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

Word count: (including abstract, tables and figures, and references)

**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 English-major students 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*, and one factor underpinning enjoyment, namely *enjoyment of online collaboration*. Correlation analysis showed medium and positive relations 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 are suggested 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. Positive emotions help FL learners explore learning opportunities and take risks in unfamiliar cultural and linguistic contexts so that they can develop better language competence (Jiang & Dewaele, 2019). In FL learning, enjoyment is one of the most prevalent positive emotions experienced by learners (Jiang & Dewaele, 2019; Li, Jiang, & Dewaele, 2018; Piniel & Albert, 2018). Recent studies have 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, Magdalena, & Saito, 2019). However, these studies have been 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, Järvelä, & Malmberg, 2015). Online collaborative learning has been studied and proved 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 their online collaboration. In online collaborative learning, positive emotions such as enjoyment are needed to maintain 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, more studies need to explore the unique pattern of positive emotions (Dewaele & MacIntyre, 2016; Li et al., 2018), especially enjoyment, in the specific context of online collaborative learning. Moreover, emotions are not a product of the mind, but regulated and constructed from interpersonal interactions (Swain, 2013). In an online setting, a positive emotional climate is more difficult to achieve as 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 spend more time and energy regulating online collaborative activities to be emotionally satisfying.

To understand the emotional aspect of online collaborative language learning, the present study aimed to investigate the factor structure of enjoyment and the types of emotion regulation that may emerge in relation to enjoyment when English as a foreign language (EFL) learners at a Chinese university complete a series of English writing tasks online in collaboration. In the coming sections, we shall review relevant studies on emotion regulation and foreign language enjoyment.

1. **Literature review**
   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, serving to monitor, change, modify, and maintain the valence, duration, and intensity of learners’ emotions (Boekaerts, 2011). Such regulation often leads to the growth of positive emotions and reduction of negative emotions in learning, facilitating learners’ academic achievement and well-being (Pekrun, 2006).

While emotion regulation has been subject to numerous empirical investigations from an intrapersonal perspective of self-regulation (e.g., Boekaerts, 2011; Gross, 1998), 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, Volet, & Järvelä, 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 when 63 teacher education students in Finland 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, Järvelä, Kirschner, and Järvenoja (2014) further explored the relations between emotion regulation and emotional challenges by combining video-observation data and video-stimulated recall interview data collected from collaborative learning processes of 22 education major students in Finland. This study revealed that in the face of socio-emotional challenges that disrupt 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 the 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 more 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, Näykki, and Törmänen (2019) revealed how student 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 climate for learners’ knowledge co-construction. Similarly, Mänty, Järvenoja, and Törmänen (2020) asserted that group-level regulation could effectively shift a group’s emotional atmosphere from negative to positive. The data were collected by means of video recording of group collaborative activities and an emotion self-report tool among 37 primary school students in Finland. As such, emotion regulation in face-to-face collaborative activities goes beyond self-regulated mechanisms, operating to achieve and maintain a positive emotional climate for effective group learning (Hadwin, Järvelä, & Miller, 2018; Järvenoja et al., 2015).

Researchers have 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 both up-regulate positive and down-regulate negative emotions by implementing specific categories of 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). Compared to face-to-face learning settings that include classroom and face-to-face collaboration, 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 (Dunlap et al., 2016). Given that emotion regulation is context-bound and situated in specific learning situations (Järvenoja et al., 2015), a different pattern of emotion regulation may arise in online collaborative learning to sustain a favorable emotional climate for productive online collaborative language learning. Such considerations have prompted the present study to identify what types of emotion regulation emerge and how these types of emotion regulation affect enjoyment, a typical positive emotion for language learning in the context of online collaborative learning.

* 1. Foreign language enjoyment

Enjoyment is a complex positive emotion that assumes dimensions in addition to a simple pleasurable feeling, such as “an intellectual focus, heightened attention, and optimal challenge” (Boudreau, MacIntyre, & Dewaele, 2018). In other words, enjoyment refers to a sense of novelty or accomplishment arising 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, enhancing 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 more effectively absorbing a foreign language. 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 have confirmed the positive effect of language learning enjoyment on learners’ willingness to communicate (Dewaele & Dewaele, 2018; Khajavy, MacIntyre, & Barabadi, 2018), language learning grit (Pawlak, Csizér, Kruk, & Zawodniak, 2022), language motivation (Pawlak, Zarrinabadi, & Kruk, 2022), language fluency (Bielak, 2022), language performance (Dewaele & Alfawzan, 2018; Saito, Dewaele, Abe, & In'nami, 2018), and language achievement (Jin & Zhang, 2018; Li, Dewaele, & Jiang, 2019) in various contexts.

Dewaele and MacIntyre (2014) were the first to develop a 21-item foreign language enjoyment scale, with which they examined the potential variables influencing foreign language 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. Based on the principal component analysis of the same dataset (*N* = 1746), Dewaele and MacIntyre (2016) modified the original 21-item scale to a 14-item version and identified a two-factor structure of FL enjoyment, namely *FL enjoyment-Social* and *FL enjoyment-Private*. These two factors reflected that both the social atmosphere of the language classroom and learners’ private thoughts could influence 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 to 11-item version in the Chinese EFL context. Different 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 indicate that the factor structure of enjoyment may differ depending on the context in which the construct is investigated (Dewaele & MacIntyre, 2016).

However, all of these studies have 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, Webster, & Hadwin, 2018). As enjoyment does vary across different language learning situations (Dewaele & MacIntyre, 2016; Piniel & Albert, 2018), 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 rather constructed or regulated interpersonally through interactions (Poehner & Swain, 2016; Swain, 2013). This could also be the case for enjoyment. Though 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 have touched upon how learners regulate their emotions to experience enjoyment in interactions. This has motivated us to take a regulative perspective to further investigate language learners’ enjoyment during their online collaboration. More specifically, the present study addresses the following three research questions:

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

**3. Method**

* 1. Participants and context

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 years old, with a mean age of 19.72 years (*SD* = .89). They were all Chinese L1 users and studied English as their only foreign language for seven to ten years. Their English proficiency ranged from lower intermediate, 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). 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 classroom.

Participants, as sophomores, were required to attend a semester-long extracurricular program, which consists 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, Li, & Li, 2018). On *WeChat*, teachersposted 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 each other’s 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 between 20 and 50 mins per week. The ten collaborative English writing assignments together accounted for 30% of learners’ final grades in English writing course.

* 1. Instruments

A composite questionnaire that contains 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, that is, *Adaptive Instrument for Regulation of Emotions* (AIRE) (Järvenoja et al., 2013) and *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.

* + 1. *Adaptive Instrument for Regulation of Emotions* (AIRE)(Järvenoja et al., 2013)

The AIRE scale, grounded in self-regulated and socially regulated learning theory, was used to capture learners’ emotion regulation processes in collaborative learning activities (Järvenoja et al., 2013). The scale included 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 ranged from 1 (“Did not happen at all”) to 5 (“Did happen a lot”). A higher score indicated more frequent use of item-related regulation activities. High internal reliability of the scale (Cronbach’s *ɑ* 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.

* + 1. *Foreign Language Enjoyment Scale* (FLES)(Jiang & Dewaele, 2019)

Jiang and Dewaele’s (2019) FLES, used to measure enjoyment in the present study, was a modified version of the original foreign language enjoyment scale developed by Dewaele and MacIntyre (2014) using 1746 FL learners worldwide. The scale included 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 were 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 *ɑ* value = .889).

* 1. 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 (.13). After this item deletion, the resulting 11-item AIRE achieved a Cronbach’s *ɑ* value of .923 in the pilot test and .937 in the subsequent main study. For FLES, all ten items exhibited satisfactory correlations (> .30) with the scale (Field, 2013). Cronbach’s *ɑ* 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.

* 1. Data analysis

The data analysis proceeded in three steps. To investigate the major types of emotion regulation and the factor structure of enjoyment (Question 1), principal component analysis was first performed through SPSS 27 based on the data collected from 336 participants. Then, a Pearson correlation analysis was conducted to offer an initial glimpse of the relations across different types of emotion regulation and enjoyment (Question 2). Based on Plonsky and Oswald’s (2014) recommendations, the strength of the correlation coefficients (*r*) was interpreted as small (.25), medium (.40), and large (.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 (Question 3). In the SEM analysis, multiple fit indices were considered to assess three optional models, including the ratio of Chi-square to degrees of freedom (χ2 / df), comparative fit index (CFI), tucker lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). Good fit thresholds for these indices are χ2 / df < 3.00, CFI > 0.90, TLI > 0.90, RMSEA < 0.08 and SRMR < 0.08 (Dagnall, Denovan, Parker, Drinkwater, & Walsh, 2018; Wan, Lee, Yan, & Ko, 2021). For χ2 / 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 (*r2*) in the present study was considered to be small (.0625), medium (.16), and large (.36).

1. **Results**
   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, namely sampling adequacy and multivariate normality (Lattin, Carroll, & Green, 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 χ2 (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, Panuwatwanich, & Stewart, 2017). After factor rotation, we retained three factors that included items with factor loadings of 0.5 or greater, as 0.5 is 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.

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.

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 towards other peers in groups, such as “I tried to explain to others that we needed to understand the differences in the group.” Factor 1 was thus labelled *peer regulation.* Factor 2 contained Items 9, 10, 11, and 12. Staring 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 is a good atmosphere”and “The online collaborative English writing is fun.” Consequently, Factor 3 was named *enjoyment of online collaboration*.

* 1. Correlations among *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 among *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 |

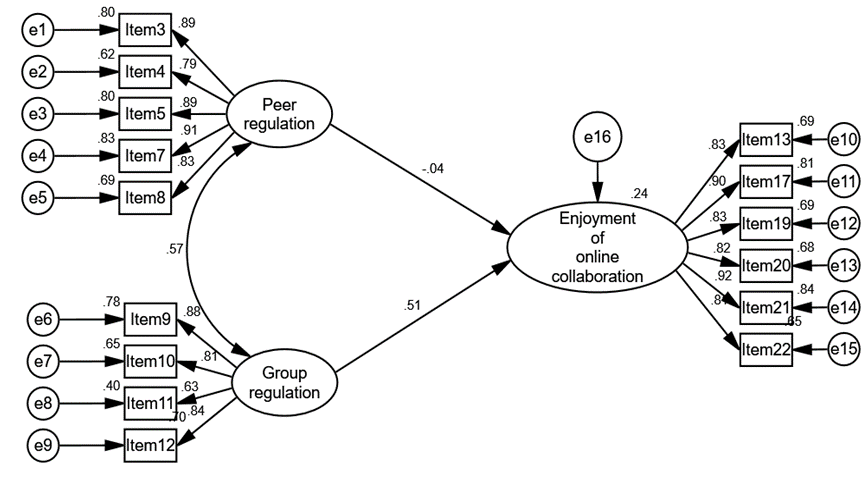
Note: \*\*\**p* < .001; EOC = *Enjoyment of online collaboration*.

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

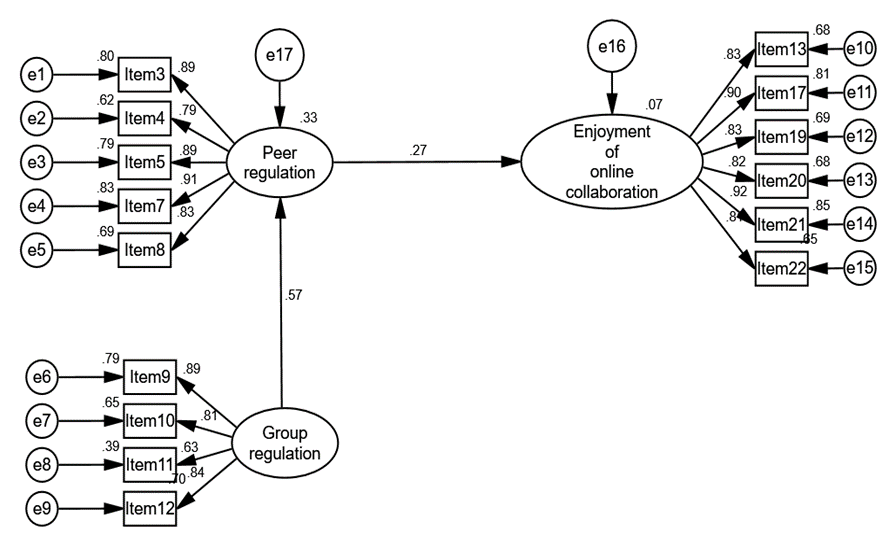
Three models, depicted in Figure 1, were established to investigate the ways *peer regulation* and *group regulation* impact *enjoyment of online collaboration*. As shown in Table 3, Model 3 was the best among the three models, as the fit indicators for this model (χ2 / df= 2.886; CFI = .960; TLI = .952; SRMR = .043; RMSEA = .075) were better generated than those for Model 1 (χ2 / df = 2.916; CFI = .960; TLI = .951; SRMR = .043; RMSEA = .076) and Model 2 (χ2 / 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). Furthermore, *peer regulation* exhibited an indirect effect on *enjoyment of online collaboration*. The results confirm the mediating effect of *group regulation* between *peer regulation* and *enjoyment of online collaboration*.

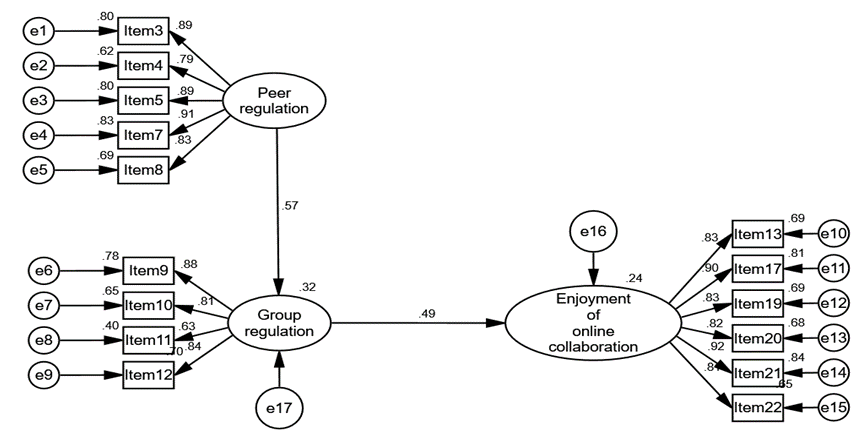
A bootstrapping procedure was conducted to evaluate the significance of *peer regulation*’s indirect effect on *enjoyment of online collaboration*. As shown in Table 5, with 95% confidence intervals, neither bias-corrected (.209 ~ .360) nor percentile confidence intervals (.205 ~ .359) included zero.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



Model 1



Model 2



Model 3

Figure 1 Three models to be tested

Table 3 Model fit indicators for three models

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Model label | χ2 | df | χ2 / 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 |

Table 4 Parameters for Model 3

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Independent variables | Dependent variables | Unstd. path coefficients | *SE* | *z* | *p* | Std. path coefficients | *r2* |
| Peer regulation | Group regulation | .460 | .044 | 10.351 | \*\*\* | .567 | .321 |
| Group regulation | EOC | .400 | .047 | 8.359 | \*\*\* | .490 | .240 |

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

Table 5 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*; \*\*\**p* < .001.

1. **Discussion**

The purpose of research question 1 was to identify the primary types of emotion regulation and the unique factor structure underpinning enjoyment in the online collaborative EFL writing of Chinese English majors. Through principal component analysis, this study identified two major types of emotion regulation in online collaborative language learning: *peer regulation* and *group regulation*. Aligning 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 present study also indicates that learners’ emotion regulation operates at both individual and group levels in collaborative learning context. *Peer regulation,* the identified Factor 1 of this study, was similar to *co-regulation*, reflecting 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 can be attributed to the fact that 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 regulating each other’s emotional states and the group work instead of themselves than they would in face-to-face situations (van der Meijden & Veenman, 2005).

Furthermore, both *peer regulation* and *group regulation* contained items that reflect 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 situation, can 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, is 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 groups’ emotional climate in collaborative learning context (Bakhtiar et al., 2018; Järvenoja et al., 2019).

*Enjoyment of online collaboration*, the enjoyment-related factor identifed 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 context. All of them focuse on the positive learning climate built up by interactions among learners. However, *enjoyment of online collaboration* presents more the online collaborative setting of this study where the socio-emotional atmosphere is strongly present (Linnenbrink-Garcia & Pekrun, 2011). The identification of this factor indicates that enjoyment learners experienced during online collaboration was mostly linked to the social emotion climate within groups.

Research question 2 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. In other words, learners’ enjoyment in online collaboration depends on not only their engagement in peer and group regulation, but also on the interactions between these two types of emotion regulation. This finding is in line with previous studies which have suggested that different types of emotion regulation, such as co- and socially shared regulation, often emerge simultaneously and interact with each other to construct a positive social climate in groups (Bakhtiar et al., 2018; Järvenoja et al., 2019).

Research question 3 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 affects *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). Given that facing socio-emotional challenges, such as relational and communication problems, is the natural part of collaboration, group regulation can take effect to control the socio-emotional atmosphere when collaborative learning is challenged (Näykki et al., 2014).

The study, as noted in Table 5, also highlighted an indirect medium-size effect of *peer regulation* on *enjoyment of online collaboration*, mediatedby *group regulation*. This result suggests that peer-directed regulation contributes 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 towards each other in a group creates affordances for the emtire group’s shared regulation to function.

1. **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 at various academic levels and from a variety of 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, it is possible that language learners employ different patterns of emotion regulation to increase their enjoyment of collaborative learning (Kwon, Liu, & Johnson, 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, Taherian, & Yazdanmehr, 2020; Järvenoja et al., 2018).

Despite these limitations, the findings of the present study can serve as a basis for some theorectical 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 specific context, we have identified *peer regulation* and *group regulation* that occur 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, Dawson, Rogers, & Gasevic, 2016). These data could allow teachers to provide personalized feedback for groups, which enables them to understand the importance of group regulation in face-to-face or online collaborative learning (Malmberg, Järvelä, & Järvenoja, 2017). Besides, the study indicates that *peer regulation*, as another important type of emotion regualtion influencing enjoyment indirectly through *group regulation*, should not be downplayed. A positive collaborative climate requires peer-directed regulation to lay the groundwork for group-directed regulation. Therefore, we suggest that language teachers, as more capable peers of learners in collaborative groups or classrooms, can 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.

1. **Conclusion**

The study has explored how English language learners regulate their emotions both individually and collectively to increase enjoyment during online collaborative learning. The findings suggest that an enjoyable collaborative atmosphere is possible when learners shoulder 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 picture 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 just 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 in 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 inteactions of diverse collaborative groups employing video observation and stimulated recall interviews so that how different types of emotion regulation interact to enhance enjoyment can be better illuminated. It would also make sense to include more emotions, such as anxiety, boredom, and burnout, to examine how varied emotions relate to different types of emotion regulation in online collaborative language learning. Understanding the interplay between emotional experiences and emotion regulation activities during language leaners’ online collaboration is vital for illustrating how they are able to transform their online interactions into pleasant and successful ones.

**References**

Bakhtiar, A., Webster, E. A., & Hadwin, A. F. (2018). Regulation and socio-emotional interactions in a positive and a negative group climate. *Metacognition and Learning, 13*(1), 57-90. doi:10.1007/s11409-017-9178-x

Bielak, J. (2022). To what extent are foreign language anxiety and foreign language enjoyment related to L2 fluency? An investigation of task-specific emotions and breakdown and speed fluency in an oral task. *Language teaching research, 0*(0), 13621688221079319. doi:10.1177/13621688221079319

Bielak, J., & Mystkowska-Wiertelak, A. (2020a). Investigating language learners’ emotion-regulation strategies with the help of the vignette methodology. *System, 90*, 102208. doi:<https://doi.org/10.1016/j.system.2020.102208>

Bielak, J., & Mystkowska-Wiertelak, A. (2020b). Language teachers’ interpersonal learner-directed emotion-regulation strategies. *Language teaching research*, 1362168820912352. doi:10.1177/1362168820912352

Boekaerts, M. (2011). Emotions, emotion regulation, and self-regulation of learning. In *Handbook of self-regulation of learning and performance.* (pp. 408-425). New York, NY, US: Routledge/Taylor & Francis Group.

Boudreau, C., MacIntyre, P. D., & Dewaele, J.-M. (2018). Enjoyment and anxiety in second language communication: An idiodynamic approach. *Studies in second language learning and teaching, 8*(1), 149-170. doi:10.14746/ssllt.2018.8.1.7

Csikszentmihalyi, M. (2000). *Beyond boredom and anxiety*. San Francisco: Jossey-Bass.

Csikszentmihalyi, M. (2008). Flow: The psychology of optimal experience. In. New York: Harper Perennial.

Dagnall, N., Denovan, A., Parker, A., Drinkwater, K., & Walsh, R. S. (2018). Confirmatory factor analysis of the inventory of personality organization-reality testing subscale. *Frontiers in psychology, 9*, 1116. doi:10.3389/fpsyg.2018.01116

Dewaele, J.-M., & Alfawzan, M. (2018). Does the effect of enjoyment outweigh that of anxiety in foreign language performance? *Studies in second language learning and teaching, 8*(1), 21-45. doi:10.14746/ssllt.2018.8.1.2

Dewaele, J.-M., & Dewaele, L. (2018). Learner-internal and learner-external predictors of willingness to communicate in the FL classroom. *Journal of the European Second Language Association, 2*(1), 24-37. doi:10.22599/jesla.37

Dewaele, J.-M., & MacIntyre, P. (2014). The two faces of Janus? Anxiety and enjoyment in the foreign language classroom. *Studies in second language learning and teaching, 4*(2), 237-274. doi:10.14746/ssllt.2014.4.2.5

Dewaele, J.-M., & MacIntyre, P. (2016). Foreign language enjoyment and foreign language classroom anxiety. The right and left feet of FL learning? In P. MacIntyre, T. Gregersen, & S. Mercer (Eds.), *Positive Psychology in SLA* (pp. 215-236). Bristol: Multilingual Matters.

Dewaele, J.-M., Magdalena, A. F., & Saito, K. (2019). The effect of perception of teacher characteristics on Spanish EFL Learners’ Anxiety and Enjoyment. *The Modern Language Journal, 103*(2), 412-427. doi:10.1111/modl.12555

Du Prel, J.-B., Hommel, G., Röhrig, B., & Blettner, M. (2009). Confidence interval or p-value?: Part 4 of a series on evaluation of scientific publications. *Deutsches Ärzteblatt International, 106*(19), 335-339. doi:10.3238/arztebl.2009.0335

Dunlap, J. C., Bose, D., Lowenthal, P. R., York, C. S., Atkinson, M., & Murtagh, J. (2016). Chapter 8 - What sunshine is to flowers: A literature review on the use of emoticons to support online learning. In S. Y. Tettegah & M. Gartmeier (Eds.), *Emotions, Technology, Design, and Learning* (pp. 163-182). San Diego: Academic Press.

Elahi Shirvan, M., Taherian, T., & Yazdanmehr, E. (2020). The dynamics of foreign language enjoyment: An ecological momentary assessment. *Frontiers in psychology, 11*, 1391. doi:10.3389/fpsyg.2020.01391

Field, A. (2013). *Discovering statistics using IBM SPSS statistics* (4th edition ed.). London: Sage.

Fredrickson, B. L. (2003). The value of positive emotions: The emerging science of positive psychology is coming to understand why it's good to feel good. *American scientist, 91*(4), 330-335. doi:10.1511/2003.4.330

Gašević, D., Dawson, S., Rogers, T., & Gasevic, D. (2016). Learning analytics should not promote one size fits all: The effects of instructional conditions in predicting academic success. *The Internet and Higher Education, 28*, 68-84.

George, D., & Mallery, P. (2019). *IBM SPSS statistics 26 step by step: A simple guide and reference.* New York: Routledge.

Gross, J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology, 2*(3), 271-299. doi:10.1037/1089-2680.2.3.271

Hadwin, A. F., Järvelä, S., & Miller, M. (2018). Self-regulation, co-regulation, and shared regulation in collaborative learning environments. In B. J. Zimmerman & D. H. Schunk (Eds.), *Handbook of self-regulation of learning and performance, 2nd ed.* (pp. 83-106). New York: Routledge.

Järvelä, S., Kirschner, P., Panadero, E., Malmberg, J., Phielix, C., Jaspers, J., . . . Järvenoja, H. (2015). Enhancing socially shared regulation in collaborative learning groups: Designing for CSCL regulation tools. *Educational Technology Research and Development 63*(1), 125-142. doi:10.1007/s11423-014-9358-1

Järvenoja, H., & Järvelä, S. (2009). Emotion control in collaborative learning situations: Do students regulate emotions evoked by social challenges. *British Journal of Educational Psychology, 79*(3), 463-481. doi:10.1348/000709909X402811

Järvenoja, H., Järvelä, S., & Malmberg, J. (2015). Understanding regulated learning in situative and contextual frameworks. *Educational Psychologist, 50*(3), 204-219. doi:10.1080/00461520.2015.1075400

Järvenoja, H., Järvelä, S., Törmänen, T., Näykki, P., Malmberg, J., Kurki, K., . . . Isohätälä, J. (2018). Capturing motivation and emotion regulation during a learning process. *Frontline Learning Research, 6*(3), 85-104. doi:10.14786/flr.v6i3.369

Järvenoja, H., Näykki, P., & Törmänen, T. (2019). Emotional regulation in collaborative learning: when do higher education students activate group level regulation in the face of challenges? *Studies in Higher Education, 44*(10), 1747-1757. doi:10.1080/03075079.2019.1665318

Järvenoja, H., Volet, S., & Järvelä, S. (2013). Regulation of emotions in socially challenging learning situations: An instrument to measure the adaptive and social nature of the regulation process. *Educational Psychology, 33*(1), 31-58. doi:10.1080/01443410.2012.742334

Jiang, Y., & Dewaele, J.-M. (2019). How unique is the foreign language classroom enjoyment and anxiety of Chinese EFL learners? *System, 82*, 13-25. doi:10.1016/j.system.2019.02.017

Jin, Y., & Zhang, L. J. (2018). The dimensions of foreign language classroom enjoyment and their effect on foreign language achievement. *International Journal of Bilingual Education and Bilingualism*, 1-15. doi:10.1080/13670050.2018.1526253

Khajavy, G. H., MacIntyre, P. D., & Barabadi, E. (2018). Role of the emotions and classroom environment in willingness to communicate: Applying doubly latent multilevel analysis in second language acquisition research. *Studies in Second Language Acquisition, 40*(3), 605-624. doi:10.1017/S0272263117000304

Kukulska‐Hulme, A., & Viberg, O. (2018). Mobile collaborative language learning: State of the art. *British Journal of Educational Technology, 49*(2), 207-218. doi:10.1111/bjet.12580

Kwon, K., Liu, Y.-H., & Johnson, L. P. (2014). Group regulation and social-emotional interactions observed in computer supported collaborative learning: Comparison between good vs. poor collaborators. *Computers & Education, 78*, 185-200. doi:10.1016/j.compedu.2014.06.004

Lattin, J. M., Carroll, J. D., & Green, P. E. (2003). *Analyzing multivariate data*. Pacific Grove: Thomson Brooks/Cole.

Li, C., Dewaele, J.-M., & Jiang, G. (2019). The complex relationship between classroom emotions and EFL achievement in China. *Applied Linguistics Review, 11*(3), 485-510. doi:10.1515/applirev-2018-0043

Li, C., Jiang, G., & Dewaele, J.-M. (2018). Understanding Chinese high school students’ foreign language enjoyment: Validation of the Chinese version of the foreign language enjoyment scale. *System, 76*, 183-196. doi:10.1016/j.system.2018.06.004

Linnenbrink-Garcia, L., & Pekrun, R. (2011). Students’ emotions and academic engagement: Introduction to the special issue. *Contemporary Educational Psychology, 36*(1), 1-3. doi:<https://doi.org/10.1016/j.cedpsych.2010.11.004>

MacIntyre, P. D., & Gregersen, T. (2012). Emotions that facilitate language learning: The positive-broadening power of the imagination. *Studies in second language learning and teaching, 2*(2), 193-213. doi:10.14746/ssllt.2012.2.2.4

Malmberg, J., Järvelä, S., & Järvenoja, H. (2017). Capturing temporal and sequential patterns of self-, co-, and socially shared regulation in the context of collaborative learning. *Contemporary Educational Psychology, 49*, 160-174. doi:10.1016/j.cedpsych.2017.01.009

Mänty, K., Järvenoja, H., & Törmänen, T. (2020). Socio-emotional interaction in collaborative learning: Combining individual emotional experiences and group-level emotion regulation. *International Journal of Educational Research, 102*, 101589. doi:10.1016/j.ijer.2020.101589

Näykki, P., Järvelä, S., Kirschner, P. A., & Järvenoja, H. (2014). Socio-emotional conflict in collaborative learning—A process-oriented case study in a higher education context. *International Journal of Educational Research, 68*, 1-14. doi:10.1016/j.ijer.2014.07.001

Pawlak, M., Csizér, K., Kruk, M., & Zawodniak, J. (2022). Investigating grit in second language learning: The role of individual difference factors and background variables. *Language teaching research*, 13621688221105775. doi:10.1177/13621688221105775

Pawlak, M., Zarrinabadi, N., & Kruk, M. (2022). Positive and negative emotions, L2 grit and perceived competence as predictors of L2 motivated behaviour. *Journal of Multilingual and Multicultural Development*, 1-17. doi:10.1080/01434632.2022.2091579

Pekrun, R. (2006). The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. *Educational psychology review, 18*(4), 315-341. doi:10.1007/s10648-006-9029-9

Piniel, K., & Albert, A. (2018). Advanced learners' foreign language-related emotions across the four skills. *Studies in second language learning and teaching, 8*(1), 127-147. doi:10.14746/ssllt.2018.8.1.6

Plonsky, L., & Oswald, F. L. (2014). How Big Is “Big”? Interpreting Effect Sizes in L2 Research. *64*(4), 878-912. doi:<https://doi.org/10.1111/lang.12079>

Poehner, M. E., & Swain, M. (2016). L2 development as cognitive-emotive process. *Language and Sociocultural Theory, 3*(2), 219-241. doi:10.1558/lst.v3i2.32922

Rogat, T. K., & Adams-Wiggins, K. R. (2015). Interrelation between regulatory and socioemotional processes within collaborative groups characterized by facilitative and directive other-regulation. *Computers in human behavior, 52*, 589-600. doi:10.1016/j.chb.2015.01.026

Saito, K., Dewaele, J. M., Abe, M., & In'nami, Y. (2018). Motivation, emotion, learning experience, and second language comprehensibility development in classroom settings: A cross‐sectional and longitudinal study. *Language Learning, 68*(3), 709-743. doi:10.1111/lang.12297

Swain, M. (2013). The inseparability of cognition and emotion in second language learning. *Language Teaching, 46*(2), 195-207. doi:10.1017/S0261444811000486

van der Meijden, H., & Veenman, S. (2005). Face-to-face versus computer-mediated communication in a primary school setting. *Computers in human behavior, 21*(5), 831-859. doi:10.1016/j.chb.2003.10.005

Von Scheve, C. (2012). Emotion regulation and emotion work: Two sides of the same coin? *Frontiers in psychology, 3*, 496. doi:10.3389/fpsyg.2012.00496

Wan, Z. H., Lee, J. C.-K., Yan, Z., & Ko, P. Y. (2021). Self-regulatory school climate, group regulation and individual regulatory ability: towards a model integrating three domains of self-regulated learning. *Educational Studies*, 1-16. doi:10.1080/03055698.2021.1894093

Wipulanusat, W., Panuwatwanich, K., & Stewart, R. A. (2017). Exploring leadership styles for innovation: An exploratory factor analysis. *Engineering Management in Production and Services, 9*(1), 7-17. doi:10.1515/emj-2017-0001

Yoshida, R. (2020). Learners’ emotions in foreign language text chats with native speakers. *Computer Assisted Language Learning*, 1-26. doi:10.1080/09588221.2020.1818787

Zou, B., Li, H., & Li, J. (2018). Exploring a curriculum app and a social communication app for EFL learning. *Computer Assisted Language Learning, 31*(7), 694-713. doi:10.1080/09588221.2018.1438474