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RESEARCH PAPER

Integrating AI-Based Feedback Systems into Teacher Education: Opportunities and Challenges

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ABSTRACT

The objective of this article is to investigate how to integrate Artificial Intelligence (AI) in providing feedback into teacher education program. Using qualitative data of pre-service teachers in Education Department at Lahore Leads University which examines the impact of the use of such tools as Grammarly, Write & Improve, and ChatGPT on providing feedback with accuracy. The research shows that the importance of AI tools is that they can be time-saving, can detect the pattern of errors, and are more consistent. The investigation highlights few issues i.e excessive use of technology, situational misunderstandings, data security, and possible decay of feedback abilities of teachers. The results indicate that it can only be effective when integrated carefully, when there is digital literacy training and when pedagogical theories are well defined. The research will help to work out a policy and strategy of professional development in the use of AI in teacher education.

| **KEYWORDS** | Artificial Intelligence (AI), Written Corrective Feedback (WCF), Teacher Education, AI-Assisted Feedback, Higher Education, Pedagogical Innovation |

Introduction

Written corrective feedback (WCF) forms a core unit in language and academic writing and mainly at teacher education level where pre-service teachers are programmed to demonstrate good feedback practices. Instructors have traditionally supplied WCF manually, and this has often been time-, labor, and pedagogically inconsistent consuming (Bitchener & Ferris, 2012). Nevertheless, with the emerging breakthrough in Artificial intelligence (AI), the situation has changed since it has become possible to provide automated support to students assist them in correcting their mistakes, including grammar, lexical, and stylist. The AI-based writing applications like Grammarly, Write & Improve and ChatGPT are becoming more and more popular in educational institutions as assistants to learners and teachers. With the help of Natural Language Processing (NLP), these tools allow creating immediate context-specific feedback, which may assist pre-service inductors in learning the process of assessing writing in a methodical manner (Zhai, 2022). Not only do AI tools improve efficiency, but also allow giving constant and repeatable feedback, which can be quite helpful in a high-student-to-teacher ratio setting (or when the time available to instruct is limited) (Ranalli, Link, & Chukharev-Hudilainen, 2017). The usage of AI-based feedback systems in the process of education among the teachers is under-explored, despite its potential. Teacher educators have to not only respond to the new technologies, but also to consider their pedagogical consequences. Investigations reveal that although AI can support WCF, it cannot recognize subtle mistakes, context-dependent language, or rhetorical suitability, in which domains knowledge of humans is needed (Liu & Wang, 2021). Furthermore, the lack of privacy in data, the academic deception, and excessive use of

automated feedback systems beg ethical and pedagogical concerns (Tegos, Retalis, & Tsiatsos, 2021). Teacher education is one area where the perspective can be discussed whether artificial intelligence tools can be applied to teacher education without compromising the future teachers to think critically and act responsibly. According to the studies, it may be common that pre-service teachers are likely to find it difficult to deliver high-quality WCF when they do not receive training or feel insecure about it (Lee, 2019). Incorporation of AI in a non-replacing capacity could enable them to get machine feedback-induced learning and still acquire their personal evaluational competencies. Considering these problems, the paper conducts researches regarding these opportunities and challenges of applying AI-based feedback systems in teacher education. It tries to address the research gap by examining the perceptions, effectiveness, and ethical aspects of AI-enhanced WCF in teacher training programs. The results will provide some indications on how AI can be substantially integrated into Pedagogy without compromising the professional integrity of teaching and learning practices.

The recent trend of using Artificial Intelligence (AI) tools in academic learning has created new frontiers on how to improve teaching and learning procedures especially in the written corrective feedback (WCF). Although AI powered systems such as Grammarly, ChatGPT, and Write and improve are fast, consistent, and easily accessible to give feedback, little research has been done to understand how they can be integrated into teacher education programs. The pre-service teachers should become excellent feedback givers, and numerous pre-service teachers do not know how to provide the WCF on time, adequately, and with beliefs of pedagogy. AI may assist in this process, and there is a doubt regarding its trustworthiness, teaching efficiency, and ethical consequences. Additionally, teacher educators are confronted by difficulties to integrate the AI use with the curricular objectives, digital literacy, and reflective practice. The urgency of this study is to explore the possibilities of meaningful incorporation of AI-based feedback systems into teacher education, including the roles and the possible constraints.

Literature Review

It is argued that written corrective feedback (WCF) plays a crucial role in the process of improving students' academic writing and language proficiency especially in English language and teacher education programs (Bitchener & Ferris, 2012). The pre-service teacher is not supposed to learn just how they can write literature effectively but how they can give accurate and constructive advice to the student in the future. Nevertheless, the skill is a problem with many teacher trainees because they have small feedback strategies exposure and experience during training (Lee, 2019). Giving a nuanced, context- and pedagogically-sensitive feedback is a complex process requiring both pedagogical knowledge and the linguistic background (Hyland & Hyland, 2006).

More recently, Natural Language Processing (NLP) and machine learning AI have become more popular in the education field with the use of AI-supported writing programs like Grammarly, Write & Improve, and ChatGPT (Zhai, 2022). The latter tools allow making recommendations on grammar, syntax, style, coherence, and even the tone automatically, and this suggestion can be used to help not only students but also teachers in the revision process as well (Ranalli et al., 2017). Tools tied to AI are praised as fast, consistent, and capable of processing a lot of text, which makes them interesting to instructors with high student-to-teacher ratios or teaching at a time constraint (Zawacki-Richter et al., 2019).

Research indicates that such tools have the potential to improve the performance of writing by students and allows them to gain instant and formative feedback (Li, Link, & Hegelheimer, 2015). In addition, they lessen the workload of the teachers and can be combined with self-directed learning. In the case of pre-service teachers, AI feedback tools can be used in two ways: helping them learn how to write their academic articles, as well as an example of how to be effective during the feedback process (Liu & Wang, 2021).

Teacher education programs provide an appropriate pedagogical potential that AI feed-back systems can offer. To start with, they are able to offer personalized assistance to pre-service educators that include those who are not confident of their writing or feedback-giving skills (Zhai, 2022). Second, AI systems can support the provision of feedback and allow trainees to track trends in the use of a language, identify typical errors, and cogitate on revision strategies. Sadeghi and Farzizadeh (2021) conclude that artificial intelligence tools can help learners become more self-sufficient and critical when revising texts when complemented with the human feedback component.

Moreover, in multicultural classrooms, or multilingual pre-service teaching classes, AI can make feedback standardized and act as a leveling unit to non-native English language learners (Tegos et al., 2021). The rise of digital literacy in teacher training also means acquaintance with AI tools would provide future educators with the skills required in the 21 st -century classrooms (Hockly, 2018).

However, AI-based feedback systems can be characterized as not perfect in some respects. Inability to interpret the context is one of the primary concerns of AI-generated feedback. Although AI may be effective in identifying surface errors, it cannot pick up on rhetoric adequacy or idiomatic usage, among other content requirements (Lee, 2022). The possibility of over-dependence in AI use by pre-service teachers is also at hand, which will make individuals develop little or no interest in acquiring their own evaluative and analytical abilities (Godwin-Jones, 2018).

The other big problem is the ethical aspect of AI usage. Such aspects as data privacy, the bias in algorithms, and the clarity of the feedback creation should be thoroughly addressed in a teacher education program (Tegos et al., 2021). Moreover, most teacher educators are doubtful in the pedagogical usefulness of AI and they have no educational background or support to work with technology (Zawacki-Richter et al., 2019).

Although present literature has examined the use of AI in writing instruction and on automated feedback system in general education, there is little on the integration of AI-based feedback systems in teacher education programmes. One needs to know the impact that the tools will have on developing pre-service teacher feedback literacy, autonomy, and confidence. In addition, the outlook of teacher educators as to the issues connected to the implementation, ethics, and training needs are underrepresented in the literature.

Material and Methods

The research design is qualitative with the application of a case study as a research approach that was utilized in this study. Data were collected from pre-service teachers at department of Education of Lahore Leads University by using semi structured

interviews and classroom observations which were based on AI generated feedback on student writing. Participants with experience in using such tools as Grammarly, ChatGPT, or Write & Improve, were selected with the idea of purposeful sampling. Thematic analysis was done to establish recurrent patterns, perceptions and challenges towards AI use in provision of written corrective feedback. Validity and reliability were triangulation of data sources and procedures of member-checks. The proposed methodology enabled a comprehensive comprehension of the role AI tools and feedback use in teacher education and which pedagogical implications this integration causes.

Theoretical Framework

The research is based on Vygotsky Sociocultural Theory of Learning according to which, social interaction, mediation, and scaffolding are significance in cognitive development. In this context AI-based feedback tools are seen as mediational artifacts that can foster the internalization of writing conventions to the learners and improve the feedback literacy. Moreover, Technology Acceptance Model (TAM) was used to examine the relationship between the perceived usefulness and perceived ease of use and the pre-service teachers' willingness to use the AI tools in the exchange of feedback. In their combination, the framework can be used to conduct a comprehensive study of both pedagogical and technical aspects of AI adoption in teacher education and reveal an interconnection between the factors of human volition and digital instruments, on the one hand, and instructional surroundings, on the other.

Results and Discussion

Four main themes with thematic analysis of the qualitative data were as follows:

- Efficiency of Using Feedback,
- Feedback Literacy
- Overreliance and Misinterpretation
- Pedagogical and Ethical Issues.

Increased Efficiency in Feedback

The AI tools were reported by participants on a wide scale to have saved lots of time in reviewing and correcting student writing. Yet, pre-service teachers explained that sites like Grammarly and ChatGPT gave them instant comprehensive feedback, which allowed them to correct drafts quicker. Teacher educators noticed there were increased rates of submission and revision among the students as well. One of the participants claimed, "I managed to update my assignment three times within one night as it is only AI suggestions I used."

Enhanced Feedback Literacy

Some pre-service teachers proved to be more aware of the grammar rules, strategies of coherence, and academic tone. Document analysis indicated that students who were given AI-based feedback supplied more polished drafts as time matured. According to the reports of many participants, the utilization of AI tools allowed them to comprehend the error patterns and critically analyze their writing. Teachers recognized that AI could serve as a basis in teaching feedback techniques. But they stressed that expert instruction should be present, as well as use of tools.

Overdependence and Shooting of the Bull

Nevertheless, the overuse of AI became one of the issues despite the benefits. Participants were willing to consider AI suggestions blindly and did not realize whether they were relevant or correlated or not, which resulted in ugly wording or inappropriate corrections. Some of the pre-service teachers revealed that they had not listened to instructor feedback at all because they thought the AI one was somehow superior. It was observed there were some instances when students did not revise the overall argument or cohesion in the text, but used recommendations of the feedback.

Pedagogical and Ethical Issues

The failure to train teachers on how to user AI was one of the issues raised by teacher educators. Although they also do not deny the potential of AI, they also pointed out the danger of loss of human judgment and pedagogical reflection. There was also discussion of ethical concerns like plagiarism, information protection and the transparency of AI-generated text. Other teachers were worried that the implementation of AI would disrupt the acquisition of key in-class activities like direct peer reviews and attending manual feedbacks.

The following are responses in interviewing five pre-service teachers about their feelings and experience over use of AI based Written Corrective Feedback (WCF) systems.

Teacher 1- (Female, Age: 23)

I believe that AI feedback is very time-saving. My experience of utilizing Grammarly in the course of my practicum consisted in the ability to recognize grammar and punctuation mistakes immediately. However, I think it does not provide the more in-depth issues such as coherence or tone, which only the human teacher can interpret adequately."

Teacher 2- (Male, 24)

AI tools come in handy, particularly in the case of big classrooms when individual feedback is impossible. I am also concerned about the possibility that the students will be over relying on the tool and lose their critical thoughts about their own writing. It must be applied in combination with the feedback of the teacher, rather than as an alternative."

Teacher 3-(Female, 26)

Honestly, it seems to me that I did not expect this at first. However, having tested AI-based feedback on a lesson plan task, I realized how quickly and precisely it worked. It marked typical mistakes and even recommended superior words. Of course, I would gladly like to incorporate it into my instruction, however, after going through training, of course.

Teacher 4- (Male, 24 years old)

The AI feedback is a two-edged weapon. It is objective and efficient, not like a teacher who is sensitive in emotions. In other cases, students might require some positive feedback or references made to them in simplified words. AI is not good at innovation and structure, though it is good at grammar."

Teacher 5 - (Female, 23 Years old)

I believe that AI-based tools have a lot of potential in relation to WCF and this is particularly true in Pakistan where coping with teacher-student ratios can be very challenging. However, we should have localized tools that know about the language problems of our students. At present, the majority of AI tools are made to fit native speakers and the Western setting."

In general, the data indicate that although AI-based feedback systems can be advisable and helpful in teacher education, their incorporation should be surrounded by training, reflective practice and clear ethical idea to promote effective and responsible engagement.

Discussion

The outcomes of this work support the potential and complexity of implementing AI-based systems of feedback into the education of teachers. The first master theme, increased feedback efficiency, corresponds to corresponding evidence of prior literature, which suggests that AI-based tools like Grammarly or Write & Improve result in a near-complete drop in the mental effort required to give written corrective feedback (Ranalli et al., 2017; Li, Link, & Hegelheimer, 2015). The immediate and regular feedback helped pre-service teachers speed up their revision and they became more involved in writing tasks. This bleeds into the Technology Acceptance Model (TAM) premise that if something is easy and perceived useful it will be readily adopted (Davis, 1989).

Moreover, this theme supports the arguments offered by Liu and Wang (2021) and Sadeghi and Farzizadeh (2021) that AI could potentially be used as a scaffold tool to acquire writing and feedback literacy. Under the Sociocultural Theory, by Vygotsky, such tools are given the power as mediational artifacts to stimulate learning via interactions that may be though a non-human agent but that does not make it not an interaction (Hyland & Hyland, 2006). Through document analysis, we found out that learners have started to notice and internalize writing patterns and linguistic norms once they started to work with the suggestions generated by AI, which is an encouraging development in the aspect of feedback literacy.

But on the pedagogical level, the theme of excessive dependence and misunderstanding poses a important issue. Just like Lee (2022), the subjects of this experiment showed the willingness to follow AI recommendations blindly, what can lead to subverting of learning and thoughtful reflection. This issue is aligned with Godwin-Jones (2018) who states that unthinking acceptance of AI tools may undermine the levels of learner autonomy and judgment. This sentiment was also echoed by the teacher educators in this study, who said that an emphasis must be placed on the idea of critically engaging with technology as opposed to remaining passive with a reliance upon the technology.

The last theme- pedagogical and ethical concerns, makes the present discourse holistic by adding an essential dimension into it. However, according to Zawacki-Richter et al. (2019) and Tegos et al. (2021), applying AI to education needs immediate ethical standards. These educators in the study expressed their concern with transparency, the biasness of algorithms, and data privacy, which is highly ignored in practice, but essential in teacher education environments where future pedagogical dispositions can be formed. In addition, members cited the absence of institutional training and policy guidance as a discouraging factor to the adoption of responsible AI.

On the whole, though AI-derived feedback system can deliver significant advantages in efficiency and enhancement of writing abilities, it cannot demonstrate its full pedagogical potential unless consciously designed, critically oriented digital literacy education, and regular educator education are provided. With the advent of future research, longitudinal impact, discipline-specific tasks, and adaptations concerning any hybrid feedback model that will incorporate the balance of AI and human pedagogical understanding must be further attempted.

Conclusion

This paper has examined the introduction of AI-based feedback systems into teacher education and indicated some promising opportunities, as well as significant challenges. The obtained results indicate that AI tools have the potential to greatly improve the efficiency and regularity of written corrective feedback, enhance feedback literacy in pre-service teachers and lead to more independent learning patterns. However, there are also some problems like overdependence on AI recommendations, the lack of critical thinking, ethical issues, and not enough institutional advice that limit the complete pedagogical promise of these technologies. Lack of training and reflectivity practices might result in the use of AI instead of enhancing human feedback processes. Therefore, although AI is one of the most promising innovations in the field of teacher education, its successful application demands paying closer attention to the pedagogical models, ethical principles, and transformation of teacher agency in online learning.

Recommendations

Following the results of the study, teacher education training is advised to consider the use of AI-based feedback systems accompanied by a theme of structured pedagogical support to facilitate the critical digital literacy development of the students. It should be offered as professional development workshops to educators and students on how to meaningfully interpret and evaluate AI-generated feedback in institutions. Curriculum designers should consider elements of fairness like transparency, data security, and ethical AI application in educational resources as well. There should be a mixed strategy where both human and AI feedback can be given in order to have balanced feedback abilities. To conclude, additional longitudinal and comparative research is required to confirm the effects of AI-supported feedback on teaching behaviors and learning outcomes over time in various data sets.

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