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Exploring the role of EFL learners' online self-regulation profiles in their social regulation of learning in wiki-supported collaborative reading activities

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Abstract Previous research indicated that the individual skills that learners bring to the group is critical to the social regulation process in computer-supported collaborative learning activities. However, few studies have explored how students' self-regulation capacity is related to the occurrence of the social regulation strategies in the learning group. Situated in a wiki-supported collaborative reading situation, this study explored the roles of English language learners' online self-regulation profiles in their use of social regulation strategies in the collaboration process. The participants of this study were 95 Chinese college students who studied English as a foreign language. The *Online Self-regulated English Learning Questionnaire* was used to measure the students' self-regulation strategies, based on which latent profile analysis was adopted to identify the students with similar patterns of self-regulation variables. Content analysis of students' discussion messages was conducted to analyze their social regulation strategies in collaborative learning, focusing on regulation types (i.e., co-regulation and socially shared regulation) and regulation foci (i.e., task, emotion, and organization). This study identified two distinctive types

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of online self-regulation profiles, namely, reflection-oriented competent profile and average profile. The results show that, in terms of the types of social regulation, individual students belonging to the reflection-oriented competent profile tended to be more active in initiating and carrying out socially shared regulation strategies. Regarding the social regulation foci, it was found that the learners of reflection-oriented competent profile demonstrated significantly more positive social–emotional regulation strategies. The findings suggest that teachers need to consider students' online self-regulation profiles when dividing them into small groups to carry out wiki-supported collaborative learning activities.

Keywords Self-regulated learning · Social regulation · Latent profile analysis · Computer-supported collaborative learning · English as a foreign language

Introduction

Wiki-supported collaborative learning activities have been widely used in the domain of teaching English as a foreign language (EFL) to provide students with more opportunities to interact with each other and to advance innovative and active learning (Lai et al. 2016; Zorko 2009). A large body of research on collaborative language learning has documented the affordances of wikis in promoting English language learners' motivation to use the target language, assisting the development of English language skills, and enhancing their learning autonomy (Ducate et al. 2011; Zheng and Warschauer 2017). However, as with other forms of technology-enhanced collaborative learning, wiki can also pose new challenges for groups' strategic regulation of learning. Researchers have showed an increasing interest in the social forms of metacognitive, emotional, and motivational regulation processes that emerge and function to deal with learning challenges during the collaboration process (Ucan and Webb 2015).

Social regulation refers to the regulatory processes directed to planning, monitoring, regulating, and evaluating learning on the group level (Grau and Whitebread 2012; Volet et al. 2009). Social regulation mainly includes two types: co-regulation and socially shared regulation (Schoor and Bannert 2012; Su et al. 2018a). When working in a collaborative learning group, students not only need to regulate their own learning, they also play a role in regulating the learning of other group members (i.e., co-regulation of learning) and the learning of the group (i.e., socially shared regulation). More importantly, the self-regulation skills that each group member brings to the collaborative task may influence the occurrence of social regulation strategies in the learning group (Panadero et al. 2015). While the specific influence of self-regulation on individual learning has been well documented (Wong et al. 2019), there is scarce evidence on the role of self-regulation on learning groups' social regulation processes (Räisänen et al. 2016). Since the interplay between self-regulation and social regulation is complex and multifaceted, researchers call for conducting more research to explore this under-researched relationship between individual self-regulation and social regulation in order to better design and

implement collaborative learning activities (Järvelä et al. 2019). Therefore, situated in wiki-supported collaborative reading activities, this study aimed to examine how the EFL learners with the distinct profiles in online self-regulation differ in terms of their social regulation strategies during the collaboration processes.

Literature review

Self-regulated learning profiles

Self-regulated learning (SRL) refers to individual learners' self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals (Zimmerman 2000). Researchers have shown increasing interest in using a person-centered analytical approach (e.g., latent profile analysis) to uncover students' SRL profiles so as to use this information to optimally support students' learning. For example, based on students' responses to the Online Self-regulated Learning Questionnaire, Barnard-Brak et al. (2010) adopted latent profile analysis to identify the SRL profiles of undergraduates from an online degree course. Their results identified five similar distinct SRL profiles: super self-regulated learners, competent self-regulated learners, forethought-endorsing self-regulated learners, reflection self-regulated learners, and non- or minimal self-regulated learners. Their findings further displayed that most of the students had the highest score in the dimension of environment structuring. Ning and Downing (2015) examined the SRL profiles among 828 undergraduates from social science faculty and science faculty at a university in Hong Kong. Their research revealed four distinct SRL profiles: minimal self-regulated learners, behavioral-oriented self-regulated learners, competent self-regulated learners, and metacognitive-oriented self-regulated learners. Similarly, another study of 205 high school students from a college preparation program identified three SRL profiles: high self-regulated learners, average self-regulated learners, and low self-regulated learners (Abar and Loken 2010). Although the aforementioned studies have revealed the profiles of self-regulated learning in the contexts of online learning or blended learning, their findings may not be generalizable to the context of English language learning due to the context-specific nature of self-regulation. One of the aims of our study is to uncover EFL learners' profiles of online self-regulated learning.

Social regulation in collaborative learning settings

Social regulation of learning emerges when students regulate as a dyad or a bigger group on a joint task to achieve the learning goals (Järvelä and Hadwin 2013). Social regulation of learning in collaborative situations shows different levels and characteristics (Isohätälä et al. 2017). To be specific, two types of social regulation have been identified: co-regulation and socially shared regulation (Panadero and Järvelä 2015). Co-regulation refers to a transitional or shifting process in which more capable others regulate another student's learning through interpersonally sharing his regulatory process, beliefs, and knowledge (Hadwin and Oshige 2011).

Co-regulation could be initiated by cues, prompts, and scripts, such as asking an individual to clarify the task criteria or prompting an individual to review the notes (Volet et al. 2009). On the other hand, socially shared regulation emerges when multiple group members interdependently or collectively regulate their learning and engage in an orchestral pattern (Hadwin and Oshige 2011; Järvelä et al. 2016; Su et al. 2018a). Socially shared regulation behaviors are usually directed to all members in the group (Panadero 2017; Zheng et al. 2017). The difference between co-regulation and socially shared regulation is that the former involves a less-shared balanced type of regulation while the latter remains to be the joint one.

Researchers have also showed increasing interest in exploring the features or foci of students' social regulation in the collaboration process (Hadwin et al. 2018). Grau and Whitebread's (2012) study revealed that students exhibited more social regulatory behaviors of process monitoring but demonstrated less regulatory behaviors of content monitoring in collaborative science learning. An investigation of first-year Educational Science students in a small group assignment revealed that content-processing strategies (e.g., asking questions and illustrating examples) were positively associated with socially shared regulation of learning (Backer et al. 2015). The results also revealed that cognitively oriented and metacognitively oriented transactive discussion significantly increased the likelihood of group members engaging in socially shared regulation. Rogat and Linnenbrink-Garcia (2011) found that the synchronic manners during the social regulatory processes (e.g., cognitive, behavioral aspects) were indicators for good social regulation of learning. Their study also revealed that students' emotion played an important role in social regulatory process. Positive emotion could activate members' cognitive and behavioral regulation in collaborative learning, while negative emotion could hinder the occurrence of social regulatory behaviors (Panadero and Järvelä 2015).

Most of the previous studies of social regulation processes during collaborative learning were implemented in face-to-face learning contexts without the support of technology. However, computer-supported collaborative learning poses special challenges for students' learning. For instance, the virtual interface cannot provide sufficient opportunities for group members to notice others' emotional expression and learning progress (Hurme et al. 2009; Volet et al. 2009). The findings of social regulation of learning in face-to-face environments are not adequate for explaining the social regulation of learning in CSCL environments (Panadero and Järvelä 2015). As information technology has been widely integrated into English language education, researchers suggested conducting empirical studies to explore the EFL learners' social regulatory behaviors in CSCL activities so as to better understand the mechanisms of social regulation of learning (Lai and Gu 2011; Su et al. 2018a).

The relationship between self-regulation and social regulation

Some studies have started to probe into the interrelationship between individuals' self-regulatory strategies and their social regulatory behaviors in collaborative learning settings. For example, Garu and Whitebread (2012) analyzed children's self and social regulation of learning during collaborative activities within regular primary science class. Their study showed that the group with a more symmetric

collaboration was the one that both achieved more individual frequencies of regulation and had more episodes of social regulation. Järvelä et al. (2016) reported that the different self-regulated learning phrases (i.e., forethought, performance, and reflection) could set a stage for metacognitive and strategic efforts in collaboration. Similarly, a study conducted by Panadero et al. (2015) with teacher education students revealed that individual self-regulated learning ability acted as a predictor of social regulation (Panadero et al. 2015). In particular, it was found that student groups with higher self-regulated members showed higher levels of group goal regulation while planning the collaborative learning tasks. However, Räisänen et al. (2016) indicated that students with good self-regulation skills did not necessarily co-regulate in learning as they were not dependent on other students' assistance.

Although the relationship between self-regulation and social regulation has been explored and discussed in the domains like science learning, one limitation of such studies is that the data of social regulatory behaviors were derived from self-reports which could not provide accurate estimation of how students engage in social regulation processes (e.g., Panadero et al. 2015; Räisänen et al. 2016). Additional studies are needed to capture social regulation of learning by analyzing the actual behavioral data (e.g., discussion messages) in order to more accurately understand the role of self-regulation in students' social regulation processes (Järvelä et al. 2019; Panadero and Järvelä 2015). In addition, few studies have addressed this issue in the area of foreign language education. Since regulation of learning is a context-specific construct, students' self- and social regulation processes in language learning situations may differ from those in other domains. Examining the relationship between these two constructs will not only inspire the design and implementation of online collaborative language learning activities, but also extend our understanding of the complex interplay between self-regulation and social regulation.

Therefore, the current study aims to explore how the EFL learners with distinct online self-regulation profiles differ in their social regulation of learning in CSCL activities. This study is guided by the following three research questions.

(1) Can EFL learners be identified as different self-regulated learning profiles?
(2) Do EFL learners with distinct individual online self-regulation profiles differ in terms of the types of their social regulation strategies during wiki-supported collaborative reading activities?
(3) Do EFL learners with distinct individual online self-regulation profiles differ in terms of the foci of their social regulation strategies during wiki-supported collaborative reading activities?

Method

Participants

A total of 95 Chinese second-year EFL learners (mean age = 19.2 years, SD = 0.6; 65% males, 35% females) participated in this study. They were from a Chinese university that focuses on disciplines of information technology, science, and

engineering. They were enrolled in a 16-week English language course named College English Reading which was a compulsory degree course for the non-English majors at the university. As most of the participants were majoring in computer science and telecommunication technologies, male students outnumbered female students in this study. This imbalanced gender proportion is a natural refection of most Chinese universities that focus on science, engineering, and technologies. These participants also represented the average English level among Chinses college students, with an English vocabulary size of around 4000 words (Xu and Nie 2016).

Learning activities

"Literature circles" activities were carried out in this study to structure a collaborative learning environment. Literature circles were "peer-led discussion groups involved in reading the same piece of literature, and who come together on a regular programmed basis to share interpretations of what they have read" (Shelton-Strong 2012). Previous studies have shown the benefits of literature circles such as improving students' English reading skills, promoting group members' communication and collaboration, and enhancing students' engagement in learning English (Larson 2009; Moreillon et al. 2009).

In this study, the participants were randomly divided into 19 groups of five students. The five EFL members within the learning group took turns to play one of the following five roles:

(1) *Discussion Leader* read the text and initiated several questions for group discussion, organized the online discussion, and made a summary of the key points mentioned in their discussion.
(2) *Word Master* Selected at least five interesting or difficult words from the reading materials, clearly explained their meanings, composed a coherent passage using those selected words, and shared it with group members.
(3) *Passage Person* Chose several complex or difficult sentences from the reading materials, translated them into Chinese, provided imitation sentences, and invited group members to check and corrected the language errors.
(4) *Summarizer* Drafted a summary of the reading materials, invited other groups members to give feedback and revise the summary.
(5) *Connector* Looked for the connection between the text and her/his own life experiences, wrote notes about it, and invited other members to respond and share their ideas.

As shown in Fig. 1, altogether five literature circle activities with different topics were conducted in this study. During each activity, students were given topic-related reading materials. When moving into a new activity, group members switched roles so that each of them would have a complete experience of doing literature circles. Additionally, after finishing each literature circle activity, students were scheduled to meet the teacher for a 100-min discussion and sharing of the literature circles artifacts. The teacher provided students with feedback and

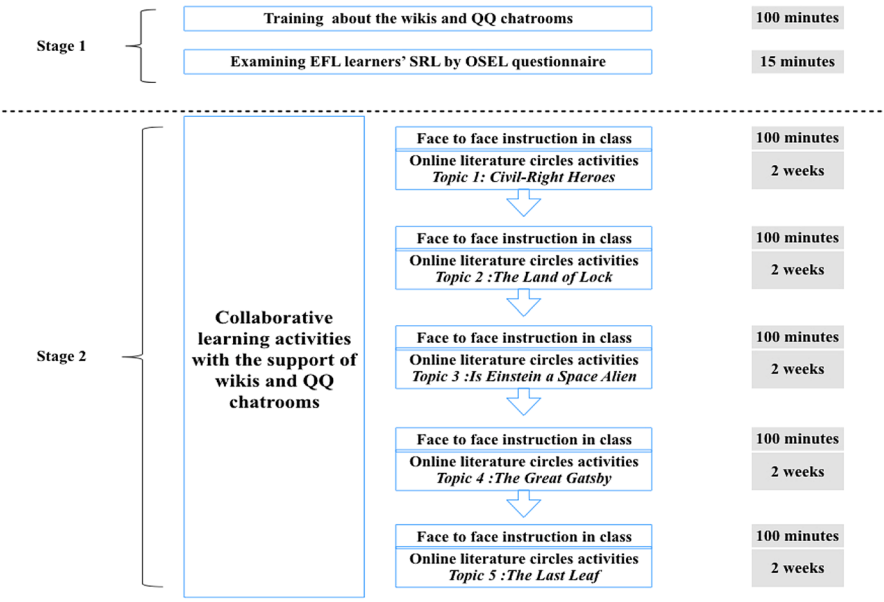

Fig. 1 The procedure of this study

gave advice for refining and improving their work. Some groups were selected by the teacher to present their group wikis to the full class.

In this study, the literature circle activities were conducted in an online environment with the parallel use of instant communicating tools (e.g., Tencent QQ chatroom) and collaborative editing platform (e.g., wikis) in CSCL activities (Su et al. 2019). All the participants received 100-min training about Tencent QQ chatroom and wiki space before carrying out the learning activities. Tencent QQ chatroom is an instant online communicating tool. When students discuss the activity topics in the form of learning groups in the Tencent QQ chatroom, they can assign the roles, fully share, and exchange their ideas online at anytime and anywhere. Tencent QQ chatroom also can present the information in a variety of forms such as texts, emojis, and stickers. Therefore, to some extent QQ maintains the characteristics of expressing emotion in the face-to-face context.

As for wikis, it has been widely used as a web-based collaboration tool in the domain of foreign language learning, due to its unique advantages for joint editing and creation of written artifacts, wikis (Ducate et al. 2011). In the wiki space, group members could share and synthesize various ideas and knowledge, then to produce a final article through collaboratively editing and revising (see Fig. 2). Wikis also have the important function of 'History' by which students can easily trace the changing progress of their jointly edited texts, compare different versions, and identify the contribution of each group member. The 'Comment' function of wikis allows users to provide feedback and exchange ideas. Pervious research indicated that the inherently collaborative and dynamic nature of wikis

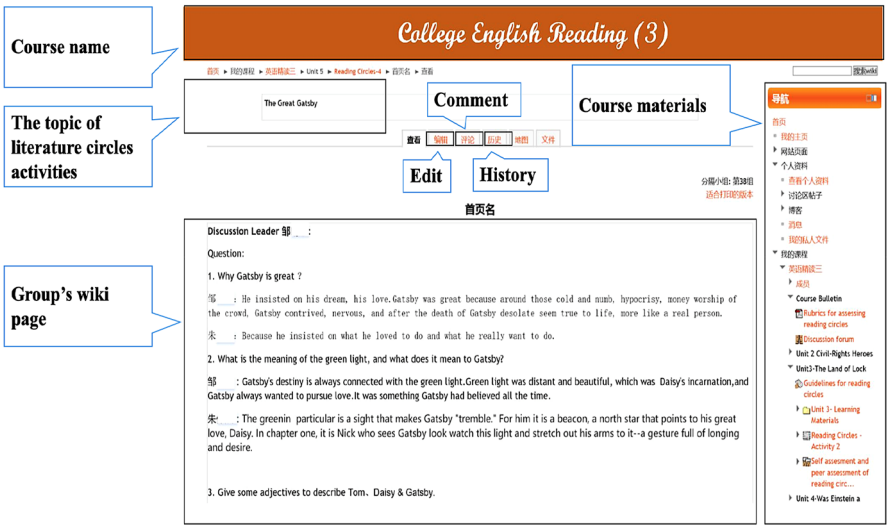

Fig. 2 The screenshot of one group's literature circles in wiki space

has the advantages to extend, deepen, and literally make visible of the essential objective of literature circles (Hathaway 2011).

Data collection

Measurement of online self-regulated English learning

Online Self-regulated English Learning questionnaire (OSEL; Su et al. 2018b), a 5-point Likert-format scale (1 = strongly disagree, 5 = strongly agree), was used to assess the participants' utilization of self-regulated learning strategies in the context of learning English online. The original questionnaire includes 6 dimensions of 30 items with Cronbach's alpha ranging from 0.88 to 0.92. Due to the differences in samples and contexts, we re-examined its validity using the method of exploratory factor analysis and re-calculated the Cronbach's alpha reliability. The revised version of OSEL questionnaire also involves the same six dimensions, but the total number of items are decreased into 23. As presented in the appendix, the six factors are as follows: Goal setting (five items, $\alpha = 0.928$); Environmental structuring (five items, $\alpha = 0.899$; task strategies (three items, $\alpha = 0.808$); Help seeking (two items, $\alpha = 0.838$); Self-evaluation (four items, $\alpha = 0.923$); Time management (four items, $\alpha = 0.858$). The six factors in the OSEL questionnaire are described below, with one sample question provided:

(1) *Goal setting* I would like to set short-term goals and long-term goals.
(2) *Environmental structuring* I know where I can learn English online most efficiently.

(3) *Task strategies* I would like to try to take notes in the online environments.
(4) *Help seeking* I would like to share my questions with my classmates to find a solution.
(5) *Self-evaluation* I would like to communicate with my classmates or teachers to check learning status.
(6) *Time management* I would like to try to schedule the same time every day to learn English online, and I observe the schedule.

Measurement of social regulation of learning

Quantitative content analysis was used to capture the students' social regulation of learning during the CSCL activities. Using the coding scheme developed by Su et al. (2018a), groups' online discussion messages archived by the QQ Tencent chatroom were coded and analyzed. Two dimensions were included in the coding scheme: social regulation types and social regulation foci.

The dimension of social regulation types (see Table 1) was used to identify social intentionality of students' regulatory behaviors in collaboration (Grau and Whitebread 2012; Su et al. 2018a). It consisted of two categories, namely, *co-regulation* (CoRL) and *socially shared regulation* (SSRL). CoRL referred to the regulatory behavior that aimed at assisting and guiding other's learning through influencing her/his cognition, metacognition, motivation, or emotion. SSRL represented the

Table 1 Coding scheme for the types of students' social regulation

Social regulation types	Definition and examples
Co-regulation (CR)	Regulation processes directed to influence the cognition, motivation, or behavior of one specific member of the group. This interaction always reveals certain asymmetry in the relationship *Example: It seems you are confusing with the task, so you should Select at least five interesting words in this article to clearly explain their original and extended meanings*
Socially shared regulation (SSR)	Regulation processes more related to group planning, monitoring, and regulation of a joint activity. The verbalizations are usually directed to everyone in the group (or no one in particular) and the talk is mainly in plural such as 'we should do this,' 'we are taking too long' *Example: Hi everyone. We should read carefully the task requirements and discuss thoroughly the details before working on them*

collective regulatory activities of the group members towards the joint goals (Su et al. 2018a).

The dimension of social regulation foci (see Table 2) was used to further differentiate between the different kinds of regulatory utterances in the group activities (Grau and Whitebread 2012). Group members' regulatory behaviors were further divided into three broad categories: *task*, *social emotion*, and *organization*. The category *task* involved three sub-codes: content monitoring, task understanding, and process monitoring. These codes described regulatory verbalization that was related to knowledge applicable to the task, collective goal setting, and time management by group members. The code *social emotion* referred to students' awareness of emotional experience and their regulation of emotional and motivational processes when they experienced socio-emotional challenges during group learning (i.e., positive emotion, negative emotion, and joking) (Grau and Whitebread 2012). Finally, the code *organization* was used to describe behaviors related to division and assignment of task among group members (Su et al. 2018a).

Two coders coded the utterances of chat logs. They first independently coded 15% of the utterances in the discussion log. Cohen's kappa coefficient was calculated to judge the inter-rater reliability of the coded variables. The results showed that the inter-coder agreement of coding regulatory types and regulatory foci are 0.81 and 0.78, respectively, indicating a satisfactory reliability for coding. The two coders then finished

Table 2 Coding scheme for the foci of students' social regulation

Social regulation foci	Definition and examples
Task	
Task understanding	Talking about understanding of the task goals and requirements *Example: We are required to organize the storyline in English*
Content monitoring	Regulatory moves focusing on checking, elaborating, revising, and improving group members' task response. It involves talking about knowledge concerning language, grammar, word choice, or relevant content about the reading materials *Example: The subject of the clause is not consistent with the subject of the main sentence*
Process monitoring	Discussion about the management of time *Example: Watching the process. We need to complete the report and submit it as quickly as we can*
Emotion	
Positive emotion	Awareness of positive emotional experience such as encouragement, compliments, enthusiasm in the task *Example: Good job! Thanks a lot*
Negative emotion	Awareness of negative emotional experience in the task that hinder task progress and make others upset *Example: I ignored the task requirements, so I feel very nervous*
Joking	Emoji or graphic emotions that regulate the atmosphere of the team *Example:*
Organization	
Organizing	Talking about the organization of the task in a pragmatic way (who does what) *Example: who would like to take the role of Content Connector?*

coding. The discrepancies between the two coders were discussed until a consensus coding was achieved.

Data analysis

The Latent Profile Analysis (LPA) approach was used to identify EFL learner' self-regulated profiles. LPA was a person-centered analytical approach aiming at addressing a probabilistic model of unobserved heterogeneity among various groups of persons through the manifested continuous variables (Muthén and Muthén 2002). One of the most salient features of adopting LPA approach was that it offered a comprehensive and principled method of selecting the optimal number of profiles. First of all, we constructed four different models by stepwise adding the number of profiles from 1 to 4. The indices of Bayesian Information Criterion (BIC; Schwarz 1978) in each model were examined (smaller values of BIC indicate better model fit). Based on the values of BIC, we further explored whether a noticeable elbow existed by analyzing the "scree plot." If a noticeable elbow existed in k-profile solution, it indicated that the fit improved relatively little from the k-profile onwards (Ning and Downing 2015). Second, we used the Vuong–Lo–Mendell–Rubin (VLMR) test and the Lo–Mendell–Rubin (LMR) test to compare the improvement in goodness-of-fit between the nearest two models (LMR-LRT; Lo et al. 2001). For example, when we compared the model with k profiles with the model with k-1 profiles, a significant p value (<0.05) indicated that the model with k groups was more competent than the model with k-1 model. Then, the value of entropy which reveals the linearity of each model should be further considered. The values of entropy higher than 0.70 indicated acceptable classification accuracy (Jung and Wickrama 2008). Besides, the size of minimal profile should exceed 5% of the total sample, and we also needed to consider the interpretability of the profiles to ensure that the results make theoretical sense and are generalizable (Ning and Downing 2015).

After capturing the EFL learners' SRL profiles, each learner is categorized into a profile depending on Bayesian Posterior Probability (BPP) of individuals. To name the profiles accurately, we adopt univariate analysis of variance (ANOVA) and pairwise comparison to assess the differences of SRL dimensions between profiles and find out which dimension in SRL questionnaire is critical for SRL profiling. In addition, if the various SRL profiles existed, the next purpose of this study was further to examine for the differences of social regulatory behaviors (i.e., social regulatory types and social regulatory foci) among them. As to the behavioral data which were not distributed normally, non-parametric equivalent of the significance test of the difference would be conducted. In this study, we employed Wilcoxon–Mann–Whitney U test to examine behavioral data for profile difference.

Table 3 Fit indices for different models with number of profiles ranging from 1 to 4

Model	BIC	*P* (VLMR)	*P* (LMR)	Entropy	Profile sizes
1 profile	1529.465	–	–	–	95
2 profiles	1420.983	0.0170*	0.0189*	0.826	61, 34
3 profiles	1394.447	0.1454	0.1529	0.852	52,23,20
4 profiles	1391.988	0.3927	0.4038	0.882	49,19,15,12

*$p < 0.05$

Table 4 Descriptive statistics and means differences of SRL dimensions between the two profiles

Dimensions	Reflection-oriented competent profile $N=61$ (64%)		Average profile $N=34$ (36%)		F(1,94)	p	η^2
	M	SD	M	SD			
GS	3.72	1.00	3.39	1.11	3.00	0.087	0.03
ES	4.13	0.87	3.68	1.02	7.52	0.007*	0.07
TS	3.33	1.08	3.19	1.01	0.61	0.437	0.00
HS	3.68	1.07	3.32	0.95	3.20	0.077	0.03
SE	3.89	0.90	3.33	0.95	9.41	0.003*	0.09
TM	3.55	1.02	3.30	1.12	1.69	0.198	0.02

GS goal setting, *ES* environmental structuring, *TS* task strategy, *HS* help seeking, *SE* self-evaluation, *TM* time management

*$p < 0.05$

Results

Self-regulated learning profiles

The criteria and fit indices used for determining the model with the optimal number of SRL profiles are shown in Table 3. Although the BIC decreased with additional profiles, the "scree plot" for BIC showed a noticeable elbow at the 2-profile solution (Ning and Downing 2015). And the VLMR test and the LMR test further confirmed that the 2-profile solution was better than the 3-profile solution ($P_{\text{VLMR}} = 0.0170$ and $P_{\text{LMR}} = 0.0189$). The entropy value (=0.826) and the size of the minimal profile (=34) in the 2-profile solution also demonstrated to be adoptable. Therefore, the 2-profile solution was selected to depict the SRL profiles among the EFL learners.

The descriptive statistics of each SRL dimension in profile 1 ($N=61$, 64%) and profile 2 ($N=34$, 36%) are presented in Table 4. Compared profile 2, profile 1demonstrated higher endorsement for all the six SRL dimensions (Mean = 3.33–4.13). Profile 2 showed relatively lower but still moderate endorsement for the SRL strategies (Mean = 3.19–3.68). As to the results of difference test, profile 1 and profile

2 significantly differed in the dimensions of environment structuring (F (1, 94), $p=0.07$) and self-evaluation (F (1, 94), $p=0.03$). Further, the results of their effect sizes showed that self-evaluation ($\eta^2=0.09$) was clearly the pivotal dimension that determined whether a learner should be classified into profile1 or profile 2. Since self-evaluation strategy is more associated with the self-reflection phase in the process of self-regulated learning (Barnard-Brak et al. 2010), profile 1 was named as *reflection-oriented competent profile* and profile 2 as *average profile*.

Difference between the profiles in terms of the types of social regulation strategies

This study examined how the EFL learners with distinct online SRL profiles differed in the types of social regulation (i.e., co-regulation and socially shared regulation) in CSCL activities. From the results of descriptive statistic, both SRL profiles showed more behaviors in socially shared regulation. However, compared with *average profile*, the *reflection-oriented competent profile* showed nearly twice more socially shared regulatory behaviors.

The significance test of the difference in social regulatory types between the two SRL profiles was summarized in Table 5. It indicated that there was no statistically significant difference between reflection-oriented competent profile and average profile concerning the frequency of co-regulation strategies and socially shared regulation strategies.

Although the difference in regulation types between the two profiles did not achieve statistical significance, the qualitative analysis of the dialogue interaction found that individual students belonging to the *reflection-oriented competent profile* tended to be more active in initiating socially shared regulation strategies in their groups. Extract 1 from students' chat logs was an example to show how the *reflection-oriented competent profile* fostered the occurrence of socially shared regulation in the collaborative learning processes. In this extract, student A who belonged to the *reflection-oriented competent profile*, took an initiative role by asking a question about the grammar of the sentences that they wrote on their wiki page. The responses from the other two students who belonged to the *average profile* suggested that they were stimulated by student A to participate in socially shared regulation of learning. In other words, the EFL learners of the *reflection-oriented competent profile* helped to create a joint collaborative learning space for co-constructing language

Table 5 Difference between the profiles regarding social regulation types

Types	Reflection-oriented competent profile		Average profile		*p*
	Percentage rate	Mean rank	Percentage rate	Mean rank	
Co-regulation	31.6%	47.02	27.6%	49.75	0.571
Socially shared regulation	68.4%	48.47	72.4%	47.16	0.819

Extract 1 Example of a socially shared regulation episode by students of the reflection-oriented competent profile

Group composition	Transcript	
Group 1 (Student A, student B, and student C). Student A belongs to the *reflection-oriented competent profile*, while student B and student C belong to the *average profile*	StudentA:	Before submitting the final report, we should check and correct paragraphs together. Here is my paragraph. Do you think that I should add "that" in front of "he"?
	StudentB:	Do you want to express the causal relationship by using the fixed syntaxes? But I'm sorry that there may be something inappropriate in your expression. Here are the directions for using [a picture of syntaxes]
	StudentA:	Ok. I'll check and correct it
	StudentA:	@B, You'd better use the phrase "spare no effort" to express that somebody tries her/his best to do that
	StudentB:	Let me check it
	StudentA:	@C, did you forget the subject of the sentence? Besides, the subject in the clause sentence is "we," but the subject in the main sentence is "you." I guess you might make a mistake
	StudentC:	Oops, my fault. I'll correct it

knowledge through discussing the errors in sentences and recommending good learning resources.

Difference between the profiles in terms of the foci of social regulation strategies

This study also examined how the EFL learners with distinct online SRL profiles differed in social regulation foci. Top four social regulation strategies that were frequently used by the two SRL profiles were consistent, and they were process monitoring, task understanding, organization, and content monitoring. The significance test of the difference in social regulatory foci between the two SRL profiles is summarized in Table 6. The results of Wilcoxon–Mann–Whitney U test revealed that the *reflection-oriented competent profile* demonstrated significantly more social regulatory behaviors in the dimension of positive emotion than the *average profile* ($U=778$, $Z=2.215$, $p=0.027$).

Extract 2 shows how the *reflection-oriented competent profile* regulated group members' emotion and sustained a good group climate during the collaborative learning task. In Extract 2, student B who belonged to the *average profile* felt worried when he got poor score in the reading circles. The other two students who were in the *reflection-oriented competent profile* comforted student B and gave some constructive suggestions. The regulatory behavior demonstrated by student A and C not only succeeded in alleviating student B's anxiety, but also regulated all the group members' emotion and helped establish a good group learning climate.

Discussion

Latent profile analysis indicated that self-evaluation was the variable that differentiated the two SRL profiles the most, indicating that it made a strong contribution to the clustering. Therefore, two distinct profiles of online self-regulation strategies were identified among the EFL learners: the *reflection-oriented competent profile*

Table 6 Difference between the profiles regarding social regulation foci

Foci	Reflection-oriented competent profile		Average profile		p
	Percentage rate	Mean rank	Percentage rate	Mean rank	
Content monitoring	6.5%	47.02	12.8%	49.75	0.571
Task understanding	15.3%	48.47	15.3%	47.16	0.819
Process monitoring	51.9%	50.19	46.8%	44.07	0.299
Positive emotion	6.3%	52.25	2.8%	40.38	0.027*
Joking	5.3%	46.80	7.7%	50.16	0.517
Negative emotion	1.3%	49.44	0.7%	45.41	0.293
Organization	13.3%	48.27	13.9x%	47.51	0.894

*$p<0.05$

Extract 2 Example of an emotional regulation episode by students of the reflection-oriented competent profile

Group composition	Transcript	
Group 16 (Student A, student B, and student C). Student A belongs to the *reflection-oriented competent profile*, while student B and student C belong to the *average profile*	StudentA:	Can you see our score in the first reading circle?
	StudentB:	Hmmm, I can. The teacher marked our report level That's too sad😔.
	StudentA:	Don't be nervous. I believe we could make a big progress next time, if we reflect on our advantages and disadvantages in English learning
	StudentC:	We should try our best to acquire the knowledge and enjoy the learning process, so don't think too much of that score
	StudentB:	You're alright, let's try our best and then we can have good score!😁.

and the *average profile*. The reflection-oriented self-regulators demonstrated high level of endorsement for all the six online self-regulation strategies measured (i.e., goal setting, environmental structuring, task strategies, help seeking, self-evaluation, and time management). This finding is different from the results of Barnard-Brak et al. (2010) research on American students' profiles in self-regulated learning in the online learning environment. In their study, the reflection-oriented profile was described as being disorganized self-regulators who are more concerned with self-regulation in the post hoc sense and rarely use other self-regulation strategies. However, the study conducted by Barnard-Brak et al. (2010) did not focus on any learning domains while our study specifically targeted at Chinese EFL learners. Since self-regulation is a context-specific construct (Zimmerman 1986), the reason for the contradicting findings might be caused by the sociocultural context of Chinese EFL learning.

It is also worth noting that, compared with the *average profile*, individuals belong to the *reflection-oriented competent profile* appeared to more highly endorse environmental structuring strategies as self-regulated learning skills, although the differences were not decisive in differentiating the profiles. This indicated that *reflection-oriented competent* self-regulators performed better in structuring a supportive learning environment for high concentrations and effective learning. According to the view of social cognitive researchers, the supportive learning environment structured by the learners serves as a resource for enhancing self-reflection and volitional control (Boekaerts et al. 2005). Previous studies have also indicated that EFL learners with more environmental structuring strategies during an online learning process tend to possess higher self-efficacy in speaking and writing and are more motivated to interact with others (Su et al. 2019).

We further explored whether the self-regulation profile membership is associated with the occurrence of social regulatory behaviors in CSCL activities. Regarding the types of social regulation, the results showed that the *reflection-oriented competent* self-regulators were active in initiating socially shared regulation. This means that the *reflection-oriented competent* self-regulators showed higher engagement in prompting the average self-regulators to collectively set learning goal, monitor the learning process, and adapt group regulation processes. This finding verified Panadero et al.'s (2015) assumption that students with a particular self-regulation profile have potential for activating and fostering the occurrence of socially shared regulation in collaborative learning situations. This finding highlights the significant role of *reflection-oriented competent* self-regulator in creating a joint collaborative learning space for the learning teams to co-construct knowledge.

Additionally, in terms of the foci of social regulation, the study found that the *reflection-oriented competent profile* demonstrated significantly more social regulatory behaviors of *positive emotion* during the CSCL activities. In our study, *positive emotion* involves students' awareness of their own or others' emotional states and their use of strategies for controlling motivation and emotion by providing encouragement or giving compliments (Grau and Whitebread 2012; Su et al. 2018a). When a group member expressed boredom, anxiety, dissatisfaction, or frustration in the process of collaboration, *reflection-oriented competent profile* would give timely encouragement to her/him. Such behaviors can help eliminate the impact of negative

emotion and rehabilitate a positive group climate which in turn can foster productive collaboration (Panadero and Järvelä 2015).

Conclusions

This study used a person-centered analytical approach to identify college English language learners' online self-regulation profiles, and further explored whether the profile membership is associated with their social regulatory behaviors in CSCL activities. The results of latent profile analysis identified two distinct profiles of online self-regulation, namely, the *reflection-oriented competent profile* and the *average profile*. We further compared the two profiles in terms of the types and foci of their social regulation strategies in CSCL activities. In terms of the types of social regulation, these two profiles did not have statistically significant difference in the frequency of two types of social regulation. However, qualitative analysis revealed that the students belonged to *reflection-oriented competent profile* were more active in initiating and carrying out socially shared regulation strategies in the collaboration process. Regarding the foci of social regulation strategies, students of the *reflection-oriented competent profile* demonstrated significantly more positive emotional regulation strategies.

Since the research on the interplay between group members' characteristics and their social regulation strategy is still a new and growing area (Panadero and Järvelä 2015; Panadero et al. 2015), this study fills a gap in the literature concerning how students' individual online self-regulation skills interact with their social regulation behaviors in collaborative learning. As this study highlights the positive role of EFL learners' self-regulation in explaining their use of social regulation strategies in collaborative learning situations, it implies that English language teachers need to take students' capability of self-regulation skills into account when dividing them into small groups to carry out technology-enhanced collaborative learning activities. This study also serves as a reminder for teachers of the necessity of paying more attention to those students with inadequate self-regulation strategies. In particular, some training of self-reflection skills should be carried out by EFL teachers when implementing collaborative learning activities in order to give students a strong basis for promoting social regulation and productive collaboration.

Limitations and future studies

This study has some drawbacks. Although our study offers new insights into the interplay between individual students' online self-regulation and their social regulation strategies in CSCL situations, we still cannot determine the causal connection between the two constructs. Another limitation was that this study involved a relatively small sample scope situated in the specific wiki-supported literature circle activities. The findings from this CSCL activity are not necessarily generalizable to other CSCL settings. In addition, self-report survey results are still insufficient for comprehensively measuring the dynamics of online-self-regulation, and the coding

of groups' discussion messages may still be limited for probing into the complexity of social regulation in collaborative learning.

Drawing upon the above-mentioned limitations, we propose several suggestions for future studies. First, more experimental research should be conducted to further explore the causal connection between the online self-regulated learning and social regulation of learning in CSC activities. Future research should also include measurement that involves multi-modal data to provide more detailed information of students' self- and social regulation strategies. Finally, extending the investigation into other online collaborative learning situations such as collaborative writing activities could shed more light on the role that students' self-regulation profiles play in their social regulation processes during CSCL activities.

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Compliance with ethical standards

Conflict of interest All authors declare that they have no conflict of interest.

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