Language learners' emotion regulation and enjoyment in an online collaborative writing program

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Abstract

Collaborative learning in online contexts is emotionally challenging for language learners. To achieve successful learning outcomes, language learners need to regulate their emotions and sustain positive emotions during the collaborative learning process. This study investigated language learners' emotion regulation and enjoyment, the most extensively researched positive emotion in foreign language learning, in an online collaborative English learning environment. In the study, we collected data by surveying 336 Chinese

459

students majoring in English who collaboratively completed a series of English language writing tasks in 108 online groups facilitated by a social media app (*WeChat*). Principal component analysis revealed two primary types of emotion regulation: peer regulation and group regulation. The analysis also revealed one factor underpinning enjoyment: enjoyment of online collaboration. Correlation analysis showed medium and positive relationships between peer regulation, group regulation, and enjoyment of online collaboration. Structural equation modeling analysis further found that group regulation exerted a medium-sized direct effect on enjoyment of online collaboration. Peer regulation affected enjoyment of online collaboration moderately and indirectly via group regulation. The theoretical and pedagogical implications of the findings can help to optimize face-to-face and online collaborative language learning activities.

Keywords: emotion regulation; foreign language enjoyment; online collaborative learning; foreign language learners

1. Introduction

Learning a foreign language (FL) is not only a cognitive process but also an emotional one (Swain, 2013). Positive emotions help FL learners explore learning opportunities and take risks in unfamiliar cultural and linguistic contexts, which helps to develop their language competence (Jiang & Dewaele, 2019). In FL learning, enjoyment is one of the most prevalent positive emotions experienced by learners (Jiang & Dewaele, 2019; Li et al., 2018; Piniel & Albert, 2018). Recent studies uncovered a range of learner-internal (e.g., age, education level, and FL proficiency level) and learner-external (e.g., teachers' friendliness and classmates' support) variables that influence enjoyment (Dewaele & MacIntyre, 2014; Dewaele et al., 2019). However, these studies were classroom-based, even though one of the primary aims of FL learning is to communicate with others outside the classroom.

In the modern era, learning is highly interactive, collaborative, and technologically enhanced (Järvenoja et al., 2015). Online collaborative learning is effective for learners' FL development (Kukulska-Hulme & Viberg, 2018). However, as Yoshida (2020) indicated, few studies have explored how language learners' emotions unfold and develop during online collaboration. In online collaborative learning, positive emotions such as enjoyment are needed to maintain the productive co-construction of language knowledge (Poehner & Swain, 2016). Given that emotions may exhibit different patterns (e.g., factor/conceptual structure) across different language learning contexts (Dewaele & MacIntyre, 2016; Li et al., 2018), more studies are needed to explore the unique pattern of positive emotions, especially enjoyment, in the specific context of online collaborative learning. Moreover, emotions are not a product of the mind but are also

regulated and constructed from interpersonal interactions (Swain, 2013). In an online setting, a positive emotional climate is more difficult to achieve because non-verbal emotional cues (e.g., facial expressions) that are abundant in face-to-face interactions are usually absent (Dunlap et al., 2016). Thus, learners may need to spend more time and energy regulating their emotions during online collaborative activities than they would in face-to-face interactions to be emotionally satisfied.

To understand the emotional aspect of online collaborative language learning, the present study investigated the primary types of emotion regulation, the unique factor structure of enjoyment, and how different types of emotion regulation interacted to increase enjoyment among English as a foreign language (EFL) learners who completed a series of online English writing tasks in collaboration at a Chinese university. In the coming sections, we review relevant studies on emotion regulation and FL enjoyment.

2. Literature review

2.1. Emotion regulation

Emotion regulation refers to the processes involved in recognizing, understanding, and managing one's emotions, including modulating, preventing, or inducing them for action and goal achievement (Pekrun, 2006; Von Scheve, 2012). Emotion regulation plays an important role in the self-regulated learning process because it monitors, changes, modifies, and maintains the valence, duration, and intensity of learners' emotions (Boekaerts, 2011). Such regulation often leads to the growth of positive emotions and the reduction of negative emotions in learning, which supports learners' academic achievement and well-being (Pekrun, 2006).

Emotion regulation has been subject to numerous empirical investigations from an intrapersonal perspective of self-regulation (e.g., Boekaerts, 2011; Gross, 1998). However, there have recently been calls to incorporate an interpersonal perspective on emotion regulation in contexts such as face-to-face collaborative learning (Järvenoja et al., 2015; Järvenoja et al., 2013). For example, using the *Adaptive Instrument for Regulation of Emotions*, a scale developed by Järvenoja et al. (2013) to measure emotion regulation processes, Järvenoja and Järvelä (2009) explored how emotions were regulated to cope with challenging situations. They examined 63 teacher education students in Finland who studied in groups of three to five during three collaborative learning tasks. The results suggested that, when students worked collaboratively, they assisted each other's regulation (*co-regulation*) and shared their regulatory efforts with others (*socially shared regulation*) while regulating themselves (*self-regulation*). Näykki et al. (2014) further explored the relationships between emotion regulation and

emotional challenges by combining video observation data and video-stimulated recall interview data collected from collaborative learning processes of 22 students majoring in education in Finland. This study revealed that, in the face of socioemotional challenges that disrupted a group's positive climate, insufficient shared efforts within the group to regulate emotions could undermine group members' enjoyment and engagement in collaborative learning. Rogat and Adams-Wiggins (2015) examined the interrelations between regulatory processes and socioemotional interactions through observations of videotaped collaboration in two four-member groups of middle school students ($N = 8$) in the United States. Results indicated that facilitative other-directed regulation, such as being inclusive of others' ideas, contributed to a balanced regulation among group members and fostered positive social interactions. Based on the video-recorded data gathered from 62 teacher education students in Finland who collaborated in groups during a mathematics course, Järvenoja et al. (2019) revealed how students employed strategies to regulate their emotions at the group level. A variety of regulatory strategies, including *encouragement*, *awareness increasing*, *social reinforcement*, and *task structuring*, were adopted by learners at the group level to ease the tension caused by challenges and create a positive environment for knowledge co-construction. Similarly, Mänty et al. (2020) asserted that group-level regulation could effectively shift a group's emotional atmosphere from negative to positive. The data were collected using video recordings of collaborative activities and an emotion self-report tool among 37 primary school students in Finland. Emotion regulation in face-to-face collaborative activities was found to function beyond self-regulated mechanisms, operating to achieve and maintain a positive emotional climate that supported effective group learning (Hadwin et al., 2018; Järvenoja et al., 2015).

Researchers also paid attention to emotion regulation in language learning. Using a scenario-based questionnaire filled out by 133 English major learners in Poland, Bielak and Mystkowska-Wiertelak (2020a) identified that language learners up-regulate positive and down-regulate negative emotions by implementing specific strategies, such as *cognitive change*, *situation modification*, *attention deployment*, and *response change*. Importantly, the above study focused on language learners' emotion regulation in the classroom language learning context. Research on emotion regulation in online collaborative language learning has been limited (Järvelä et al., 2015). The lack of non-verbal behaviors and relational cues, such as facial expressions and the use of hands, in online collaborative learning makes it more difficult to establish a positive atmosphere during interactions than in face-to-face settings (Dunlap et al., 2016). Emotion regulation is context-bound and situated in specific learning situations (Järvenoja et al., 2015). Therefore, a different pattern of emotion regulation may

arise in online collaborative learning to sustain a favorable emotional climate for productive online collaborative language learning. To build on these considerations, this study aims to identify the types of emotion regulation that emerge and how these types of emotion regulation affect enjoyment during online collaborative language learning.

2.2. Foreign language enjoyment

Enjoyment is a complex positive emotion that incorporates various dimensions in addition to a pleasurable feeling, such as "an intellectual focus, heightened attention, and optimal challenge" (Boudreau et al., 2018). In other words, enjoyment refers to a sense of novelty or accomplishment from pushing oneself to earn an unexpected achievement in the face of challenging tasks, such as learning (Csikszentmihalyi, 2008). Csikszentmihalyi (2000) perceived enjoyment as a key component of the flow experience that enhanced learners' engagement in learning activities. Based on Fredrickson's (2003) broaden-and-build theory of positive emotions, MacIntyre and Gregersen (2012) argued that positive emotions like enjoyment could broaden learners' perspectives and assist them in effectively absorbing an FL. In addition, enjoyment helps to reduce the lingering effect of negative emotions, promoting long-term resilience and well-being in the future (Li et al., 2018). An increasing number of studies confirmed the positive effect of language learning enjoyment on learners' willingness to communicate (Dewaele & Dewaele, 2018; Khajavy et al., 2018), language learning grit (Pawlak, Csizér, et al., 2022), language motivation (Pawlak, Zarrinabadi, et al., 2022), language fluency (Bielak, 2022), language performance (Dewaele & Alfawzan, 2018; Saito et al., 2018), and language achievement (Jin & Zhang, 2018; Li et al., 2019) in various contexts.

   Dewaele and MacIntyre (2014) were the first to develop a 21-item FL enjoyment scale. They used the enjoyment scale to examine the potential variables influencing FL enjoyment of 1746 language learners from all around the world in classroom learning. Their results suggested that learners who were older, multilingual, more educated, and more proficient in the target languages tended to experience more enjoyment than those with the opposite qualities. Based on the principal component analysis of the same dataset (N = 1746), Dewaele and MacIntyre (2016) modified the original 21-item scale into a 14-item version and identified a two-factor structure of FL enjoyment: *FL enjoyment – Social* and *FL enjoyment – Private*. These two factors showed that the social atmosphere of the language classroom and learners' private thoughts influenced enjoyment. Via a series of exploratory and confirmatory factor analyses of the scale data gathered from 2078 high school learners in China, Li et al. (2018) further modified the 14-item scale into an 11-item version in the Chinese EFL context.

In findings that differed from the two-factor structure in the study of Dewaele and MacIntyre (2016), a three-factor structure was confirmed by Li et al. (2018) in the 11-item version, that is, *FL enjoyment – Private, FL enjoyment – Teacher,* and *FL enjoyment – Atmosphere.* The results of such studies indicated that the factor structure of enjoyment might differ depending on the context in which the construct is investigated (Dewaele & MacIntyre, 2016).

However, these studies focused narrowly on traditional classroom language learning settings (e.g., Dewaele & MacIntyre, 2014; Li et al., 2018). Few investigations of enjoyment have been performed in an online collaborative language learning environment, where knowledge and emotion are built up through group interaction facilitated by online technology (Bakhtiar et al., 2018). Enjoyment varies across different language learning situations (Dewaele & MacIntyre, 2016; Piniel & Albert, 2018). Therefore, the above factor structures of enjoyment identified in classroom learning may not fit in online collaborative learning. As a result, it is necessary to examine the factor structure of enjoyment in the present study. Moreover, emotions are not private (intrapsychic) but are constructed or regulated interpersonally through interactions (Poehner & Swain, 2016; Swain, 2013). This could also be the case for enjoyment. Although the studies reviewed above identified numerous learner-internal (e.g., age and educational level) and learner-external variables (e.g., teacher and social atmosphere) that influence enjoyment, none of them investigated how learners regulated their emotions to experience enjoyment in interactions. This has motivated us to take a regulative perspective to further investigate language learners' enjoyment during online collaboration. Specifically, the present study addresses the following research questions:

1. What are the major types of emotion regulation, and what is the factor structure of enjoyment of Chinese English-major students during an online collaborative EFL writing program? (RQ1)
2. What are the relationships between different types of emotion regulation and enjoyment during the program? (RQ2)
3. In what ways do the participants enact different types of emotion regulation to increase their enjoyment during the program? (RQ3)

3. Method

3.1. Participants and context

The participants were 336 second-year English majors (310 females, 26 males) at a provincial comprehensive university in Northern China. Their ages ranged from 18 to 22, with a mean age of 19.72 years (*SD* = .89). They were all Chinese

L1 users and studied English as their only FL from seven to ten years. Their English proficiency ranged from lower intermediate and intermediate to higher intermediate based on their final grades in the previous semester's English proficiency exam (*M* = 73.91 out of 100; *SD* = 11.01). Their English writing ability was also between lower intermediate and higher intermediate based on their self-perceptions on the 5-point Likert scale (*M* = 3.14; *SD* = .86). By majoring in English, participants regularly took various English language courses (e.g., writing and reading) and content courses (e.g., applied linguistics and literature of English-speaking countries) in the classroom.

Participants, as sophomores, were required to attend a semester-long extracurricular program consisting of a series of online collaborative English writing activities. The program was exam-oriented, aiming to help learners prepare for the Test for English Majors Band 4 (TEM4), a national English language proficiency test mandatory for second-year English majors in China. During a semester (18 teaching weeks in total), participants worked on about ten possible writing tasks of TEM4 in three-to-four-member online groups. A total of 108 online groups were formed randomly by participants using WeChat, a popular social communication app where users can share messages, photos, and videos free of charge (Zou et al., 2018). On WeChat, teachers posted writing tasks and collected groups' assignments on approximately a weekly or fortnightly basis. The writing tasks usually required participants to compose essays of at least 200 words based on a 200-word piece of reading material. The writing topics differed weekly or fortnightly, including the pros and cons of artificial intelligence, the protection of local culture, the problems of media use, and others. Within WeChat groups, learners were encouraged to freely organize online meetings, search for online resources together, exchange thoughts, and collaboratively complete writing tasks assigned by teachers before the due date. The duration of online meetings on WeChat differed for most of the groups and was between 20 and 50 mins per week. The ten collaborative English writing assignments together accounted for 30% of learners' final grades in the English writing course.

3.2. Instruments

A composite questionnaire that contained 22 5-point Likert items in total was used in this study. It began with a sociodemographic section (e.g., age, gender) followed by two well-established scales: *the Adaptive Instrument for Regulation of Emotions* (AIRE) (Järvenoja et al., 2013) and *the Foreign Language Enjoyment Scale* (FLES) (Jiang & Dewaele, 2019). The translation and back translation of the questionnaire were conducted by the first author and another Chinese-English bilingual researcher. Twelve second-year English major students at the same university were invited to

help assess whether the participants would potentially misunderstand the items. Based on their comments, further revisions were made before the final version of the questionnaire was posted online using *Qualtrics*, an online survey tool. In addition to the translated Chinese version, the original English version was also provided in *Qualtrics*, and participants could choose which version they wished to complete. The two scales are described in more detail in the subsections below.

3.2.1. Adaptive Instrument for Regulation of Emotions (Järvenoja et al., 2013)

The AIRE scale is grounded in self-regulated and socially regulated learning theory and is used to capture learners' emotion regulation processes in collaborative learning activities (Järvenoja et al., 2013). The scale includes 12 5-point Likert items reflecting different types of emotion regulation, such as s*elf-*, *co-*, and *socially shared regulation*, which learners may enact during their collaborative learning. Example items are: "I convinced myself that it could be a good thing to have differences in the group," "I told the others that we needed to accept that some people did have differences," and "As a group, we accepted the differences within the group." The 5-point response options for the 12 items range from 1 ("Did not happen at all") to 5 ("Did happen a lot"). A higher score indicates more frequent use of item-related regulation activities. High internal reliability of the scale (Cronbach's *a* value = .85 and .86) was reported by Järvenoja et al. (2013) at two measurement points, two weeks apart, in a face-to-face collaborative learning context.

3.2.2. Foreign Language Enjoyment Scale (Jiang & Dewaele, 2019)

Jiang and Dewaele's (2019) FLES, which was used to measure enjoyment in the present study, is a modified version of the original foreign language enjoyment scale developed by Dewaele and MacIntyre (2014) using 1746 FL learners worldwide. The scale includes ten items reflecting both social and private factors of enjoyment identified in Dewaele and MacIntyre (2016). Example items are: "It was cool to know English as a foreign language" and "There was a good atmosphere." All ten items are scored on a 5-point Likert style scale ranging from 1 ("Strongly disagree") to 5 ("Strongly agree"), with the higher score indicating a higher level of enjoyment. In the context of a Chinese university, Jiang and Dewaele (2019) reported that the scale displayed high internal reliability (Cronbach's *a* value = .889).

3.3. Data collection

Before collecting data, we obtained permission from the university to conduct the research. Then, three English language teachers briefly introduced the research

purpose to potential participants and invited them to participate during regular class time. To reduce students' potential concerns that participation in the research might impact their course grades, the teachers explained that the data were collected solely for research purposes and were unrelated to students' course scores. We sent consent forms via email to participants who showed interest in the research project to obtain their formal approval and consent. Data collection began in early January 2020 after the participants had completed all ten online collaborative English writing tasks in the winter semester of the 2019-2020 academic year. First, two scales in the questionnaire, AIRE and FLES, were pilot tested with 37 students who were not included in the main study but were similar to the participants in terms of age, grade, major, and language proficiency. For AIRE, analysis of internal reliability indicated that Item 2 "I tried to act more flexible, open, and tolerant" needed to be deleted due to a low corrected item-total correlation ($r = .13$). After this item deletion, the resulting 11-item AIRE achieved a Cronbach's a value of .923 in the pilot test and .937 in the subsequent main study. For FLES, all ten items exhibited satisfactory correlations ($r > .30$) with the scale (Field, 2013). Cronbach's a value of FLES was .917 in the pilot test and .942 in the subsequent main study. Following the pilot test, a total of 345 questionnaires were distributed and completed online. Nine cases with missing values were deleted, which left 336 participants in the database.

3.4. Data analysis

The data analysis proceeded in three steps. To investigate the major types of emotion regulation and the factor structure of enjoyment (RQ1), principal component analysis was first performed using SPSS 27 based on the data collected from 336 participants. Then, Pearson correlation analysis was conducted to offer an initial glimpse into the relations across different types of emotion regulation and enjoyment (RQ2). Based on Plonsky and Oswald's (2014) recommendations, the strength of the correlation coefficients (r) was interpreted as small ($r = .25$), medium ($r = .40$), and large ($r = .60$). Finally, structural equation modeling (SEM) was further conducted using AMOS 26 to explore how different types of emotion regulation directly and indirectly affected enjoyment in online collaboration (RQ3). In the SEM analysis, multiple fit indices were considered to assess three optional models. These were the ratio of chi-square to degree of freedom (χ^2 / df), the comparative fit index (CFI), the Tucker–Lewis index (TLI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). Good fit thresholds for these indices are χ^2 / df < 3.00, CFI > 0.90, TLI > 0.90, RMSEA < 0.08, and SRMR < 0.08 (Dagnall et al., 2018; Wan et al., 2021). For χ^2 / df, RMSEA, and SRMR, the smaller value is assumed to be

the better model fit. For CFI and TLI, the greater value represents the better model fit. It should also be noted that, following Plonsky and Oswald (2014), the strength of the determination coefficients (r^2) in the present study was considered to be small ($r^2 = .0625$), medium ($r^2 = .16$), and large ($r^2 = .36$).

4. Results

4.1. Major types of emotion regulation and factor structure of enjoyment

To identify the appropriateness of the data for EFA, we first tested two basic assumptions of factor analysis: sampling adequacy and multivariate normality (Lattin et al., 2003). The KMO value of the data ($N = 336$) was .921, which was above the minimum acceptable level (.600), indicating that the sampling was sufficient (George & Mallery, 2019). The Bartlett's Test of Sphericity obtained a value of $\chi^2 (210) = 5978.093$, which was significant at the $p < .001$ level, indicating that the data were multivariate normal and the correlations between the items were sufficient for factor analysis (George & Mallery, 2019).

The subsequent principal component analysis extracted three factors with eigenvalues over Kaiser's criterion of 1, explaining 76.88% of the total variance. To maximize the items' factor loadings for a clearer interpretation of the extraction results, varimax rotation was run to present the pattern of loadings (Wipulanusat et al., 2017). After factor rotation, we retained three factors that included items with factor loadings of 0.5 or greater, as 0.5 was perceived as a cut-off value indicating items' significant interpretability of the related factor (Wipulanusat et al., 2017). Table 1 shows the items and their factor loadings related to each factor.

As shown in Table 1, we named the factors to correspond with the items included in each factor. Factor 1 included items 3, 4, 5, 7, and 8. With "I" and "others" being the keywords, all these items were associated with the regulatory acts directed by one person toward other peers in groups, such as "I tried to explain to others that we needed to understand the differences in the group." Therefore, factor 1 was labeled *peer regulation.* Factor 2 contained items 9, 10, 11, and 12. Starting with "as a group" and "we," these items reflected the joint activities made by the group as a whole in supporting emotion regulation. Therefore, factor 2 was named *group regulation.* Factors 1 and 2 represented two major types of emotion regulation participants enacted during online collaborative language learning. Factor 3 received high positive loadings from items 13, 17, 19, 20, 21, and 22, highlighting the enjoyable atmosphere for online collaborative learning; for instance, "There was a good atmosphere" and "We laughed a lot in groups." Consequently, factor 3 was named *enjoyment of online collaboration.*

Table 1 The factor items and their loadings

Items	Factor loadings
Factor 1	
3. I told the others that we needed to accept that some people did have differences.	.894
7. I tried to explain to others that we needed to understand the differences in the group.	.892
5. I told the others we needed to be more flexible in order to find a compromise/solution to differences and conflicts between us.	.879
8. I tried to convince someone that the others were not simply trying to be difficult, and we could sort out the problem.	.846
4. I tried to understand that the others were not simply trying to be difficult, but there were some differences between us.	.781
Factor 2	
9. As a group, we understood that we had to understand and reconcile our differences, being open and accepting diversity within the group.	.837
12. As a group, we accepted the differences within the group.	.828
10. As a group, we solved our problems by compromising to accommodate others' differences.	.777
11. As a group, we decided that we had to sort out problems together in order to carry on working.	.624
Factor 3	
21. There was a good atmosphere.	.910
17. It was a positive environment.	.899
22. We laughed a lot in groups.	.841
19. It was fun.	.837
20. My peers in groups were nice.	.822
13. I didn't get bored.	.822

Note. The item numbers show the place where the items are in the original composite questionnaire.

4.2. Correlations between *peer regulation*, *group regulation*, and *enjoyment of online collaboration*

Pearson correlation analysis was conducted among *peer regulation, group regulation,* and *enjoyment of online collaboration* to investigate relationships among these constructs. As displayed in Table 2, all of them were positively and significantly correlated with each other (ranging from $r = .255$ to $.569$; $p < .001$). According to Plonsky and Oswald (2014), these results represent medium effect sizes, as the variance accounted for ranged from 6.5% to 32.3%. The correlation between *peer regulation* and *group regulation* was found to be the strongest ($r = .569$, representing a medium effect size, with 32.4% of the variance being explained). Both *peer regulation* and *group regulation* were positively linked to *enjoyment of online collaboration*. However, compared with *peer regulation* ($r = .255$, representing a medium effect size, with 6.5% of the variance being explained), *group regulation* ($r = .492$, representing a medium effect size, with 24.2% of the variance being explained) exhibited a stronger relationship with *enjoyment of online collaboration*.

Table 2 Correlations between *peer regulation*, *group regulation*, and *enjoyment of online collaboration*

Factor	Group regulation	Peer regulation	EOC
Group regulation	1.000		
Peer regulation	.569***	1.000	
EOC	.492***	.255***	1.000

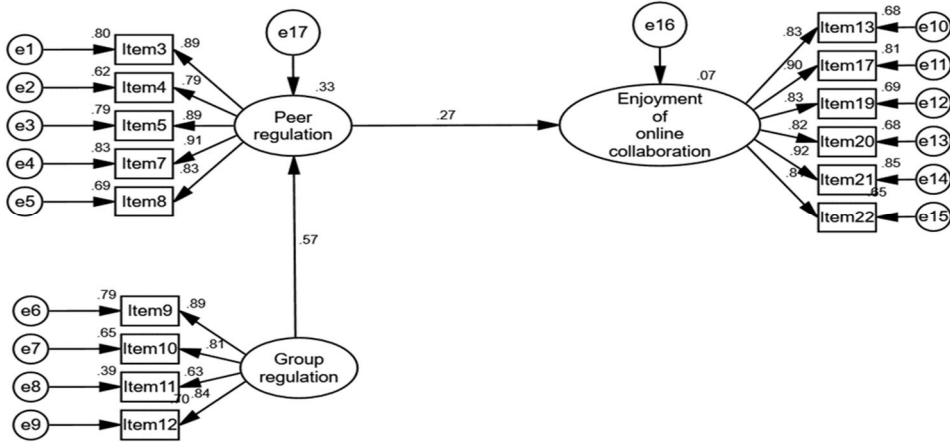*Note.* EOC = *enjoyment of online collaboration*; *** *p* < .001.

4.3. Effects of *peer regulation* and *group regulation* on the *enjoyment of online collaboration*

Three models, depicted in Figure 1, were established to investigate how *peer* and *group regulation* impacted *enjoyment of online collaboration*. As shown in Table 3, Model 3 was the best among the three models, as the fit indicators for this model (χ^2 / df = 2.886; CFI = .960; TLI = .952; SRMR = .043; RMSEA = .075) were better generated than those for Model 1 (χ^2 / df = 2.916; CFI = .960; TLI = .951; SRMR = .043; RMSEA = .076) and Model 2 (χ^2 / df = 3.498; CFI = .947; TLI = .937; SRMR = .115; RMSEA = .086). The parameters of Model 3 are presented in Table 4.
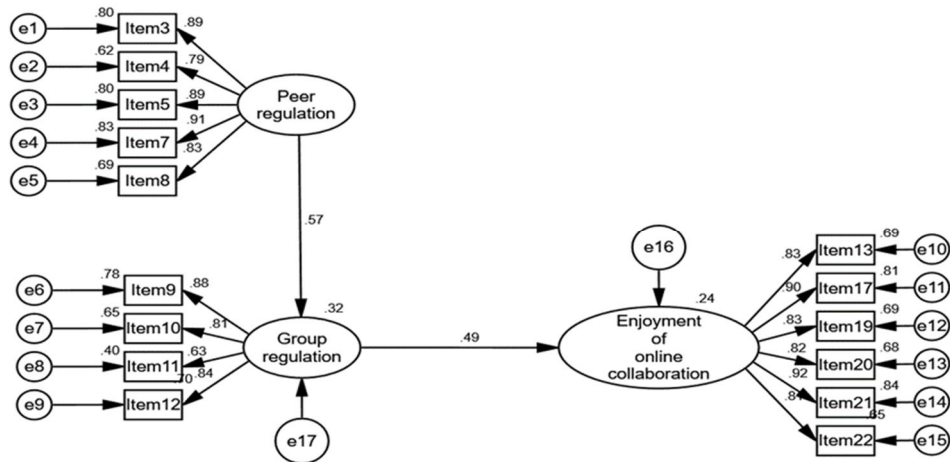
As shown in Table 4, *peer regulation* predicted *group regulation* significantly and positively (β = .567; *p* < .001), explaining 32.1% of its variance (effect size was medium). In addition, *group regulation* predicted *enjoyment of online collaboration* in a positive and significant way (β = .490; *p* < .001), explaining 24% of its variance (effect size was medium). Further, *peer regulation* exhibited an indirect effect on *enjoyment of online collaboration*. The results suggested there was a mediating effect of *group regulation* between *peer regulation* and *enjoyment of online collaboration*.
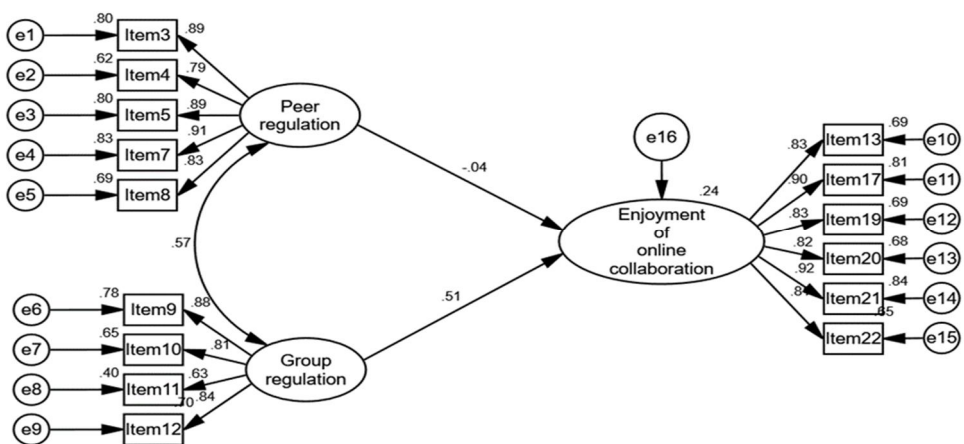
Model 1

Model 2

Model 3

Figure 1 Three models to be tested

A bootstrapping procedure was conducted to evaluate the significance of *peer regulation*'s indirect effect on *enjoyment of online collaboration*. As shown in Table 5, with 95% confidence intervals, neither bias-corrected (.209 ~ .360) nor percentile confidence intervals (.205 ~ .359) included zero. This demonstrates that *peer regulation* exerted a significant indirect effect (Du Prel et al., 2009) on *enjoyment of online collaboration*. The standardized indirect effect coefficient of *peer regulation* for *enjoyment of online collaboration* was .278, signaling a medium effect size by explaining 7.7% of the variance.

Table 3 Model fit indicators for three models

Model label	χ^2	df	χ^2 / df	CFI	TLI	SRMR	RMSEA
Model 1	253.654	87	2.916	.960	.951	.043	.076
Model 2	307.849	88	3.498	.947	.937	.115	.086
Model 3	235.966	88	2.886	.960	.952	.043	.075

Note. χ^2 = chi-square; df = degree of freedom; CFI = comparative fit index; TLI = Tucker–Lewis index; SRMR = standardized root mean square residua; RMSEA = root mean square error of approximation.

Table 4 Parameters for model 3

Independent variables	Dependent variables	Unstd. path coefficients	SE	z	p	Std. path coefficients	r^2
Peer regulation	Group regulation	.460	.044	10.351	***	.567	.321
Group regulation	EOC	.400	.047	8.359	***	.490	.240

Note. EOC = *enjoyment of online collaboration*; *SE* = standard error; *** *p* < .001.

Table 5 The indirect effect of *peer regulation* on *enjoyment of online collaboration*

Path	Unstd. estimate	Product of coefficients		Std. estimate	Bootstrap 2000 times 95% confidence interval				
						Bias-corrected		Percentile	
		SE	z		BC/PC *p*	Lower	Upper	Lower	Upper
IE	.184	.031	5.935	.278	***/***	.209	.360	.205	.359

Note. IE = the indirect path of *peer regulation* to *enjoyment of online collaboration*; *SE* = standard error; *** *p* < .001.

5. Discussion

The purpose of RQ1 was to identify the primary types of emotion regulation and the unique factor structure underpinning enjoyment in the online collaborative EFL writing of Chinese students majoring in English. Through principal component analysis, this study identified two major types of emotion regulation in online collaborative language learning: *peer regulation* and *group regulation*. In line with the two types of emotion regulation, *co-regulation* and *socially shared regulation*, defined in previous studies (Järvenoja & Järvelä, 2009; Järvenoja et al., 2019; Järvenoja et al., 2013), the findings of the present study indicate that learners' emotion regulation operates at individual and group levels in a collaborative learning context. *Peer regulation*, the identified factor 1 of this study, was similar to *co-regulation* because it reflected individual learners' attempts to affect others or their inclination to be affected by others. *Group regulation* was equivalent to *socially shared regulation*, as they contained the same items stressing the joint regulatory efforts of the group as an entity. However, *self-regulation*, a traditional type of emotion regulation Järvenoja and Järvelä (2009) observed in face-to-face collaborative settings, was not identified as a major type of emotion regulation in the online collaborative setting examined in this

study. This difference might have occurred because the implementation of emotion regulation depends on the situational context (Hadwin et al., 2018; Järvenoja et al., 2015). Due to the reduction of non-verbal cues, such as facial expressions and physical behaviors in online collaboration, learners might tend to spend more time and energy than they would in face-to-face situations regulating each other's emotional states and the group work instead of their own emotions (van der Meijden & Veenman, 2005).

Further, both *peer regulation* and *group regulation* contained items that reflected learners' adoption of emotion regulation strategies originally used for self-regulation in previous studies (e.g., Bielak & Mystkowska-Wiertelak, 2020a; Gross, 1998). For example, *cognitive change*, an emotion regulation strategy to reassess the personal meanings of emotion-inducing situations, could be found in learners' acceptance of individual differences in Item 7 ("I tried to explain to others that we needed to understand the differences in the group") and Item 12 ("As a group, we accepted the differences within the group"). *Situation modification*, which entails the alteration of emotionally-charged situations, was also notable in learners' modification of the way they collaborate in Item 5 ("I told the others we needed to be more flexible in order to find a compromise/solution to differences and conflicts between us") and Item 11 ("As a group, we decided that we had to sort out problems together in order to carry on working"). This result corroborates the previous finding that learners may enact various strategies originally developed to regulate themselves, such as change of cognitions and modification of the situation, to regulate peers' emotions and the group's emotional climate in a collaborative learning context (Bakhtiar et al., 2018; Järvenoja et al., 2019).

Enjoyment of online collaboration, the enjoyment-related factor identified in this study, corresponded to *FL enjoyment–Social* (Dewaele & MacIntyre, 2016) and *FL enjoyment–Atmosphere* (Li et al., 2018) in previous studies conducted in classroom learning contexts. All these factors focused on the positive learning climate built up by interactions among learners. However, *enjoyment of online collaboration* specified the online collaborative setting of this study where the socioemotional atmosphere was strongly present (Linnenbrink-Garcia & Pekrun, 2011). The identification of this factor indicates that the enjoyment learners experienced during online collaboration was mostly linked to the social and emotional climate within their group.

RQ2 concerned the relationships between *peer regulation, group regulation,* and *enjoyment of online collaboration*. The Pearson correlation analysis revealed medium positive correlations among these constructs. The results imply potentially reciprocal relations among two major types of emotion regulation and enjoyment. Learners' enjoyment in online collaboration depended on not only their engagement in *peer* and *group regulation* but also perhaps the interactions between these two types of emotion regulation. In line with previous studies (Bakhtiar et al., 2018;

Järvenoja et al., 2019), this finding suggests that different types of emotion regulation, such as *peer* and *group regulation*, often emerge simultaneously and interact with each other to construct a positive social climate in groups.

RQ3 pertained to direct and indirect influences of *peer regulation* and *group regulation* on *enjoyment of online collaboration*. The SEM analysis demonstrated that *group regulation* directly and positively affected *enjoyment of online collaboration.* The effect size was medium. This result strengthens the previous finding that group regulation is essential to creating and maintaining a positive group climate during collaboration (Mänty et al., 2020). Facing socio-emotional challenges, such as relational and communication problems, is a natural part of collaboration process (Järvenoja et al., 2019). Therefore, group regulation can help control the socioemotional atmosphere when challenging situations arise in collaborative learning (Näykki et al., 2014).

The study also highlighted an indirect medium-size effect of *peer regulation* on *enjoyment of online collaboration*, mediated by *group regulation*. This result suggests that peer-directed regulation contributed to enjoyment in online collaboration indirectly by boosting group-directed regulation. The facilitative role of *peer regulation* in *group regulation* supports the argument of Rogat and Adams-Wiggins (2015) and Hadwin et al. (2018) that consistent and productive regulation toward each other in a group enables the entire group's shared regulation to function.

6. Limitations and implications

The current study has several limitations. First, the participants were English major students recruited from a single university in China. Future studies should involve more participants from various academic levels and institutions to strengthen our findings on language learners' emotion regulation and enjoyment. Second, the study focused on online collaborative learning via *WeChat*-enhanced group chat. Since different platforms may provide different affordances to language learners, it is also important to explore how language learners work together through various communication tools, such as *Blackboard* or *Skype*. When using different communication tools, language learners might employ different patterns of emotion regulation to increase their enjoyment of collaborative learning (Kwon et al., 2014). Third, the cross-sectional nature of this study means it may not reflect the dynamic changes in learners' emotion regulation, their enjoyment, or the relationship between these aspects. Future studies may adopt various techniques and instruments, such as idiodynamic approaches and interviews, to capture learners' ongoing emotion regulation processes and their enjoyment experience within groups (Elahi Shirvan et al., 2020; Järvenoja et al., 2018).

Despite these limitations, the findings of the present study can serve as a basis for some theoretical and practical implications. On the theoretical level, the present investigation extends previous studies on language learners' emotion regulation and enjoyment to an online collaborative language learning context. Within this context, we have identified *peer regulation* and *group regulation*, and their complex effects on learners' enjoyment. The findings offer a novel understanding that different forms of regulation (i.e., peer-directed and group-directed regulation) interact in contributing to an enjoyable group atmosphere in online collaborative activities.

On a practical level, the findings of the present study remind language teachers that the shared efforts of group members are needed to respond to group-wide emotions, as these efforts directly promote learners' enjoyment. Thus, we propose that teachers should create opportunities to raise learners' awareness of group regulation. For example, via learning analytics, teachers may capture log data from learners' group regulation processes (Gašević et al., 2016). These data could allow teachers to provide personalized feedback for groups, which would enable them to understand the importance of group regulation in face-to-face or online collaborative learning (Malmberg et al., 2017). Further, the study indicates that the importance of *peer regulation*, as another important type of emotion regulation influencing enjoyment indirectly through *group regulation*, should not be downplayed in language learning contexts. A positive collaborative climate requires peer-directed regulation to lay the groundwork for group-directed regulation. Therefore, we suggest language teachers, as more capable peers of learners in collaborative groups or classrooms, employ appropriate strategies to guide or support learners' emotional states. The strategies (e.g., *cognitive change* and *situation modification*) learners used in this study could be a good choice. For instance, in the study of Bielak and Mystkowska-Wiertelak (2020b), language teachers purposefully reminded learners to accept the interpersonal differences in writing pace and strategy use.

7. Conclusion

This study has explored how English language learners regulate their emotions individually and collectively to increase their enjoyment during online collaborative learning. The findings suggest that an enjoyable collaborative atmosphere is possible when learners take on individual responsibility to manage the emotions experienced within groups and maintain their shared responsibility to overcome challenges (Bakhtiar et al., 2018).

More importantly, the study illuminates both direct and indirect effects of different emotion regulation types on FL enjoyment in online collaboration.

Group regulation was highlighted as a direct influencing factor on enjoyment, mediating the effect of *peer regulation*. This finding further enriches our understanding of the complex interaction between different types of emotion regulation and positive emotions (FL enjoyment in this study). While such findings are enlightening, they provide only another piece of a very complex puzzle of how language learners regulate their emotions to enjoy the online collaborative learning process. Therefore, further research is needed to gain more insights into this area. Given the complexity of relationships between emotion regulation and enjoyment in online collaboration, it is advisable to conduct in-depth case studies on the online interactions of diverse collaborative groups using video observation and stimulated recall interviews. Doing so would illuminate how different types of emotion regulation interact to enhance enjoyment. It would also make sense to include more emotional states, such as anxiety and boredom, to examine how these relate to different types of emotion regulation in online collaborative language learning. Understanding the interplay between emotional experiences and emotion regulation activities during language learners' online collaboration is vital for illustrating how they can transform their online interactions into pleasant and successful ones.

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