A review of research on technology-enhanced peer feedback for second language writing based on the activity theory framework

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Abstract

Technology-enhanced peer feedback (TEPF) activity has been increasingly investigated in L2 writing education. Researchers have conducted many review and meta-analysis studies on related research and identified factors influencing the activity effectiveness. However, few reviews have been conducted based on the activity theory that may clarify details of this learning approach and reveal how various factors influence the activity effectiveness. To fill in the gap, we reviewed 40 relevant articles from 2001 to 2021, following the activity theory. The findings showed that most TEPF activities were based on network-based social computing to enhance academic performance in English as L2 writing. College and university students with training experiences attended the activities independently or collaboratively as feedback givers and/or takers in anonymous, out-of-class, online settings for a long term. Learners may influence TEPF activities via peer feedback quality and the efficiency of peer interaction. Technology may influence the activities via peer feedback quality, learner emotions, and the efficiency of peer interaction and feedback generation, giving, taking and comprehension. Peer interaction may influence the activities via error identification, affective aspects, and knowledge and ideas of writing. Conditions may influence the activities via learners' experiences, trust in peers, devotion of effort and time, emotions and efficiency in peer interaction and feedback giving and taking. Mechanisms may influence the activities via learners' cognitive processes and active learning. Based on the results, we analysed the interactions in TEPF activities that may influence the activity effectiveness.

Keywords Peer feedback · Second and foreign language learning · Second language writing · Technology-enhanced language learning

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1 Introduction

Technology-enhanced peer feedback (hereinafter, TEPF) activity refers to an educational process in which students use new technology to evaluate their peers' L2 writing outcomes and provide feedback (Loncar et al., 2021; Yu & Lee, 2016a). For recent decades, this learning activity has been frequently implemented in L2 writing classrooms, attracting growing scholarly attention (Chen et al., 2016). Researchers have investigated the TEPF activity at different educational levels (Lv et al., 2021), in different conditions (Chen et al., 2016) and diversified writing tasks (Lv et al., 2021), and using different types of technology (Loncar et al., 2021). The overall effectiveness of TEPF activities has been identified in enriching opportunities for receiving L2 input (Yu & Lee, 2016a), improving affective states in L2 writing (Chen et al., 2016), developing constructive knowledge and critical thinking skills (Yu & Hu, 2017), and enhancing academic performance in L2 writing (Loncar et al., 2021). Along with the growing empirical research of TEPF activities for L2 writing, researchers have conducted review and meta-analysis studies in this field and identified many factors that may influence the effectiveness of TEPF activities, such as technology (Loncar et al., 2021), peer interaction (Yu & Lee, 2016a), training (Saeed et al., 2018), and educational level (Lv et al., 2021).

Despite the vital contributions, two limitations remain in current review studies of TEPF research. One concerns the details of factors that may influence the effectiveness of TEPF activities in empirical studies. These details appear meaningful for practitioners who aim to efficiently implement TEPF activities and achieve satisfactory outcomes, while few review studies have clarified these critical details. The other limitation regards the specific processes of these factors influencing the effectiveness of TEPF activities. These processes may deepen the understanding of TEPF activities and provide implications for future investigation and implementation of this learning method (see Maxwell, 2011, 2013), while few previous reviews have been conducted on this aspect.

To address the two limitations, reviewing previous research on TEPF activities based on the activity theory seems a promising approach. The activity theory is a framework for understanding interactions and contradictions in goal-directed activity systems (Engeström, 2001a, 2001b), useful in analysing peer feedback activities for L2 writing (e.g., in Yu & Lee, 2015; Yu & Lee, 2016b). In previous review studies, this theory has demonstrated advantages for clarifying factor-related details and processes in technology-enhanced learning activities (e.g., Chung et al., 2019; Frohberg et al., 2009). For example, Chung et al. (2019) applied the activity theory framework in their review of experimental mobile learning studies. Based on this framework, they clarified the details of this learning approach concerning learning settings, pedagogical designs, and technology affordances. They also pinpointed the major ways mobile technology influenced various learning activities. Hence, reviewing research on TEPF activities from the activity theory perspective is likely to clarify the details of factors that may influence the effectiveness of TEPF activities in current studies and illustrate the processes of how these factors exert influence. The findings of such a review can provide valuable implications for the future implementation of TEPC activities and enhance the understanding of this learning method.

We present a review of 2001–2021 research on TEPF activities for L2 writing based on the activity theory framework. By undertaking this review, we aim to (a) clarify the factor-related details of TEPF activities for L2 writing, (b) explore the factor-related processes influencing the effectiveness of TEPF activities, (c) analyse the interactions among factors influencing the effectiveness of TEPF activities, and (d) provide implications for future investigation and implementation of TEPF activities. Two questions guided this study:

1) What are the factor-related details of TEPF activities for L2 writing in 2001–2021 studies from the perspective of the activity theory?
2) What factor-related processes influence the effectiveness of TEPF activities for L2 writing in 2001–2021 studies from the perspective of the activity theory?

2 Literature review

2.1 Peer feedback activity

The peer feedback activity refers to the educational approach in which learners analyse and evaluate peers' academic proficiency and generate feedback accordingly (Double et al., 2020; Topping, 1998). Feedback contents consist of grading or scoring, corrections, elaborate comments, and suggestions for improvement (Hansen & Liu, 2005; Topping, 1998). Unlike collaborative learning activities, peer feedback activities require the interaction between feedback givers and takers after the completion of academic work or performance, rather than during the working or performing process (Storch, 2019; Zhang & Zou, 2021). Givers and takers of feedback should have similar, if not the same, L2 learning goals.

In recent decades, peer feedback activities have been frequently applied across domains and subjects (Double et al., 2020), demonstrating overall usefulness. Double et al. (2020) reviewed 54 experimental and quasi-experimental studies on peer feedback activities. They found that this activity could improve academic performance across domains, although not significantly (Hedges'g=0.31, p=.004). The activity effectiveness may be moderated by activity frequency, technology, and students' education levels. Similarly, Li et al. (2020) conducted a meta-analysis of 58 studies on peer feedback activities published from 1950 to 2017. They reported significant effects of this activity on enhancing students' academic performance (Hedges'g=0.291, p<.000) and identified feedback training and technology as the main factors influencing the activity effectiveness.

2.2 Technology-enhanced peer feedback (TEPF) for L2 writing

Previous studies have evidenced the overall effectiveness of peer feedback activities for L2 writing (Lv et al., 2021; Saeed et al., 2018; Yu & Lee, 2016). For example, Yu and Lee (2016) reviewed 2005–2014 studies on peer feedback activity for L2 writing. They found that the activity facilitated L2 writing by enhancing reader awareness, autonomy, self-regulation, engagement in meaning negotiation, and social support.

Lv et al., (2021) conducted a meta-analysis of 17 studies on online feedback activity for EFL writing. They identified overall positive effects (Hedges'g=0.777) of the online peer feedback activity on L2 writing from global and local dimensions.

Along with the rapid growth of technology-enhanced L2 learning (Chen et al., 2021b; Zhang & Zou, 2020), technology has been increasingly integrated into peer feedback activities for L2 writing (Chen, 2016; Loncar et al., 2021). Loncar et al., (2021) reviewed 2015–2019 studies on technology-enhanced feedback activities for L2 writing, identifying five main categories of technology in the activities: individual study tools (e.g., grammar checkers), cloud-based word processors and shared documents (e.g., Google Docs), network-based social computing (e.g., blogs, wikis and digital games), schoolhouse or classroom-based technologies (e.g., course management systems), and web-based emails. Chen (2016) reviewed 20 articles on computer-mediated peer feedback activity for English as a foreign language (EFL) writing. They found that technology could enhance the effectiveness of peer feedback activity by reducing learner pressure, expediting feedback production and provision, encouraging free and creative self-expression, and enriching learning opportunities.

Researchers have identified various factors that may influence the effectiveness of TEPF. For example, Lv et al. (2021) found that the online feedback activity might be the most effective for L2 writing when the participants were secondary school students in summary writing tasks. Saeed et al. (2018) reviewed 37 papers on face-to-face and computer-assisted peer review activities for EFL writing published from 1990 to 2016. They identified several factors that may influence the quality of peer feedback, including training on peer feedback, technology, writing task, activity context, learner roles and English proficiency levels. Chen (2016) focused on computer-mediated peer feedback activities. They found that learners might have enhanced effectiveness of TEPF for EFL writing when having detailed examination of peer feedback, combination of face-to-face peer feedback and TEPF, training on technology and peer feedback, and strengthened inter- and intra-group collaboration. The heavy workload, unsatisfactory efficiency and feedback quality, technical problems, and the lack of non-verbal communication could reduce learner outcomes from TEPF.

In TEPF, learners interacted with each other in different patterns. Chen (2016) found that students tended to have high levels of student-centredness, equality, and flexibility of discourse and language use when interacting with peers in TEPF activities. Saeed et al. (2018) found three main patterns of peer interaction in the TEPF activities: (a) the exploratory pattern in which learners collaborated in L2 writing and feedback production, (b) the procedural pattern in which learners collaborated in the revision of L2 writing based on peer feedback, and (c) the social pattern in which learners sought for good relationships with peers.

2.3 Research rationales

Researchers have conducted many review and meta-analysis studies on TEPF activities for L2 writing and identified many factors of the activity effectiveness, such as technology (Loncar et al., 2021), peer interaction (Yu & Lee, 2016a), training (Saeed et al., 2018), and educational level (Lv et al., 2021). Appendix A presents some representative studies and summaries of their research focuses.

Despite the rich contribution, however, we identified two limitations. Firstly, few studies have clarified the details of TEPF activities based on the factors that influence the activity effectiveness, while these details appear valuable for the authentic implementation of this learning method. For example, researchers have identified training as an essential factor influencing the effectiveness of TEPF activities, while it remained un-clarified how many TEPF activities involved training sessions and what the training contents exactly were (e.g., in Chen, 2016; Saeed et al., 2018). This lack of information might have resulted in practitioners' confusion when applying the training factor in TEPF activities in authentic pedagogy, wondering what training contents are helpful based on sufficient evidence. To remove practitioners' possible confusion and facilitate the implementation of TEPF activities, it appears meaningful to clarify the factor-related details of this learning method in current studies.

Secondly, few previous studies have explored the explicit processes of factors influencing the effectiveness of TEPF activities. Most previous studies have investigated the factors of TEPF activity effectiveness from a variable approach (e.g., Lv et al., 2021). The variable approach, despite its usefulness in revealing whether and to what extent various factors could influence the TEPF activity effectiveness, could hardly explain how these factors exert these influences (see Maxwell, 2011, 2013). However, the "how" question may be investigation-worthy. For example, many researchers conducted statistical analyses and defined technology as an essential moderator of the effectiveness of TEPF activities for L2 writing (e.g. Saeed et al., 2018; Yu & Lee, 2016a). Nevertheless, technology could influence L2 learning in diverse ways, such as delivering learning materials, expediting and scaffolding practices, restructuring teaching approaches and encouraging interactions (Zhang & Zou, 2020) – some of them might be the exact processes by which technology influence the TEPF activity, while others might not. By exploring the specific ways factors, i.e. technology in this example, may influence the TEPF activity effectiveness, we may obtain a more in-depth understanding of this complex learning method and provide implications for future implementation and investigation of it. Thus, it is valuable to investigate the factor-related processes influencing the effectiveness of TEPF activities.

2.4 Understanding TEPF activities for L2 writing from the perspective of the activity theory framework

The activity theory appears a promising approach to clarifying the factor-related details and processes influencing the effectiveness of TEPF activities. Activity theory is a framework for understanding interactions and contradictions within "object-oriented, collective and artifact-mediated activity systems" (Engeström, 2001b, p. 281). It is a sub-branch and extension of Vygotsky's (1978) cultural-history theory, emphasising different forms of human practices to mediate the relationships among humans, artefacts, and the environment as developmental processes (Engeström, 2001b; Kuutti, 1996). Having experienced several waves of expansion, the activity theory framework has become a complex, network-shaped model (Engeström, 2001a), while the uppermost six elements of the model play the central role (Gibbes & Carson, 2014). Chung et al. (2019) have interpreted the six elements from an educational perspective: (a) Subject that refers to the participants of learning activities,
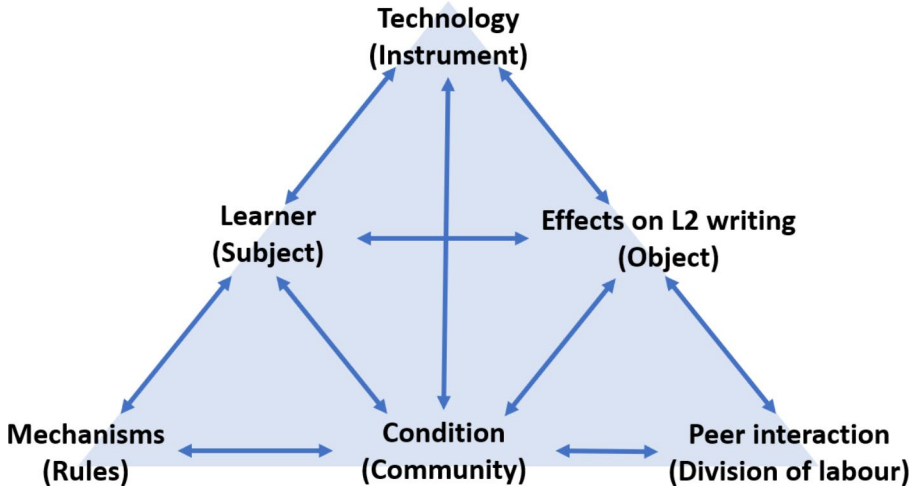
Fig. 1 The activity theory framework of the TEPF activity for L2 writing

such as teachers and students; (b) Object that refers to the goal of Subject in learning activities, such as the development of L2 writing; (c) Instrument that refers to the tool, device, and materials supporting learning activities, such as computers; (d) Community that refers to the environment where Subject carries out learning activities, such as a classroom; (e) Rules that refers to the methods and strategies of implementing learning activities, such as feedback giving and taking; (f) Division of labour that refers to participants' respective roles and duties in learning activities, such as independent feedback givers.

The activity theory has been used to analyse the complexity of peer feedback activities for L2 writing and demonstrated overall effectiveness (Yu & Lee, 2016a). For example, Yu and Lee (2016b) used theory to investigate students' strategies in peer feedback activities for L2 writing. They identified the use of native language in the activities as Instrument/Artefact, teacher support as Community, L2 writing criteria and rules of group interaction as Rules, and learners' different roles in group interaction as Division of Labour. Using the activity theory, researchers identified peer feedback activity as a socially mediated activity enhanced by group interaction strategies. Yu and Lee (2015) focused on two university students and used the activity theory to analyse their motives in peer feedback activities for L2 writing. In the light of theory, they identified the mediating effects of learning context on students' motives and the direct, positive effects of student motives on their activity outcomes.

The TEPF activity for L2 writing may also be analysed from the activity theory perspective because it can be conceptualised as a "collective and situated activity, during which students as agents of the activity system use a range of (cognitive and sociocultural) strategies (Lei 2008) to facilitate collaborative learning and achieve the goals and object of the activity" (Yu & Lee, 2016a, p. 464). From the previous literature (e.g., Yu & Lee, 2015, 2016b), an activity theory framework of the TEPF activity for L2 writing was developed that consists of six factors: effects on L2 writing, learner, technology, peer interaction, condition, and mechanisms (see Fig. 1).

1) *Effects on L2 writing* It is the aspects of L2 writing on which the TEPF activity has effects, falling into two main categories. One is the target language type (Shadiev & Yang, 2020), e.g., English and Chinese. The other category concerns the investigated aspects of L2 writing in the TEPF activity, consisting of academic performance and affective states, following Zhang & Zou (2021) and Zhang et al. (2021).

2) *Learner* It indicates the L2 students in the TEPF activity that can be analysed from two aspects. One is educational levels, concerning whether the students are at the preschool, primary, secondary, tertiary or higher levels (Lv et al., 2021). The other aspect regards the students' experiences of training on technology, feedback, or technology plus feedback (Chen, 2016; Saeed et al., 2018).

3) *Technology* This factor indicates the digital tools, systems, and electronic platforms supporting the TEPF activity. It falls into five categories: individual study tools, cloud-based word processors and shared documents, network-based social computing, schoolhouse or classroom-based technologies, and web-based emails, following Loncar et al., (2021).

4) *Peer interaction* It refers to the students' duties and engagement in interactions with other students in the TEPF activity that may be analysed from two aspects. One is duties, concerning whether the students are feedback givers or takers (Yu & Lee, 2016a). The other aspect concerns whether the students do their duties independently or collaboratively (Alshuraidah & Storch, 2019; Saeed et al., 2018).

5) *Condition* This factor indicates the implementation of the TEPF activity, falling into four main categories: (a) anonymousness concerning whether the students engage in the TEPF activity anonymously or non-anonymously (Chen, 2016); (b) access to the Internet concerning whether the TEPF activity is online, offline, or blended (Lv et al., 2021); (c) physical environment concerning whether students engage in the TEPF activity in-class, out-of-class or blended (Hattie & Timperley, 2007); and (d) duration concerning whether the TEPF activity is one-session, short-term (1 week – 4 weeks), intermediate-term (5 weeks – 10 weeks), and long-term (11 weeks –), following Chen et al. (2020).

6) *Mechanisms* This factor refers to the tasks and processes students experience in the TEPF activity for L2 writing, mainly consisting of (a) students' L2 writing, (b) generation of peer feedback on L2 writing, (c) peer feedback giving, (d) peer feedback taking, and (e) revision of L2 writing based on the feedback (Saeed et al., 2018; Yu & Lee, 2016a).

Reviewing research on TEPF activities based on the activity theory framework may provide rich details of various factors and illustrate the processes of how these factors influence the activity effectiveness. Researchers have applied the activity theory in review studies and identified its usefulness in clarifying the details of learning activities (Chung et al., 2019). For example, Chung et al. (2019) reviewed the 2010–2016 experimental mobile learning research based on the activity theory framework. The result revealed that most experimental mobile learnings were conducted in real-world contexts based on the existing school curriculums and that most students used mobile technology to interact with peers, events and specified real-world learning targets.

Considering the usefulness of theory in review studies (e.g., in Chung et al., 2019), we may review the research on TEPF activities for L2 writing following the activity theory to clarify the details of factors influencing the effectiveness of TEPF activities in current studies.

Furthermore, a review study following the activity theory may result in a more in-depth understanding of the specific processes of how different factors influence the effectiveness of TEPF activities. For example, by conducting a review based on the activity theory framework, Chung et al. (2019) found that providing access to self-learning materials was the main way mobile technology exerted influence in mobile learning activities. In another review study following the activity theory, Frohberg et al. (2009) identified the explicit processes through which mobile technology influenced mobile learning outcomes: communication and collaboration. In the same way, a review study from the activity theory perspective may contribute to an in-depth understanding of the processes of various factors influencing the effectiveness of TEPF activities for L2 writing.

Hence, we conducted a review on TEPF activities for L2 writing based on the activity theory framework, focusing on the factor-related details and the factor-related processes influencing the activity effectiveness. By undertaking this review, we may address the two limitations in previous review studies on TEPF activities for L2 writing, obtain a more in-depth understanding of this learning method, and provide implications for future implementation and investigation.

3 Methodology

Our review adopted a basic three-step method: search, selection, and data analysis, following Zou et al., (2020) and Zhang & Zou (2021). The search was conducted with "English" for the language and "article" for the document type. The time-span was from 2001 to 2021, because we focused on the publications in the past two decades. The time-span of several previous review studies is two decades, for example, Chen (2016), Chen et al. (2021a), and Chen et al. (2022). The articles were extracted from the Web of Science Core Collection, which was frequently used as the source of Social Sciences Citation Index (SSCI) journal articles in previous review studies in the field of technology-enhanced L2 learning (e.g., Chen et al., 2021a; Zhang et al., 2022). We used four groups of keywords developed from the literature review on technology-enhanced language learning (e.g., Shadiev & Yang, 2020; Su & Zou, 2020; Zhang & Zou, 2020), technology-enhanced feedback for L2 learning (e.g., Bahari, 2021; Loncar et al., 2021), and peer feedback for L2 writing (e.g., Chen, 2016; Yu & Lee, 2016), with the AND operators between them: (a) "peer feedback", "peer review", "peer revision", "peer response", "peer evaluat*", "peer assess*", and "peer comment"; (b) "writing", "write", "written", "essay", and "composition" ; (c) "second language", "foreign language", "SLA", "ESL", and "EFL"; and (d) "technology", "computer", "online", "web-based", "mobile-based", and "mobile-assisted". "SLA", "ESL", and "EFL" are the acronyms of "second language acquisition", "English as a second language", and "English as a foreign language".

Table 1 Criteria for article selection

Screening phases	Inclusion criteria	Exclusion criterion
Screening by titles and abstracts	• Focusing on peer feedback activity; • Focusing on the enhancement of L2 writing	• Review, synthesis, or meta-analysis studies
Screening by full texts	• Focusing on TEPF; • Reporting the TEPF activity process	N.A.

3.1 Journal selection

We selected only SSCI journal articles in this review. At the initial stage of this research, we included all relevant journal articles, book chapters, and conference papers in the review list. However, after reading a few, we spotted problems with many of them: Some studies did not specify the factors of TEPF activities in detail; others lacked convincing explanations for the influence of factor-related processes in TEPF activities. This research focused on the TEPF activity factors and factor-related processes influencing the activity effectiveness, so the reviewed articles had to present clear descriptions of the TEPF activities processes and logically-sound interpretations for the activity outcomes. As observed in our reading at the initial stage, SSCI articles generally include more needed information than the other data sources. Moreover, SSCI articles are "usually rigorously reviewed based on stringent criteria," having an overall high impact (Hwang & Fu, 2019, p.568). In the field of language learning, many researchers focus on SSCI articles to ensure high data quality in their review studies (e.g. Duman et al., 2015; Hung et al., 2018; Zou et al., 2021). Hence, we decided to review only SSCI articles following previous studies.

3.2 Article selection

The search was conducted on 10 June, 2022, and ended with 102 articles. After removing one duplicate and one article of which the full text was unavailable online, the remaining 100 articles were screened by four inclusion criteria and one exclusion criterion (see Table 1). We first screened the articles by titles and abstracts based on three criteria. First, the research had to focus on the peer feedback activity. This criterion screened out 40 articles. Second, the research had to focus on L2 writing development. This criterion screened out eight articles. Third, the research could not be a review, meta-analysis, or synthesis study because this study focused on empirical studies. This criterion screened out five articles. In our article screening process, we found some researchers did not emphasise their application of technology in TEPF activities in titles and abstracts, so the focus on technology was not set as an inclusion criterion in our article screening by these two parts. Then, we read the full texts of the remaining 47 articles based on two further criteria. First, the research had to focus on TEPF. This criterion screened out four articles. Second, the research had to report the process of TEPF activities for L2 writing because this review focuses on the activity theory framework of TEPF activities. This criterion screened out three articles. Forty
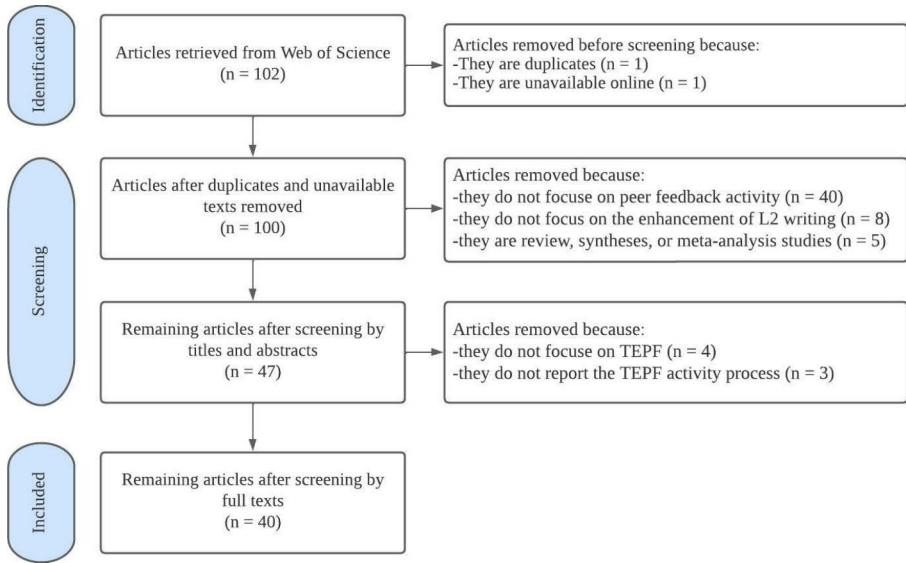
Fig. 2 Process of data search, selection, and collection

articles were finalised in the selection, as listed in Appendix B. Figure 2 illustrates the process of data search, selection and collection, following the PRISMA2020 flow diagram.

3.3 Data analysis

According to the activity theory framework developed from the literature review, we analysed the factor-related details of TEPF activities and the factor-related processes influencing the activity effectiveness in the 40 articles based on six codes as follows:

1) *Effects on L2 writing* It includes two sub-codes: (a) target language type; (b) investigated aspects of L2 writing (academic performance and affective states).
2) *Learner* It falls into two sub-codes: (a) educational level (preschool, primary, secondary, tertiary or higher); (b) training (training on technology, training on feedback, training on technology plus feedback).
3) *Technology* It consists of five sub-codes: (a) individual study tools; (b) cloud-based word processors and shared documents; (c) network-based social computing; (d) schoolhouse or classroom-based technologies; (e) web-based emails.
4) *Peer interaction* It falls into two sub-codes: (a) students' roles (feedback givers or feedback takers); (b) students' condition (independent or collaborative).
5) *Condition* It is analysed by four sub-codes: (a) anonymousness (anonymous, non-anonymous, or partial-anonymous); (b) access to the Internet (online, offline, or blended); (c) physical environment (in-class, out-of-class, or blended); (d) duration (one-session, short-term, intermediate-term, or long-term).
6) *Mechanisms* It consists of four sub-codes: (a) feedback generation, (b) feedback giving, (c) feedback taking, and (d) revision of L2 writing based on feedback.

Fig. 3 Target language types of TEPF activities

The authors first analysed five articles together to reach an agreement on the coding method. We independently analysed the remaining articles based on the coding method and the coding scheme. When we spotted sub-categories beyond the scheme, we enriched the coding scheme by adding new categories. The compared coding results showed satisfactory inter-feedback giver reliability (Pearson's $r=.94$). The remaining differences were resolved via discussion.

4 Results

This section presents our review results concerning the details of TEPF activities for L2 writing based on the six factors of the activity theory: effects on L2 writing, learners, technology, peer interaction, conditions, and mechanisms, with the summary presented in Appendix C. We also identified the main processes how various factors influenced TEPF activities in current studies, with the summary presented in Appendix D.

4.1 Effects on L2 writing of TEPF activities

As illustrated in Fig. 3, most reviewed articles (39 studies, 98%) investigated EFL writing. As the only exception, Paul and Friginal (2019) required 37 English-speaking learners to write Chinese sentences or short paragraphs and give feedback on each other's output on Twitter or Facebook, identifying the overall positive effects of the TEPF activity on Chinese as L2 learning.

As for the target aspects of L2 writing on which TEPF activities exerted impacts, Fig. 4 showed that 33 studies investigated academic performance in L2 writing, of which 29 (87%) reported positive results. For example, Awada and Diab (2021) required 74 students to participate in peer feedback activities for EFL argumentative writing, among whom 74 used Moodle platform and 47 employed the face-to-face approach. The researchers found the usefulness of the TEPF activity and the advantage of TEPF over face-to-face peer feedback in enhancing EFL writing quality. They explained that TEPF enabled students to learn new knowledge from their interactions with peers, with the technology expediting their efficiency in peer interaction.

However, TEPF did not necessarily exert positive effects on L2 writing performance. Three of the reviewed studies reported mixed effects (9%), and one (i.e., Wu et al., 2015) reported neutral effects (3%) (see Fig. 4). For example, Wu et al. (2015) required the students to post their L2 writings and exchange peer feedback on the writings online, while identifying little progress in the students' writing proficiency after one-semester treatment. The researchers observed that their students tended to avoid giving explicit or corrective comments to peers out of their lack of self-efficacy and fear of offending others, which might have reduced the usefulness of TEPF.
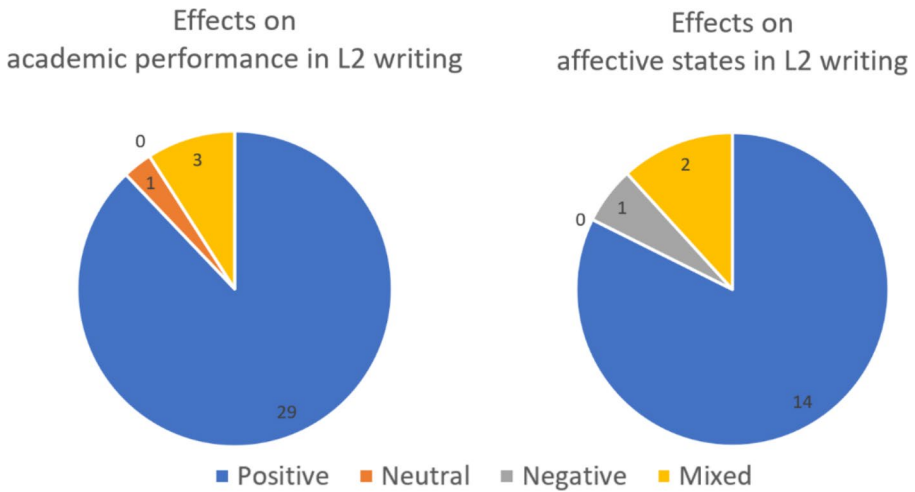
Effects on
academic performance in L2 writing

Effects on
affective states in L2 writing

Fig. 4 Effects of TEPF activities on L2 writing

Figure 4 also showed that 17 studies investigated the effects of TEPF activities on affective states in L2 writing, of which 14 (82%) reported positive results. For example, Zhang et al. (2014) required 39 students to conduct TEPF activities for EFL writing. The interviews and questionnaire survey data reflected the positive effects of the activities on students' self-efficacy and motivation in L2 writing. The researchers argued that TEPF activities increased interactions and positive competition among students, leading to enhanced affective states.

Nonetheless, TEPF activities can also have negative (i.e. in Liou, 2012) and mixed effects (in two studies, 12%) on affective states in L2 writing. For example, Ho (2015) investigated 13 students' engagement in TEPF activities for eight weeks. The results showed that the activities positively influenced students' emotions by making their writing and commenting more convenient. At the same time, the activities can also worsen the students' affective states by leading to their distraction from academic tasks.

4.2 Learners of TEPF activities

As shown in Fig. 5, all the reviewed studies focused on students at a tertiary or higher level, other than Vurdien (2013), who did not specify the participants' educational level. In addition, 15 studies (38%) investigated the students who had experienced training on feedback generation; four (10%) investigated those who had experienced training on technology; 11 (28%) studies investigated those who had experienced training on feedback generation plus technology; 10 studies (25%) reported no student training.

We identified three processes of learners influencing TEPF activities. The first process regards peer feedback quality. Researchers reported that some students failed to produce complete and comprehensible feedback due to poor reviewing and feedback generation skills (Hsu & Liu, 2019); Some students purposely produced ambiguous
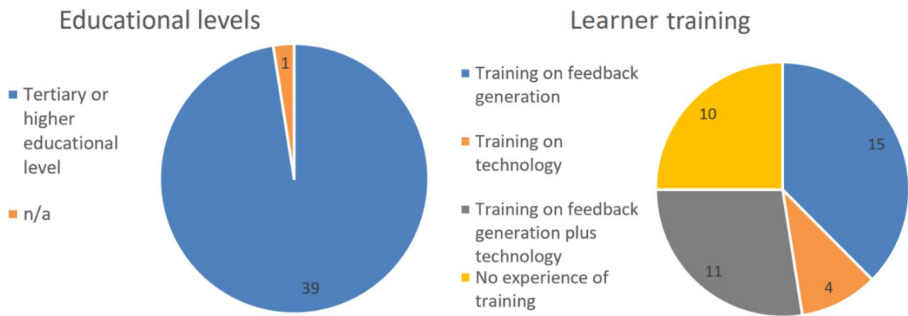
Educational levels

Learner training

- Tertiary or higher educational level
- n/a

- Training on feedback generation
- Training on technology
- Training on feedback generation plus technology
- No experience of training

**Fig. 5** Learners of TEPF activities

and inexplicit comments due to their lack of L2 self-efficacy (Vurdien, 2013; Wu et al., 2015) and fear of offending others (Ma, 2020); Other students were not proficient enough to provide high-quality feedback on L2 writing (Ruegg, 2015). Problematic with ambiguity (Wu et al., 2015), inaccuracy and incorrectness (Hsu & Liu, 2019), the low-quality peer feedback resulting from learner factors may reduce the effectiveness of TEPF activities for L2 writing (Ruegg, 2015).

Secondly, learners may influence TEPF activities by influencing the efficiency of peer interaction. Peer learners, especially those from different majors and departments, may have different ways of thinking and different repertoires of knowledge (Hsu & Liu, 2019). These differences caused difficulty in discussing language use and meaning negotiation (Hsu & Liu, 2019) and required extra time for information exchanging and agreement making (Liang, 2010), thus reducing efficiency in peer interaction (Hsu & Liu, 2019; Liang, 2010). Moreover, some students felt resistance to peer feedback and defensiveness in peer interaction because they lacked trust in their peers' L2 proficiency (Ge, 2011; Yang & Meng, 2013), which might have further reduced the efficiency of peer interaction.

Thirdly, learners may influence TEPF activities via emotions and engagement in TEPF activities. Some students felt anxious and uncomfortable about TEPF activities because they were reluctant to leave their pedagogical comfort zones (Matsumura & Hann, 2004) and unfamiliar with new technology (Alharbi, 2020; Ciftci & Kocoglu, 2012). Wu et al. (2015) also reported that their students had declining motivation in TEPF activities due to the lack of incentives. Those negative emotions and declining motivation led to students' disengagement from TEPF activities (Matsumura & Hann, 2004; Wu et al., 2015), reducing the activity effectiveness.

4.3 Technology of TEPF activities

As illustrated in Fig. 6, previous studies investigated six categories of technology. Network-based social computing was investigated most frequently (17 studies), followed by schoolhouse or classroom-based technology (14 studies), cloud-based word processors and shared documents (five studies), individual study tools (four studies), offline word processors (four studies), and web-based emails (Ge, 2011). The total number is bigger than 40 because some studies investigated more than one type of technology (e.g., Wu, 2019).

Fig. 6 Technology of TEPF activities
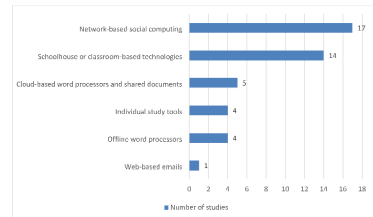
We identified five processes of technology influencing TEPF activities. The first regards the efficiency of feedback generation and provision. The technology could provide powerful, easy-to-use modules and functions (Liou, 2012), such as lucid draft viewing (Ciftci & Kocoglu, 2012), convenient comment-making and comment-editing (Alharbi, 2020), and easy document sharing (Ebadi & Rahimi, 2017). Those modules and functions expedited the analysis and evaluation of L2 writing and the composition and delivery of peer feedback (Li & Li, 2018), enhancing the efficiency of feedback generation and provision (Shang, 2017). However, technology could also reduce the efficiency when the technical features and design failed to meet learners' needs (Hsu & Liu, 2019) and when the Internet connection was unstable (Ciftci & Kocoglu, 2012).

Secondly, technology may influence TEPF activities by influencing learners' efficiency in taking and comprehending feedback. Peer feedback can be eye-catching and comprehensible with the aid of different technology features, such as text-reformulation, text-insertion, text-highlighting in different colours (Li & Li, 2018). Consequently, feedback takers could quickly notice and understand feedback in TEPF activities, either explicit or implicit (AbuSeileek, 2013; AbuSeileek & Abualsha'r, 2014).

Thirdly, technology may influence TEPF activities by influencing feedback quality. Technology can automatically identify and highlight errors in L2 writing, especially local grammar and spelling errors, thereby scaffolding feedback givers in writing analysing and feedback generation (AbuSeileek, 2013; Pham, 2020). Li and Li (2018) also noted that technology might enable teachers to scaffold feedback givers with references and guiding questions. By scaffolding feedback givers, technology may increase feedback quality and improve the effectiveness of TEPF activities (Li & Li, 2018).

Fourthly, technology may influence TEPF activities by influencing the efficiency of peer interaction. Technology encourages bi-directional, frequent peer interactions (Paul & Friginal, 2019; Yang, 2011). It can also afford the externalisation of students' thoughts in TEPF activities by tracking their processes of writing, analysing and commenting, which may help students accurately and quickly understand their peers' intentions in writing and feedback making (Yang, 2011, 2016). By affording bi-directional, frequent, and transparent interactions between peers, technology may lead to high efficiency in peer interaction. However, some technology, such as blogs, may reduce the efficiency because they were unsuitable for peer interaction (Lin, 2014; Vurdien, 2013).

Fifthly, technology may influence TEPF activities by influencing learner emotions in peer interaction. Technology could create a relaxing and encouraging environment
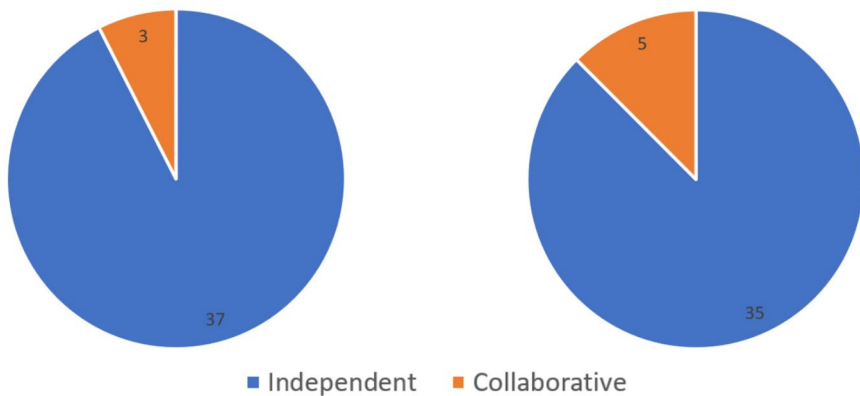
Fig. 7 Peer interaction of TEPF activities

for peer interaction (Awada & Diab, 2021; Ciftci & Kocoglu, 2012), where students felt comfortable expressing opinions and enjoyed warm interpersonal relationships (Shih, 2011; Yang, 2011). By improving the environment, technology can enhance students' affective states in peer interaction (Lee & Evans, 2019). However, some technical functions and features, such as asynchronous communications (Matsumura & Hann, 2004), were inappropriate for peer interaction in TEPF activities and could negatively affect learner emotions (Shang, 2017).

4.4 Peer interaction of TEPF activities

All studies investigated both feedback givers and takers in TEPF activities. As shown in Fig. 7, most students engaged in the activities independently to produce (37 studies, 92%) and/or receive feedback (35 studies, 88%). As for collaborative feedback generation, AbuSeileek (2013) and AbuSeileek and Abualsha'r (2014) investigated the collaboration among four feedback givers; Li and Zhang (2020) investigated that among three to five feedback givers. As for collaborative L2 writing and feedback taking, Vurdien (2013) investigated the collaboration between pairs of feedback takers; Liou (2012) investigated that among two or three takers; Tai et al. (2015) investigated that among three takers; Liang (2010) investigated that among four takers; Ma (2020) investigated that among three to five takers.

The results showed three processes of peer interaction influencing TEPF activities. Firstly, peer interaction can influence TEPF activities via knowledge and ideas of writing. Through peer interactions, students read others' writing and comments, learning about others' knowledge, strategies, advantages and disadvantages in L2 writing (Lin & Yang, 2011). In this process, students may be aware of their limitations in L2 writing (Alharbi & Al-Hoorie, 2020), develop new L2 knowledge and skills (Shih, 2011), and obtain new ways of thinking and points of view of writing (Shang, 2019), leading to their enhanced L2 writing proficiency.

Secondly, peer interaction can influence TEPF activities by influencing error identification. Sharing similar educational backgrounds and close interpersonal relationships with peers, students tended to easily recognise and understand peers' weaknesses and problems in writing (Tai et al., 2015). Therefore, students can identify many mistakes in their peers' writing (Pham et al., 2020) and make corrections with high preciseness (Shang, 2017), helping them to improve their writing qualities in TEPF activities (Hsu & Liu, 2019; Shang, 2017).

Thirdly, peer interaction can influence TEPF activities by influencing learners' affective aspects. Students perceived less stress in interacting with peers than teachers or experts due to their similar educational and proficiency levels (Lin & Yang, 2011). Moreover, in peer interaction, students received considerable emotional support, such as praise and encouragement (Ma, 2020; Xu & Yu, 2018), which reduced their anxiety and improved their emotions in learning (Shih, 2011; Tai et al., 2015). Students could also achieve enhanced awareness of their learning progress from peer interaction (Lee & Evans, 2019) and develop self-efficacy in L2 writing (Ruegg, 2015). The reduced stress, improved emotions, and boosted self-efficacy may encourage learners to devote more time and effort to TEPF activities (Ruegg, 2015).

4.5 Conditions of TEPF activities

As shown in Fig. 8, most studies investigated online (37 studies, 92%), out-of-class (26 studies, 65%) TEPF activities. In terms of duration, most TEPF activities were long-term (24 studies, 60%), followed by intermediate-term (seven studies, 18%), short-term (seven studies, 18%), and one-session (three studies, 8%) activities. Students can engage in TEPF activities anonymously (25 studies, 62%) or non-anonymously (12 studies, 30%). Paul and Frigal (2019) investigated both short-term (i.e., two-week) and intermediate-term (i.e., 10-week) TEPF activities, so the total number of studies reporting duration information is 41. They also applied partial-anonymousness by allowing the participants to engage in TEPF activities using their real names or pseudo-names. Hsu and Liu (2019) and Yang and Meng (2013) did not specify the information concerning anonymousness, coded as "n/a".

Conditions may influence TEPF activities in four ways. The first regards experiences of activity mechanisms and trust in peer feedback. Researchers observed that most students lacked experience with TEPF activity mechanisms (Xu & Yu, 2018) and trust in their peers' feedback quality (Pham et al., 2020), so they could hardly perform well or learn well in the initial stages (Wu et al., 2015). However, in long-term TEPF activities, students' performance and achievements kept improving along with their increasing perception of the usefulness of peer feedback (Pham et al., 2020) and increasing familiarity and skills in the learning method (Xu & Yu, 2018). AbuSeileek (2013) found that the participants performed better in the delayed test of L2 writing than in the post-test, evidencing the positive relationship between the duration and the effectiveness of TEPF activities.

Secondly, conditions may influence TEPF activities by influencing the efficiency of giving and taking peer feedback. Unlike traditional peer feedback activities, TEPF activities allowed students to express opinions, share knowledge, and make comments anonymously or partial-anonymously, which reduced learners' risk of embar-
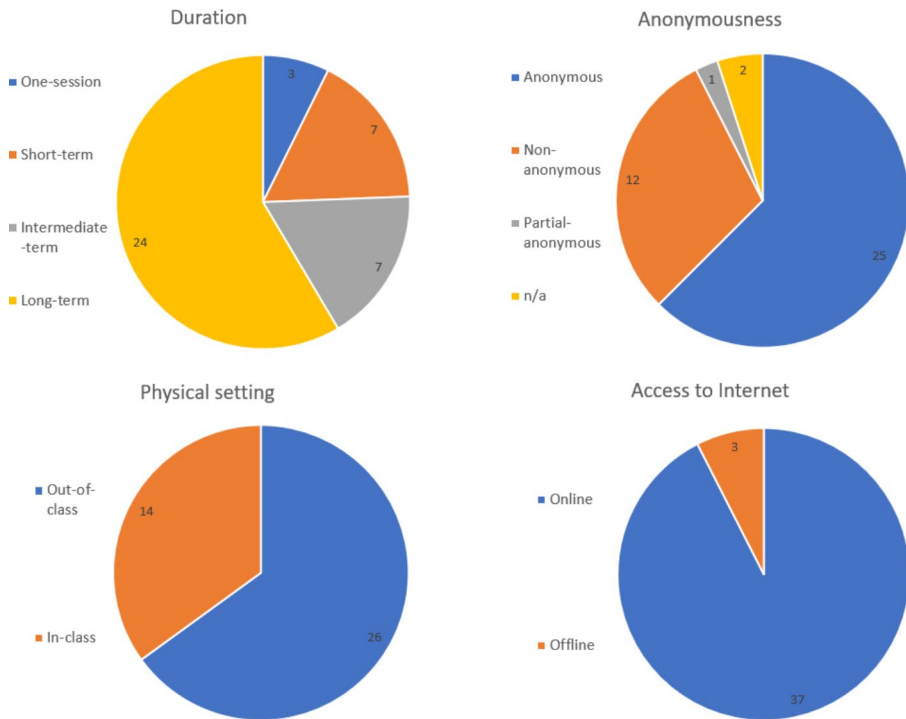
Fig. 8 Conditions of TEPF activities

rassing themselves and offending others (Ma, 2020). With the reduced risks, students tended to feel less stress and anxiety in exchanging peer feedback (Alharbi & Al-Hoorie, 2020): Feedback givers were more willing to give critical, constructive, honest feedback (Lin & Yang, 2011), and feedback takers were more likely to analyse peer feedback objectively without influence of feedback givers' identity or competence (Li & Li, 2018). In this way, conditions of TEPF activities may influence learners' emotions and efficiency in feedback giving and taking.

Thirdly, conditions may influence TEPF activities by influencing learner devotion of effort and time. The conditions of TEPF activities tended to be highly flexible, with little constraint in time or space (Awada & Diab, 2021). Students could engage in TEPF activities at their convenient times and locations (Yang & Meng, 2013) and spend as much time as needed in writing analysis, peer interaction, and feedback composition (Ebadi & Rahimi, 2017). Consequently, students would devote much time and effort to TEPF activities (Pham, 2020), leading to improved peer feedback quality and enhanced activity effectiveness (Xu & Yu, 2018).

Finally, conditions may influence TEPF activities by influencing the efficiency of peer interaction. TEPF activities could proceed much more slowly than traditional peer feedback activities (Ho, 2015). It was because TEPF activities could take place out of class, and students were more likely to get distracted by irrelevant issues (Ho, 2015) and social talks (Liang, 2010) from academic content in the out-of-class condition. Moreover, allowing students to engage in TEPF activities whenever and

Fig. 9 Mechanisms of TEPF activities

wherever they like, the condition of TEPF activities can result in late feedback, thus reducing the efficiency of peer interaction (Matsumura & Hann, 2004; Shang, 2017).

4.6 Mechanisms of TEPF activities

As shown in Fig. 9, the mechanisms of TEPF activities in all studies included L2 writing, feedback generation, feedback giving and taking, and revision of L2 writing based on peer feedback. In addition, the discussion between feedback givers and takers on the feedback and L2 writing was involved in fourteen studies (35%).

The mechanisms may influence TEPF activities via two processes. One concerns learners' cognitive processes. When producing feedback, students have to retrieve prior knowledge from long-term memory (Yang, 2016), transform and construct the knowledge in authentic application (Pham et al., 2020), make holistic evaluations of writing, compose constructive comments and justify their comments with reasoning (Pham et al., 2020). When receiving feedback, students have to reflect on their writing process and proficiency levels (Pham & Usaha, 2016), evaluate the correctness and accuracy of peer feedback (Yang, 2010a), view their writings from readers' perspectives (Yang, 2018), re-plan their writing (Vurdien, 2013), and reconceptualise their ideas based on critical analyses of peer feedback (Pham et al., 2020). By triggering those complex cognitive processes, the mechanisms of TEPF activities improved students' critical thinking ability and self-reflection (Vurdien, 2013), leading to their development of L2 writing (Hsu & Liu, 2019).

The other process regards active learning. Focusing on the mechanisms of TEPF activities, students tended to have an enhanced sense of responsibility for their written output (Ebadi & Rahimi, 2017; Pham & Usaha, 2016) and motivation in self-improvement (Pham, 2020). Thus, they will proactively enrich their L2 repertoire (Lee & Evans, 2019), seek new learning materials (Vurdien, 2013; Wu, 2019), use thinking skills and creativity (Ebadi & Rahimi, 2017), and employ self-regulated learning strategies in TEPF activities, such as self-monitoring and self-evaluation (Lee & Evans, 2019). In this way, the mechanisms of TECP activities may foster skilful, active learners of L2 writing, leading to their long-term development of L2 writing.

5 Discussion

5.1 Interactions in an effective peer feedback activity

We combed through the impacts of various factors, categorised the factors under these impacts, and analysed the conditions of different impacts in TEPF activities as reported in the previous studies. Based on the analyses of the review results, we iden-

tified interactions among different factors of TEPF activities that may influence the activity effectiveness for L2 writing: learners could influence the activity effectiveness via peer interaction, technology, mechanisms and condition; technology could influence the activity effectiveness via peer interaction, mechanisms and learners; peer interaction could influence the activity effectiveness via learners and mechanisms; condition could influence the activity effectiveness via mechanisms, learners and peer interaction; mechanisms could influence the activity effectiveness via learners. These dynamics take place collaboratively and parallelly, and the positivity/negativity and the size of the effects are not constant. The details of the influences related to different factors of TEPF activities are presented as follows.

Learners could exert influences on four factors of TEPF activities. One is peer interaction. Learners can enlarge the positive effects of peer interaction by keeping open-minded to new information and ideas (Ge, 2011). Nonetheless, the quality of peer interaction may decline if students lack confidence in their L2 competence (Vurdien, 2013), lack trust in peers (Shang, 2019), and over-worry about offending others (Ma, 2020). Another factor learners could influence is technology. Learners' high levels of technology acceptance may lead to their high efficiency in technology use, optimising the value of technology in TEPF activities (Ciftci & Kocoglu, 2012). Otherwise, learners may disengage from TEPF activities to avoid technology use (Matsumura & Hann, 2004). The third factor is mechanisms. Learners' emotions and competence (Wu, 2019) in feedback generation and peer interaction are positively related to the quality of peer feedback and the efficiency of feedback giving and taking (Hsu & Liu, 2019; Ruegg, 2015). The fourth factor is the condition. Learners' declining motivation would result in their disengagement from TEPF activities, leading to reduced activity duration (Wu et al., 2015).

Technology could influence TEPF activities by influencing three factors. One is peer interaction. Technology enables the externalisation of thoughts (Yang & Meng, 2013), free (Shih, 2011) and bi-directional expression of opinions (Yang, 2011), thereby improving the efficiency of peer interaction (Yang, 2016). Nonetheless, unsuitable technology, such as blogs, may reduce the efficiency of peer interaction (Lin, 2014; Vurdien, 2013). Another factor is mechanisms. The efficiency of mechanisms may be enhanced by various technical features, such as draft viewing (Ciftci & Kocoglu, 2012), editing (Shang, 2017), and commenting (Tai et al., 2015). However, technical problems (Ciftci & Kocoglu, 2012) and unsuitable technology design (Hsu & Liu, 2019) may reduce the efficiency of mechanisms. Thirdly, technology may influence learners. By creating an enjoyable environment for interaction (Ciftci & Kocoglu, 2012) and providing convenient tools for feedback giving and taking (Awada & Diab, 2021), technology can make students feel comfortable (Awada & Diab, 2021), supported (Shih, 2011; Yang, 2011), and motivated (Ciftci & Kocoglu, 2012). However, technical problems (Ciftci & Kocoglu, 2012) and unsuitable technology design (Hsu & Liu, 2019) may worsen learners' affective states in the activities.

Peer interaction may exert influences on learners and activity mechanisms in TEPF activities. As for influencing learners, positive peer interaction helps students develop new knowledge, skills, and ideas about L2 writing (Shih, 2011; Yang & Meng, 2013) and become more motivated and confident in L2 writing (Ma, 2020; Xu & Yu, 2018).

As for influencing activity mechanisms, peer interaction enables students to identify more errors, contributing to the excellent quality of peer feedback and the high effectiveness of TEPF activities (Hsu & Liu, 2019; Yang & Meng, 2013).

Conditions of TEPF activities may influence three factors. One is mechanisms. Flexible conditions of TEPF activities encourage students to devote more time and effort to mechanisms (Ebadi & Rahimi, 2017), leading to improved peer feedback quality (Pham, 2020). Additionally, activity duration is positively correlated to students' skills (Xu & Yu, 2018) and their perceived usefulness (Pham et al., 2020) of TEPF activities, conducive to the high efficiency of activity mechanisms (Xu & Yu, 2018). Another factor is the learner. Flexible (Ebadi & Rahimi, 2017) and anonymous (Ma, 2020) conditions of TEPF activities can reduce learner stress and improve learner emotions (Alharbi & Al-Hoorie, 2020). The third factor is peer interaction. Anonymous or partial-anonymous conditions of TEPF activities result in worry-free (Alharbi & Al-Hoorie, 2020), honest (Lin & Yang, 2011), and objective (Li & Li, 2018) communications among peers, thereby increasing the efficiency of peer interaction. However, flexible conditions of TEPF activities may also result in distraction (Ho, 2015) and procrastination in peer interaction (Matsumura & Hann, 2004; Shang, 2017).

Activity mechanisms may influence learners by triggering complex cognitive processes and developing critical thinking skills (Pham et al., 2020; Yang, 2016). Moreover, students focusing on the mechanisms of TEPF activities were likely to become active learners of L2 writing, who would use self-regulated strategies (Lee & Evans, 2019), seek extra learning materials (Vurdien, 2013; Wu, 2019), and proactively improve L2 writing quality (Pham & Usaha, 2016) and L2 writing proficiency (Pham, 2020).

5.2 Comparisons with the previous studies and future directions

The study contributes to the field of TEPF by echoing previous studies and revealing new findings and trends, which may provide inspiration and implications for researchers and practitioners in their future investigation and implementation of this learning activity.

In terms of the findings similar to those of the previous reviews, our review identified the usefulness of technology in expediting feedback production and provision (e.g., in Ciftci & Kocoglu, 2012) and encouraging free and creative self-expression (e.g., in Shih, 2011), consistent with Chen (2016). Researchers and practitioners are recommended to take full advantage of technology for those two purposes in TEPF activities. This study also found the collaboration among feedback givers (e.g., in Li & Zhang, 2020) and among feedback takers (e.g., in Liang, 2010), echoing Saeed et al.'s (2018) ideas of exploratory patterns and procedural patterns in computer-assisted peer review activities. Hence, researchers and practitioners may allow students to collaborate in TEPF activities.

In addition to the similarities, new findings and future directions were identified in this study. Firstly, this research revealed how factors of TEPF activities interacted with each other and exerted influences on activity effectiveness, which was hardly mentioned in previous reviews and might have contributed to a more in-depth under-

standing of the factors and dynamics of TEPF activities identified in previous studies. For example, our results showed that learners' self-efficacy and competence (Wu, 2019) in L2 writing, feedback generation and peer interaction is positively related to the quality of peer feedback, which further influence the effectiveness of TEPF activities (Hsu & Liu, 2019; Ruegg, 2015). This interaction between learners and activity mechanisms explained how many learner factors identified in previous review studies, such as L2 proficiency levels (Saeed et al., 2018), educational levels (Lv et al., 2021) and training experiences (Yu & Lee, 2016), may influence TEPF activity outcomes. For another example, Chen (2016) identified the benefits of TEPF activities on learners' affective states by reducing bias in peer interaction, while how the bias got reduced in the activities remained hardly explained. This review detailed three learner-related processes that may explain the bias reduction in TEPF activities: One concerns the warm, relaxing environment of peer interaction created by technology (Shih, 2011; Yang, 2011); another process concerns the flexible, anonymous conditions of TEPF activities that encourage honest (Alharbi & Al-Hoorie, 2020), objective (Lin & Yang, 2011) communications among peers; the other process regards the long duration of TEPF activities that is conducive to learners' perceived usefulness of peer feedback (Pham et al., 2020). Hence, this study may contribute to a more in-depth understanding of TEPF activities for L2 writing by clarifying the specific processes and interactions related to diverse factors. Future researchers and practitioners may implement TEPF activities for L2 writing with reference to our findings concerning the interactions in TEPF, so they may cooperate different factors of this activity in a more constructive way and obtain enhanced teaching outcomes. For example, if practitioners identified their learners' low engagement in feedback giving and taking, they may seek solutions with reference to all the mechanism-related interactions identified in this study. Based on our findings, possible reasons for learners' low engagement in feedback giving and taking can be (a) learners' low competence and negative emotions in feedback generation and peer interaction; (b) technical problems and unsuitable technology design; (c) poor quality of peer interactions; (d) insufficient time and inflexible conditions for feedback giving and taking. By considering these factors, practitioners are more likely to address this problem with learner engagement and implement TEPF efficiently.

Furthermore, this study revealed the significant impacts of learner beliefs in TEPF activities, which were seldom discussed in previous studies. Regarding the beliefs about technology, we found that learners' acceptance of technology may mediate their efficiency, emotions and engagement in TEPF activities (Alharbi, 2020; Matsumura & Hann, 2004), consistent with theories of technology acceptance (Tsai, 2015). In terms of beliefs about peer interaction, students may obtain high-quality peer interactions and better learning outcomes if they are willing to interact with others (Shih, 2011; Yang, 2011) and trust their peers (Pham et al., 2020) without fear of offending others (Ma, 2020). Regarding beliefs about themselves, learners with more confidence may engage more actively in peer interaction and feedback exchange (Wu et al., 2015). These findings are consistent with the widely-recognised influences of learner beliefs on the L2 learning process and outcomes (see Ellis, 2008; Gabillon, 2005), while, so far, few researches on TEPF activities for L2 writing have been

conducted in this direction. Hence, future researchers in this field may work on the learner beliefs about technology, peer interactions, and the learner themselves.

Thirdly, most previous reviews focused on the effects of TEPF activities on academic performance in EFL writing (e.g., Saeed et al., 2018; Lv et al., 2021). However, this study found the application of this learning method in L2 education of other language types and identified its overall positive effects (e.g., in Paul & Friginal, 2019). We also found studies that investigated the effects of TEPF activities on affective states, such as intrinsic motivation in L2 writing (Li et al., 2019), self-efficacy in L2 writing (Lin, 2014), and learning experiences (Liou, 2012), while reporting inclusive results. For example, Shih (2011) found that the application of technology in TEPF activities had positive effects on learner motivation in L2 writing, while Lin (2014) observed the opposite results; Ciftci and Kocoglu (2012) found that learners tended to have better emotions in TEPF activities than in traditional peer feedback activities, while Liou (2012) reported the opposite results. Considering the relatively insufficient literature in these directions and the inclusive results, we call for more investigations concerning the effects of TEPF activities on affective states (e.g., anxiety, self-efficacy) and L2 writing in languages other than English (e.g., Chinese, Japanese).

5.3 Implication for practising TEPF activities

We provide three implications for practising TEPF activities for L2 writing. These implications were developed from the in-depth analyses of different interactions in TEPF activities from the pedagogical perspective, focusing on how practitioners could manipulate these interactions to enhance the effectiveness of this learning activity in authentic pedagogy. With reference to these implications, teachers and educators may design and implement TEPF activities for L2 writing more efficiently and help their students achieve better learning outcomes.

Firstly, TEPF activities may be implemented based on students' sufficient competence and confidence in feedback production. The results showed the influence of feedback quality on the effectiveness of TEPF activities: Students could learn new knowledge and ideas of writing from explicit, accurate, constructive feedback (Alharbi & Al-Hoorie, 2020), while they could hardly learn anything if the feedback was general (Ma, 2020), incomplete (Pham & Usaha, 2016), or ambiguous (Wu et al., 2015). Feedback quality was largely influenced by students' competence and confidence in feedback generation (Wu et al., 2015; Wu, 2019). Hence, to improve feedback quality and the effectiveness of TEPF activities, practitioners are recommended to improve students' knowledge, skills, and confidence in L2 writing analysis and feedback generation. They may ask students to conduct pre-task discussions about writing tasks (Wu et al., 2015) and provide them with scaffolding materials about writing evaluation (Wu, 2019) and explicit training on feedback generation (Lin & Yang, 2011). Students may also be allowed to use their native language in TEPF activities, so they can clearly express their ideas with enhanced confidence (Wu, 2019).

Secondly, TEPF activities may be implemented based on useful technology and technology training. This review found that powerful and user-friendly technology

could improve the environment of peer interaction (Yang, 2011, 2016), increase the efficiency in activity mechanisms (Shang, 2017), and enhance affective states (Shih, 2011), leading to satisfactory activity outcomes in L2 writing. Technology with inappropriate design (Vurdien, 2013) would reduce L2 writing development by worsening learners' affective states (Shang, 2017) and decreasing the efficiency of peer interaction and activity mechanisms (Hsu & Liu, 2019). Hence, in implementing TEPF activities, practitioners should carefully select and apply technology. Technologies that support anonymousness (Alharbi & Al-Hoorie, 2020), lucid draft viewing (Ciftci & Kocoglu, 2012), convenient commenting (Li & Li, 2018), easy editing (Shang, 2017), and record tracking (Yang, 2011) are recommended in the activities. In addition, digital literacy and familiarity with technology-enhanced learning methods were also essential for students' engagement and efficiency in TEPF activities (Lin & Yang, 2011), which specific technology training could foster (Alharbi, 2020). Hence, practitioners are suggested to provide students with technology training before and during TEPF activities, helping them be more prepared for new technology and new learning method (Xu & Yu, 2018).

Thirdly, TEPF activities may be implemented based on positive peer relationships. Researchers observed that students tended to feel supported, relaxed, and motivated in peer interaction when sharing positive relationships with their peers (Awada & Diab, 2021; Tai et al., 2015), which increased students' motivation and engagement in TEPF activities (Ma, 2020). Additionally, students sharing positive relationships were more likely to produce high-quality feedback because they could easily recognise and understand peers' intentions and problems in writing (Shang, 2017). To implement TEPF activities based on positive interpersonal relationships, practitioners may allow their students to decide on their partners for peer interaction (Shang, 2017). If students have not known about each other, they should be allowed to engage in peer interaction anonymously, so they feel more comfortable commenting on others (Ma, 2020). Hsu and Liu (2019) observed that students from the same domain are more likely to have good relationships, mutual understanding, and similar ways of thinking, so they suggested that practitioners group students for peer interactions according to their majors.

6 Conclusion

This study presents a review of articles from 2001 to 2021 on TEPF activities for L2 writing, presenting details of the activities based on the six factors of the activity theory framework: learner, effects on L2 writing, technology, condition, peer interaction, and mechanisms. Various factors interact with each other and collaboratively influence the effectiveness of TEPF activities. Future studies in this field may enhance the quality and efficiency of TEPF activities by referring to the interactions identified in this study. They may also work on learner beliefs, affective states and writing in languages other than English as L2. Practitioners are recommended to implement TEPF activities based on sufficient learner competence and confidence in feedback generation, useful technology and technology training, and positive peer relationships.

This study is not without its limitations. First, all of the reviewed articles were from SSCI journals. Future research may expand the review based on a larger data body to present a more comprehensive picture of this field, including book chapters, conference papers, and journal articles indexed by AHCI, Scopus and ERIC, etc. Second, this review focused on the factors and factor-related processes influencing the effectiveness of TEPF activities for L2 writing. Hence, this study did not analyse the statistics related to the activity outcomes, involving no meta-analysis. Future studies may conduct a statistical meta-analysis to investigate the effect sizes of different processes of the peer feedback activity on L2 writing. Thirdly, this review focused on the publications in the past two decades, i.e., from 2001 to 2021. Future researchers may conduct a more comprehensive review in this field by including the relevant studies published in 2022 in their review lists.

Finally, our review identifies the TEPF activity as an effective approach to L2 writing education and the complex dynamics among various factors therein. In the present time when student-centredness, technology-enhanced learning, and peer-to-peer interactivity have been increasingly valued in L2 education, the TEPF activity has demonstrated tremendous potential. Thus, we expect further explorations of this field to expand the variety of TEPF modes, for example, avatar-based peer feedback activity and peer feedback activity in a digital game-based setting.

Data Availability on Request from the Authors The data that support the findings of this study are available from the corresponding author, Di Zou, upon reasonable request.

Declarations

Disclosure statement There are no relevant financial or non-financial competing interests to report.

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