson et al., 2019). If instructors are to adopt the intervention of feedforward and grade the same assignment multiple times, they are advised to make use of peer feedback as support. Integrating peer feedback in the feedforward strategy increases students' performance as it plays an active role in their learning process (Wolstencroft and De Main, 2021). Furthermore, it is recommended that curriculum designers at the K-12 level integrate authentic tasks that engage students with real-world problems and train them on inferring information as a scaffold to the development of their critical thinking skills.

Owing to the importance of technology in student learning, it is also recommended that researchers explore the impact of using videos when giving feedforward to help students improve their writing skills. Researchers are also invited to investigate the use of Yu and Liu (2021) feedforward framework featuring teacher- and peer-scaffolding across the technical, social-interactive and individual levels when showcasing exemplars of academic writing to students.

This study is limited to a small and homogenous sample of 14 Emirati female undergraduate students and limited to the same reflection assignment throughout the whole period, this imposing limitations on generalizing the results of this study to a wider population. However, the qualitative part of the study corroborates the quantitative findings and deepens the results significantly. Experimental research designs, for instance, are needed to investigate the impact of feedforward on their critical thinking skills by comparing two groups with the same assignment, one in English and

the other in Arabic to see if the language is a barrier to the development of their critical thinking skills. Lastly, to increase the reliability of findings, collecting the instructor's perceptions would have triangulated the data and provided a comprehensive picture about the topic investigated (Merriam and Tisdell, 2015).

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Research ethics committee at Zayed University. Ethical approval number is ZU21_163_F. The patients/participants provided their written informed consent to participate in this study.

Author contributions

SB, SA, and DH performed material preparation, data collection, and analysis. SB wrote the first draft of the manuscript. All authors contributed to the study conception and design, commented on previous versions of the manuscript, and read and approved the final manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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