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RESEARCH ARTICLE

Individual differences in self-regulated learning profiles of Chinese EFL readers: A sequential explanatory mixed-methods study

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Abstract

This study explored the latent profiles of self-regulated learning (SRL) strategies (cognitive, metacognitive, and motivational regulation) endorsed by Chinese English-as-a-foreign-language (EFL) readers in a high-stakes testing environment, and also their associations with individual factors (gender, grade, reading proficiency, and motivational beliefs). With a sequential explanatory mixed-methods design, students in grades 11 and 12 (n = 1,113) completed a reading comprehension test and a questionnaire regarding their strategy use and individual factors, and some (n = 16) were randomly selected for follow-up semi-structured interviews. Findings revealed three SRL profiles, characterized by high, medium, and low levels of SRL-strategy use. Self-efficacy and extrinsic motivation most powerfully predicted an individual's profile membership; all the intrinsic and extrinsic motivation variables were significantly higher for learners from the higher strategy-use profile. Moreover, reading proficiency did not significantly predict profile membership, but more self-regulated students still achieved higher reading scores as a group tendency.

Introduction

Second-/foreign-language (L2) acquisition is an arduous process, and L2 learners should be proficient in self-regulated learning (SRL) to sustain their motivation to learn through proactive control and consistent use of efficient strategies (Teng & Zhang, 2016a, 2018). However, self-regulation is still a novel paradigm in language learning strategies (LLS) research of L2 learning (for a review, see Rose et al., 2018), especially for English as a second/foreign language (ESL/EFL) in a Chinese context (Bai et al., 2020). Within this pertinent ESL/EFL scope, a substantial effort has been directed to self-regulated writing (e.g., Bai et al., 2020; Teng & Zhang, 2016a, 2016b, 2018; Teng et al., 2020), whereas reading has garnered limited attention (X. Wang, 2018). SRL is essential to reading development, as readers must actively perform self-control using various strategies applied before, during, and after reading a text (J. Chen et al., 2021).

L2 reading requires learners to be particularly motivated to self-monitor tactically under linguistic constraints (L. Zhang et al., 2014; L. J. Zhang & Wu, 2009).

Methodologically, most extant SRL studies have adopted a variable-centered approach, examining how input variable(s) could predict outcome variable(s); recently, interest has grown in a person-centered approach that tests the links among variables from an intra-individual perspective and classifies learners by characteristics (Chon & Shin, 2019). This approach can capture the behavioral patterns shared by small groups within a large population, which inter-individual, variable-centered methods often ignore (Dunn & Iwaniec, 2022; Y. Zhang & Lin, 2020). Several studies have used such approach to identify different types of SRL learners in ESL/EFL learning in general, or subskills of writing and listening (X. Chen et al., 2019; Chon & Shin, 2019; Csizér & Tankó, 2017), leaving reading unexplored. The functionality and/or dynamics in the ESL/EFL reading domain warrant scrutiny, not only because of the fact that SRL is context- and skill-specific (Teng & Zhang, 2018) but also because addressing the diversity of SRL readers could help teachers to orchestrate subgroup-tailored teaching plans to stride toward individualized education.

Further, research linking personal factors with SRL types remains sparse. It is worthwhile to explore this lacuna because from the social–cognitive perspective, SRL behaviors are shaped by cyclical interactions between personal and environmental processes (Pintrich & Zusho, 2002), and personal factors such as gender, age, motivational dispositions, academic competency, and cultural background profoundly influence a learner's strategy use (Bai et al., 2020; X. Wang, 2018). Accordingly, we employed a person-centered approach to explore how Chinese EFL learners use SRL strategies in reading and how this usage relates to the learners' personal factors.

Literature review

Theoretical and cultural/educational backgrounds of self-regulated learning

Theoretical framework

From social–cognitive theories, Pintrich (2000) defined SRL as "an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate and control their cognition, motivation, and behavior" (p. 453). Learners draw on SRL strategies to take active control of their mental processing, affective states, overt behaviors, and learning environments (Pintrich & Zusho, 2002).

SRL strategies exclusive to L2 learning are highly relevant to LLS research, which developed from Rubin's (1975) work on what makes a good language learner. However, LLS research has been criticized for its definitional fuzziness, unreliable/invalid measurement instruments, and use of single-source approaches (Rose et al., 2018). Addressing this, Dörnyei and colleagues (Dörnyei, 2005; Tseng et al., 2006) proposed revitalizing LLS research by incorporating the self-regulation mechanisms of language learners, and many LLS-based investigations have followed their lead. Teng and Zhang's (2016a) model is recognized as one of the best hybrid models that apply SRL theory to the L2 field while framing strategies as the product of behaviors (Rose et al., 2018). Instead of simply coupling models from the two fields together, Teng and Zhang (2016a) created and validated their instrument by surveying the SRL strategies adopted by Chinese EFL writers. They identified LLS as being theoretically related to four SRL components, namely cognitive, metacognitive, motivational, and social–behavioral regulation. This served as the conceptual framework for the current study.

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Within this framework, cognitive strategies denote skills for processing knowledge and/or information to complete a task. Metacognitive strategies are used to monitor cognition as well as the cognitive resources used in the process. Strategies for motivational regulation involve individuals' attempts to accommodate their affective state to promote their motivation or efforts (cf. motivational dispositions such as self-efficacy, task value, and goal orientation). Strategies for social behaviors are tactics for managing behaviors under environmental influences. Cognitive and metacognitive strategies constitute the core of SRL (Pintrich, 2004), and they "facilitate understanding, increase meaningful mental associations, and are the most useful strategies for long-term retention of information" (Oxford, 2013, p. 30). As strong contributors to deep processing, many of them, for example, rehearsal, organization, planning, and monitoring, have been confirmed to be useful in decoding, retaining, and transforming L2 knowledge (Teng & Zhang, 2018). Because motivation often functions as precursors, mediators, or consequences of SRL, the significance of motivation-regulation strategies to L2 learning has gained increasing acknowledgment (Teng & Zhang, 2016a, 2016b). Therefore, cognitive, metacognitive, and motivational regulation were the foci of the current study.

Chinese high-stakes testing context

Apart from the theoretical underpinnings, contexts such as culture and education are also important concerns for SRL research because they significantly shape students' SRL development through learning activities and knowledge construction (X. Wang, 2018). As most SRL theories were developed in Western contexts, their applicability to other cultures requires demonstration (Pintrich & Zusho, 2002). Chinese students, influenced by Confucian Heritage Culture (CHC), are often assumed as passive, examination-oriented learners heavily relying on memorization (X. Wang, 2018). High-school students in mainland China experience substantial pressure from the College Entrance Examination (*gaokao*) and exhibit low confidence and weak self-control (Yu et al., 2018). The fact that the Chinese students, who seem to lack self-regulation skills, are often academically competent may detract from SRL's relevance to scholastic achievement, in contrast with the Western findings. Furthermore, striving for excellence in exams may push students to study for controlled instead of self-determined reasons (Yu et al., 2018) and reduce their intrinsic motivation to learn (Q. Zhang & Kim, 2013). Exploring how SRL operates in this peculiar learning context could enrich SRL's theoretical understandings, and particularly so if in distinct approaches.

Person-centered approaches to self-regulated learning

Studies commonly use a variable-centered approach to scrutinise how study variables are associated, on average, with learning outcomes; its inherent assumption is that the sampled subjects representing the population are homogeneous concerning the causal dynamics of the variables (Bergman, 2001). In contrast, a person-centered approach posits that individuals, as the conceptual and analytic unit, are a functioning whole of various characteristics; its theoretical underpinning is that individual development is a process featured by states changing continuously (Bergman, 2001).

Specific to SRL, learners may develop SRL components through different trajectories of growth (Karlen, 2016), which leads to the components configuring differently in individuals. In addition, as different components may interact (Teng & Zhang, 2016a, 2018) and learners use "strategy chains" (i.e., multiple strategies) instead of a single

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strategy for task management in real-life situations (Yamamori et al., 2003), a person-centered approach that clusters strategies on a person level would be more appropriate. Extant studies taking this approach often utilize analytic methods such as clustering, latent profile analysis (LPA), and latent class analysis (LCA) to explore profiles/clusters (i.e., subgroups) of learners endorsing SRL strategies of similar breath and strength, and to link types of SRL learners with a host of individual factors.

Typologies of self-regulated learners

As blended/online learning involves distinct interactive and autonomy-supportive dynamics, this literature review on typologies of self-regulated learners is limited to face-to-face settings, including language learning (e.g., X. Chen et al., 2019; Chon & Shin, 2019) and other areas (e.g., Abar & Loken, 2010; Ning & Downing, 2015) at various educational levels.

Researchers have often identified three or four subgroups (profiles/clusters) of self-regulated learners (totaling three sets of classification), by quantifying SRL in the amounts/frequencies of behaviors/strategies typically conceptualized from a mixture model of (meta-)cognitive, social–behavioral regulation, affect and motivation. Trichotomy, for example, differentiates between respondents with high, average, and low scores on all SRL subscales, to be high, medium, and low SRL learners, respectively (e.g., Abar & Loken, 2010; Csizér & Tankó, 2017; Muwonge et al., 2020). The second classification further partitions the in-between subgroup in trichotomy into two with optimal SRL features (e.g., Chon & Shin, 2019; Karlen, 2016; Ning & Downing, 2015), for example, cognitive-oriented learners who use more (meta-)cognitive strategies than behavioral strategies, and behavioral-oriented learners showing the opposite strategic pattern (Ning & Downing, 2015). The last classification involves a more flexible combination of SRL indicators to constitute three or four subgroups, without being fully high or low on all the measures (e.g., X. Chen et al., 2019; Dörrenbächer & Perels, 2016; Liu et al., 2014); it seems that sometimes quality, rather than quantity of SRL strategies, is profound for learning autonomy and performance (Karlen, 2016). Also note that learners are often disproportionately distributed among the subgroups. Moreover, except that the high self-regulated learners occupied the largest 47.8% of the three profiles in Muwonge et al. (2020), no other studies have found that either the most or the least competent SRL learners account for a significantly larger proportion than others. Presumably, most students, regardless of learning backgrounds, often develop SRL competency inadequately in the learning process.

Underneath such general research territory, more illumination of the peculiarities of EFL learners' "strategy chains" for self-regulation is needed. For instance, Csizér and Tankó (2017) investigated how 222 college English majors in Budapest used self-regulatory strategies in relation to metacognition, emotions, environment, satiation, and commitment for writing, with a typical three-cluster finding, that is, high (34.2% of all participants), moderate (48.7%), and low (17.1%) SRL learners. Regarding the subskill of listening, Chon and Shin (2019) surveyed 312 Korean middle-school students and reported four SRL clusters related to metacognitive awareness and motivational beliefs, that is, "High Autonomous Motivation–Achievement Strategists" (11%), "Introjected—Totally Alert" (40.7%), "Externally Motivated—Don't Do Much Planning or Evaluation" (39.7%), and "Amotivated Translators" (8.0%), being the second SRL classification mentioned above. In another endeavor, X. Chen et al. (2019) investigated Chinese university students' SRL-strategy use in EFL learning and found three profiles regarding cognitive, metacognitive, social, and affective

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strategies. Of all the participants, 40.1% were metacognitive learners (highest on all subscales), 48.3% cognitive learners (relatively lower than metacognitive learners), and 11.6% memorization learners (higher on extrinsic, behavioral regulation). The existence of various SRL typologies in EFL learning and the unbalanced subgroup membership align with the general research reviewed above. However, it remains unclear how EFL learners exploit their SRL-strategy repertoire in reading, given that SRL is a context-sensitive construct.

Unlike the previously mentioned reviewed typologies drawing on typical SRL conceptualizations, studies adopting a person-centered approach to examining motivation-regulation strategies are scarce. Schwinger et al. (2012) scrutinized how eight strategies (e.g., interest enhancement, relevance enhancement) were used simultaneously to motivate learning by 231 high-school students (Study 1) and 600 college students (Study 2) in Germany and identified five profiles: a high-frequency profile (high scores for all strategies; 16.8% in Study 1 and 15.9% in Study 2), a low-frequency profile (low scores for all strategies; 5.6% in Study 1 and 7.3% in Study 2), and other mixed-feature profiles. As with the classification based on typical SRL models, subgroups were detected at both ends of the strategy-use continuum, and neither of them contained a large proportion of the participants. However, the profiling patterns of the motivation-regulation strategies appeared more complicated, with a larger number of subgroups and more feature mixture within them. Despite the close connections discovered between them and other SRL strategies (Pintrich, 2004), no research has explored to determine how EFL students execute self-regulation in cognition, metacognition, and motivation concurrently from a person-centered perspective.

Associations between individual factors and typologies of self-regulated learners

In addition to classifying SRL learners, individual differences have been reported among SRL-strategy profiles/clusters. A general trend is that learners of an L2 and other subjects endorsing more frequent/higher-quality SRL tend to have higher academic performance (X. Chen et al., 2019; Chon & Shin, 2019; Dörrenbächer & Perels, 2016; Karlen, 2016; Ning & Downing, 2015) and more positive motivation to learn (e.g., higher self-efficacy and lower test anxiety; Abar & Loken, 2010; Csizér & Tankó, 2017; Dörrenbächer & Perels, 2016; Muwonge et al., 2020; Ning & Downing, 2015).

However, certain subtleties deserve mention. For example, among the three SRL clusters, Csizér and Tankó (2017) identified no significant relationships between self-regulatory strategies and EFL writing scores. Likewise, no significant differences were detected in high-school students' GPA between five profiles of motivation-regulation strategies by Schwinger et al. (2012). Such deviation from the main trend might be because, for L2 and/or motivation, learning behaviors are not directly related to achievement, merely as precursors manifesting learners' willingness/effort to learn, whereas performance is contingent on many other influencing factors (Csizér & Tankó, 2017; Schwinger et al., 2012). A richer understanding of the relational dynamics of motivation regulation in L2 proficiency is needed.

Next, this research stream has focused on the associations between SRL-strategy profiles/clusters and certain individual factors (e.g., learning performance, motivation, attitudes), ignoring other important variables, such as gender. Whilst numerous studies have found that girls' SRL-strategy use is more frequent and diverse, intra-individual traits between the genders also exist (Bai et al., 2020).

Further, as the previously mentioned studies have explored the relationships between SRL-strategy use and individual factors primarily by comparing their mean differences across strategy profiles/clusters, they failed to consider the potential

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heterogeneity within each subgroup. For example, X. Chen et al. (2019) investigated the role of language proficiency in Chinese EFL learners' SRL-strategy use and reported significant differences in English test results between the three SRL profiles. While the most competent SRL profile obtained the highest mean results, it remained unclear whether this group contained a mixture of higher and lower English achievers. Indeed, researchers have alleged that more successful EFL learners do not more frequently apply all language strategies and that less successful learners also use many strategies including the deeper metacognitive variety (Bai et al., 2020). Testing whether an individual variable is linearly predictive of particular subgroup membership could shed more light on this issue; yielding more specific knowledge of group members' characteristics could help teachers to tailor their instructional practices.

Present study

To fill the aforementioned research gaps, the current study utilized a person-centered approach to explore how Chinese high-school students use SRL strategies (cognitive, metacognitive, and motivation-regulation) for EFL reading, and how this use relates to individual factors (reading proficiency, gender, grade, and motivational beliefs such as self-efficacy and task value). The study was guided by the following research questions:

(1) How many SRL profiles can be identified from students' use of SRL strategies in EFL reading?
(2) To what extent do SRL profiles differ in students' use of SRL strategies?
(3) To what extent do individual factors predict students' SRL profile membership?

Methodology

Research design and procedure

Considering criticisms of the single-source approach to LLS research, which relies mainly on questionnaires (Rose et al., 2018), and the relative novelty of profiling L2 learners' SRL strategies, this study adopted a sequential explanatory mixed-methods design (Creswell et al., 2003). Consent to participate was first obtained from the school principal, the participating students, their English teachers and parents. The study proceeded in three phases. In Phase One, during the first semester of the 2021–2022 academic year, the participants took an English reading comprehension test and completed a questionnaire eliciting their demographic information and self-reported usage of the three focal types of SRL strategies and motivational beliefs regarding English reading. We analyzed the data to identify SRL profiles and model their relationships with individual factors to address the three research questions. In Phase Two, we conducted semi-structured interviews with randomly selected participants from each SRL profile to elicit their experiences, feelings, and opinions relating to their SRL-strategy use and underlying motivations. In Phase Three, we triangulated the data from the two phases, incorporating evidence from the literature, to compare and contrast the outcomes.

Context and participants

The study was conducted at a public high school in a city in eastern China. The school ranks academically slightly above average in the city's league table, and its students are

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assumed to have a relatively higher socioeconomic status than those in many other parts of the country. Through convenience sampling and negotiation with the school, 1,113 students (out of 1,260) from grades 11 and 12 participated in the project. The participants had 8 to 9 years of formal English learning experience. After an initial case screening, such as removing those who left the questionnaire blank or filled with one or two digits throughout, our valid sample comprised 899 students (53.28% girls; 472 from grade 12) from 26 classes, with ages ranging from 15 to 19 ($M = 16.64$, $SD = 0.59$).

Quantitative measures

Questionnaire

The survey items focusing on SRL strategies were taken directly or slightly adapted from established questionnaires with sound psychometric properties. All the responses were given on a 7-point Likert scale ranging from 1 (*not at all true of me*) to 7 (*very true of me*).

Cognitive strategies. This type of SRL strategies encompassed three subscales, specifically the integration and inference subscales from the Metacognitive and Cognitive Strategy Use Questionnaire (L. Zhang et al., 2014) and the memorization subscale from the Writing Strategies for Self-Regulated Learning Questionnaire (Teng & Zhang, 2016a). Integration and inference are how learners comprehend texts by building connections or making inferences between texts, while memorization involves remembering what has been taught in reading classes.

Metacognitive strategies. The two measured metacognitive strategies were planning (L. Zhang et al., 2014), which focuses on behaviors before starting to read an English article, and monitoring (Teng & Zhang, 2016a), which concerns how readers set goals for, monitor and self-evaluate their learning.

Motivation-regulation strategies. We measured interest enhancement skills, which are used to increase learners' interest in reading and make learning more enjoyable; self-talk, which is how students persuade themselves to work toward mastery and performance goals; and emotion control, which is used to combat negative emotions in learning. These three subscales were minimally adapted from Teng and Zhang (2016a).

Motivational beliefs. The constructs of utility and interest measure the degree to which the students think of their reading tasks and materials as useful/important and interesting, respectively. Self-efficacy reflects the students' confidence in their ability to learn to read and to perform well in reading. Mastery goal and performance goal evaluate students' intrinsic reasons (e.g., interest) and external reward (e.g., test scores), respectively, for learning to read. All the motivation items were adapted from the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1991).

All questionnaire items were presented to students in their native language (Mandarin Chinese) for easy understanding. Items were translated from their English sources by the first author and confirmed by the other authors; all of us are native Chinese speakers. The number of items, a sample item, and Cronbach's alpha for each of the previously mentioned subscale variables are summarized in Table 1. Cronbach's alpha values between 0.641 and 0.924 indicate acceptable internal consistency (Taber, 2018).

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Table 1. Item numbers, internal consistency, and item samples for study variables

Variable	Items	α	Item sample
Cognitive strategies			
Integration	4	0.744	When the text becomes difficult, I reread the problematic part to increase my understanding.
Inference	3	0.641	I guess the meanings of new words from the context.
Memorization	3	0.773	I read and/or write useful words and expressions taught in reading courses to help me remember them.
Metacognitive strategies			
Planning	5	0.705	I plan what to do before I start reading an article.
Monitoring	6	0.862	When learning to read, I set up goals for myself to direct my learning activities.
Motivation-regulation strategies			
Interest enhancement	4	0.875	I look for ways to bring more fun to the learning of reading.
Self-talk	6	0.892	I tell myself that I need to keep studying to improve my reading competence.
Emotion control	3	0.764	I tell myself not to worry when taking a reading test or answering questions in reading courses.
Motivational beliefs			
Utility	4	0.731	I think I will be able to use what I learn in this course in other courses.
Interest	3	0.791	I am very interested in the content area of this course.
Self-efficacy	8	0.924	I believe I will receive an excellent grade in this class.
Mastery goal	4	0.725	In a class like this, I prefer course material that really challenges me so I can learn new things.
Performance goal	4	0.781	Getting a good grade in this class is the most satisfying thing for me right now.

English reading comprehension test

The reading comprehension test was part of a College Entrance Examination (*gaokao*) from past paper compiles. As a nationwide standardized test, *gaokao* ensures high quality of content and satisfactory property of measurement. Reading comprehension was tested through objective multiple-choice questions, with no ambiguity in grading the right/wrong answers (Brantmeier, 2006), which was also appropriate for this large-scale project. Its selection was approved by the school's English teaching panel, confirming that the test would be moderately difficult for the students and that they had not taken it previously. The test comprised five passages of various genres and 35 multiple-choice questions worth 1.5, 2, or 2.5 points each, with a full score of 70 points. It took the students one class period (40 minutes) to complete the test.

Qualitative semi-structured interviews

One goal of the interviews was to confirm the respondents' SRL-strategy use as reported in the questionnaire; elaboration was requested if, for example, some strategies (e.g., cognitive and metacognitive) had been used more frequently than others (e.g., motivational). The interviews also elicited more information on the students' motivational beliefs to clarify their relationships with strategy use. Respondents with particularly high or low strategy scores compared with their counterparts in the same profile were asked to elucidate further (see Appendix 1 for sample interview questions). The interviews were conducted in the students' native language (Mandarin Chinese) for

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ease of communication, and each of them (20~30 minutes) was audio-recorded for transcription and analysis.

Data analysis

Quantitative data

To address **RQ1**, LPA was used to identify SRL profiles in relation to cognitive, metacognitive, and motivation-regulation strategies (totaling eight subscales). Following the primer provided by Ferguson et al. (2019) on conducting LPA in Mplus, we performed a three-step analysis. Step One involved regular data inspection, including screening cases, handling missing values, and checking statistical assumptions. In Step Two, a series of plausible, competing LPA models were iteratively run, with solutions (models) ranging from one to five/six profiles (Ferguson et al., 2019; Masyn, 2013). In Step Three, we evaluated the LPA models to identify the model with the best fit as well as theoretical interpretability. Each model was compared against the previous (k-1) one for retention decision, based on criteria such as Akaike's Information Criteria (AIC), Bayesian Information Criteria (BIC), and Sample-Adjusted BIC (SABIC); lower values often suggested better model fit and thus preferred models (Masyn, 2013). In addition, the Lo-Mendell Ruben Test (LMRT) and Bootstrapped Likelihood Ratio Test (BLRT) compared the likelihood ratio of each model with that of its previous counterpart; significant test results suggested that adding profiles statistically improved model discrimination (Masyn, 2013). Another criterion was entropy, a measure of classification uncertainty in each model's partitioning observations into subgroups; higher entropy values represented better classification results, and a common threshold of 0.80 or above supported a satisfactory performance (Tein et al., 2013). Furthermore, we noted the number of members in each profile; less than 5% of the full sample was considered too spurious to render the profile representative (Ferguson et al., 2019; Masyn, 2013). A trade-off between relatively sound criteria performance and model parsimony was sometimes necessary, as increased model complexity, along with profile addition, seemed to keep decreasing the AIC, BIC, and SABIC values and making LMRT and BLRT significant. The theoretical interpretability of the results was also of great concern for decision-making (Ferguson et al., 2019).

To address **RQ2**, we first inspected the best SRL-profiling solution and grouped observations based on their most likely latent profile membership. As the eight SRL-strategy subscales were continuous variables, we performed a one-way analysis of variance (ANOVA) with post-hoc comparisons if there were more than two profiles, and otherwise a t-test, accompanied by effect sizes, to determine whether there were significant differences in the study constructs across profiles.

To address **RQ3**, we first compared the mean differences in individual factors across profiles. We conducted a one-way ANOVA or t-test with post-hoc comparisons for the continuous motivational variables and reading scores, and an omnibus chi-square difference test with post-hoc comparisons for the categorical variables of gender and grade, accompanied by effect sizes, to determine if those factors were significantly different between the profiles. The hypothesized significant differences in individual factors as external validation variables would reconfirm the best SRL-profiling solution (Csizér & Dörnyei, 2005; Karlen, 2016) identified in **RQ1**. Next, we performed the VAM approach (Asparouhov & Muthén, 2014; Vermunt, 2010) by including the six individual variables to the LPA model as covariates to predict SRL-profile membership. Once the best profiling solution had been found, individuals were assigned to the most

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likely profile based on their posterior probabilities. Instead of directly adding predictors, the VAM approach included them as auxiliary variables to avoid changing the nature of the profiling and considered assignment uncertainty by estimating each profile's average classification errors (Ferguson et al., 2019). The steps were automatically implemented in Mplus using the "AUXILIARY" ("R3STEP") specification.

The statistical package Mplus 8.3 (Muthén & Muthén, 1998–2019) was used for LPA and covariate analysis with MLR estimator, a maximum likelihood estimation robust to nonnormality. Models used 1,000 random sets of start values in the first and the best 250 in the second stage of optimization, and also 500 initial stage iterations to avoid local likelihood maxima. SPSS 23.0 software was used for the ANOVA/*t*-tests and chi-square difference tests with post-hoc comparisons. The thirteen subscale variables from the questionnaire were computed from parcels of items that were the mean values of all items under each subscale, with 0.30% and 0.16% missing rates at the item and subscale levels, respectively. Missing values were handled by default in different models, that is, full information maximum likelihood (FIML) for LPA and list-wise deletion by analysis for covariate analysis as well as difference tests with post-hoc comparisons.

Qualitative data

The audio-recorded interviews were first transcribed verbatim and then imported into NVivo 11 for coding and analysis. Thematic analysis was conducted to identify the SRL strategies and motivational beliefs of the students in each profile with reference to the categorization of those constructs in the questionnaire, as well as to identify important or recurring patterns in the students' elaborations on their experiences and opinions (**RQ1, 2, 3**). The coding and analysis proceeded cyclically from data reduction to reorganization of the data level to adjustment of the coding decisions until appropriate themes were generated.

Results

Quantitative results

Descriptive statistics and correlations between the variables

Table 2 shows the means, standard deviations, range, skewness, and kurtosis of the variables and the zero-order correlations between them. The whole sample had moderately high means on the study constructs, with particular high values on performance goal ($M = 5.14$, $SD = 1.25$) and integration ($M = 5.15$, $SD = 1.03$), and low values on interest ($M = 3.95$, $SD = 1.24$), memorization ($M = 3.72$, $SD = 1.23$), and monitoring ($M = 3.98$, $SD = 1.10$). The absolute values of the skewness of kurtosis all fell within 2, which suggests normal distributions of the variables (Field, 2013). All the variables except grade and gender had significant correlations with each other, most of which were of a small to medium magnitude ($.10 < r < .50$)

Identification and description of self-regulated learning profiles (RQ1, 2)

The LPA fit indices of the models with one to six profiles are presented in Table 3. As the LMRT and BLRT values indicate, the model fit improved significantly with the addition of profiles up to six; comparison of the six- and five-profile models (LMRT, $p > 0.05$) indicates that the six-profile solution was not significantly better than the five-profile solution. Furthermore, while the AIC, BIC, and SABIC values declined as profiles were added, the decrease rates slowed after the three-profile model, suggesting that the

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Table 2. Descriptive statistics of and zero-order correlations among variables

	Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Individual factors																	
1	Grade	–	−.14***	.30***	−.07*	−.02	.06	.02	.05	−.02	.03	.03	.09**	.10**	−.05	.04	.05
2	Gender		–	.09**	.15***	.07*	.06	.04	−.03	.05	.00	.12***	.01	.09**	.02	.05	.08*
3	Reading			–	.08*	.19***	.26***	.20***	.08*	.24***	.15***	.15***	.13***	.17***	.08*	.14***	.18***
4	Utility				–	.63***	.42***	.46***	.23***	.29***	.32***	.48***	.36***	.44***	.34***	.43***	.40***
5	Interest					–	.51***	.57***	.17***	.35***	.36***	.47***	.32***	.42***	.42***	.38***	.34***
6	Self-efficacy						–	.62***	.29***	.46***	.43***	.43***	.35***	.43***	.30***	.44***	.39***
7	Mastery goal							–	.27***	.41***	.39***	.37***	.34***	.39***	.49***	.37***	.37***
8	Performance goal								–	.25***	.16***	.17***	.25***	.27***	.16***	.48***	.26***
Self-regulation learning strategies																	
9	Integration									–	.61***	.31***	.35***	.34***	.30***	.37***	.37***
10	Inference										–	.28***	.27***	.30***	.30***	.30***	.30***
11	Memorization											–	.36***	.60***	.30***	.48***	.37***
12	Planning												–	.49***	.25***	.36***	.30***
13	Monitoring													–	.29***	.56***	.38***
14	Interest enhancement														–	.32***	.27***
15	Self-talk															–	.49***
16	Emotion control																–
	N	899	899	878	899	899	899	899	898	899	898	899	899	899	899	899	899
	Min.–Max.	0–1	0–1	19–70	1–7	1–7	1–7	1–7	1–7	1–7	1–7	1–7	1–7	1–7	1–7	1–7	1–7
	Skewness	−.10	−.13	−.82	−.41	−.23	.00	−.29	−.67	−.38	−.13	−.03	−.29	−.11	−.42	−.55	−.40
	Kurtosis	−1.99	−1.98	1.69	.64	.21	−.23	.17	.55	.04	−.19	−.19	.01	.22	−.14	.54	.36
	M	.53	.53	53.98	4.57	3.95	4.20	4.33	5.14	5.15	4.86	3.72	4.69	3.98	4.56	4.97	4.93
	SD	.50	.50	6.99	1.10	1.24	1.22	1.16	1.25	1.03	1.09	1.23	1.08	1.10	1.40	1.14	1.18

Notes: Grade: 1 = Grade 12, 0 = Grade 11; Gender: 1 = Girl, 0 = Boy.
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Table 3. Relative model fit indices of latent profile analysis of models with 1–6 profiles

Profile	Nfp	LL	△ *diff*	AIC	△ *diff*	BIC	△ *diff*	SABIC	△ *diff*	Entropy	Smallest	LMRT *p*	BLRT *p*
1	16	−11208.740		22449.481		22526.301		22475.488		1.000	100%	/	/
2	25	−10565.039	643.701	21180.077	1269.404	21300.110	1226.191	21220.714	1254.774	0.771	49.61%	< 0.001	< 0.001
3	**34**	**−10383.068**	**181.971**	**20834.135**	**345.942**	**20997.379**	**302.731**	**20889.401**	**331.313**	**0.807**	**9.57%**	**0.024**	**< 0.001**
4	43	−10271.129	111.939	20628.257	205.878	20834.712	162.667	20698.152	191.249	0.780	7.79%	0.002	< 0.001
5	52	−10198.838	72.291	20501.676	126.581	20751.343	83.369	20586.199	111.953	0.801	7.34%	0.028	< 0.001
6	61	−10153.673	45.165	20429.346	72.330	20722.224	29.119	20528.498	57.701	0.814	2.67%	0.476	< 0.001

Notes: $n = 899$. The three-profile model in bold was selected as the best solution. △ *diff* indicates the absolute value difference between a model and the previous model. Nfp = Number of free parameters. LL = Log-Likelihood. AIC = Akaike's Information Criteria. BIC = Bayesian Information Criteria. SABIC = Sample-Adjusted BIC. LMRT = Lo-Mendell Ruben Likelihood Ratio Test. BLRT = Bootstrapped Likelihood Ratio Test.

improvements to model fit due to the addition of the fourth, fifth, and sixth profiles were not as substantial as those from the addition of the second and third profiles. Close examination of the competing models with three, four, and five profiles suggested that the extra profiles in the latter two models were conceptually redundant. Moreover, the entropy (0.807) for the three-profile solution was above the recommended cutoff score for satisfactory subgroup classification. The average latent profile probabilities for the most likely membership (0.909, 0.898, 0.917) in this solution manifested excellent performance as well. Its smallest profile accounted for 9.57% (>5%) of the sample. Therefore, the three-profile model was identified as the optimal solution for classifying SRL learners, which was again supported by the generally significant differences in individual factors (external validation) for the distinctness of the subgroups, as reported in the following text.

Descriptive statistics of the eight SRL strategies for the three profiles are shown in Table 4, and the mean values are illustrated in Figure 1. The means of all the variables were in the ascending order of Profile 1 (n = 86, 9.57%), Profile 2 (n = 540, 60.07%) and Profile 3 (n = 273, 30.36%). We therefore classified them as Low, Medium, and High SRL profiles, respectively. Within each profile, the means of the strategies were relatively similar, except a few low points; specifically, memorization had the lowest mean for all three profiles, followed by monitoring.

To quantify the degree to which the profiles differed in the SRL subscales, we performed one-way ANOVA after Levene's test for the assumption of homogeneity of variance, given the unequal sample sizes of the profiles. As seen in Table 4, only planning and monitoring supported this assumption ($p > 0.05$) and therefore merited the regular *F*-test in ANOVA, whereas all the other subscales with unequal variances ($p < 0.05$) were subject to another robust Welch's *F*-test. All *F*-ratios were significant with large effect sizes ($\eta^2 > 0.14$; Cohen, 1988). And the two types of subscales (equal vs. unequal variances) went through Hochberg's GT2 and Games–Howell post-hoc procedures, respectively, for their statistical power over Type I error (Field, 2013). The results showed that the three profiles were significantly different from each other on all the subscales ($p < 0.05$).

Associations between individual factors and self-regulated learning profiles (RQ3)

Table 4 also shows descriptive statistics and comparison results of the individual factors across the three profiles. The means of all the motivation variables and reading scores also rose from Low Profile, Medium Profile and to High Profile. To test the significance of these differences, the approach used for the SRL indicators mentioned in the preceding text was implemented again for the continuous variables. Statistical significance was confirmed for all of the five motivational constructs ($p < 0.05$) with effect sizes near or above the large benchmark of $\eta^2 = 0.14$ (Cohen, 1988). However, the reading differences reached significance only between High and Low Profiles, and between High and Medium Profiles ($p < 0.05$). For the categorical variables of grade and gender, a chi-square difference test was first conducted. Only the difference between gender percentages was significant ($\chi^2(2) = 14.72$, $p < 0.01$) with a small effect size (Cramér's V = 0.13; Cramér, 1946). Then a cross-tabulation was formulated for pairwise comparisons (Table 5). To avoid Type I error, the significance level was adjusted to 0.0056 (0.05 divided by nine comparisons), and the corresponding critical value of the adjusted residual with Bonferroni correction was 2.77 (or below –2.77).

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Table 4. Descriptive statistics of and comparisons among the three profiles

	Profile 1 (Low, n = 86, 9.57%)	Profile 2 (Medium, n = 540, 60.07%)	Profile 3 (High, n = 273, 30.36%)			
	M (*SD*)	M (*SD*)	M (*SD*)	Levene (*df*)	$F/\chi^2(df)$	Effect size (η^2/V)
Self-regulated learning strategies						
Integration	$4.32\ (1.22)_{23}$	$4.89\ (0.90)_{13}$	$5.93\ (0.68)_{12}$	23.83 (2, 896)***	Welch's $F(2, 216) = 201.78$***	$\eta^2 = 0.24$
Inference	$4.11\ (1.25)_{23}$	$4.60\ (0.97)_{13}$	$5.60\ (0.84)_{12}$	9.87 (2, 895)***	Welch's $F(2, 217) = 136.22$***	$\eta^2 = 0.20$
Memorization	$1.92\ (0.74)_{23}$	$3.50\ (0.92)_{13}$	$4.73\ (1.00)_{12}$	5.37 (2, 896)**	Welch's $F(2, 244) = 392.96$***	$\eta^2 = 0.42$
Planning	$3.56\ (1.04)_{23}$	$4.47\ (0.93)_{13}$	$5.48\ (0.83)_{12}$	2.99 (2, 896)	ANOVA $F(2, 896) = 185.66$***	$\eta^2 = 0.27$
Monitoring	$2.29\ (0.79)_{23}$	$3.75\ (0.75)_{13}$	$4.97\ (0.82)_{12}$	1.66 (2, 896)	ANOVA $F(2, 896) = 452.00$***	$\eta^2 = 0.43$
Interest enhancement	$3.33\ (1.57)_{23}$	$4.39\ (1.27)_{13}$	$5.28\ (1.21)_{12}$	6.21 (2, 896)**	Welch's $F(2, 218) = 77.84$***	$\eta^2 = 0.19$
Self-talk	$3.08\ (1.16)_{23}$	$4.78\ (0.81)_{13}$	$5.94\ (0.69)_{12}$	15.65 (2, 896)***	Welch's $F(2, 214) = 370.92$***	$\eta^2 = 0.42$
Emotion control	$3.65\ (1.31)_{23}$	$4.67\ (0.96)_{13}$	$5.84\ (0.86)_{12}$	7.34 (2, 896)**	Welch's $F(2, 215) = 204.17$***	$\eta^2 = 0.30$
Individual factors						
Grade	0.43 (0.50)	0.53 (0.50)	0.55 (0.50)	/	$\chi^2(2) = 3.77$	V = 0.06
Gender	0.34 (0.48)	0.56 (0.50)	0.55 (0.50)	/	$\chi^2(2) = 14.72$**	V = 0.13
Reading	$51.87\ (7.48)_{3}$	$53.43\ (7.10)_{3}$	$55.71\ (6.29)_{12}$	4.18 (2, 875)*	Welch's $F(2, 213) = 14.71$***	$\eta^2 = 0.18$
Utility	$3.42\ (1.19)_{23}$	$4.39\ (0.91)_{13}$	$5.29\ (0.96)_{12}$	5.51 (2, 896)**	Welch's $F(2, 214) = 127.04$***	$\eta^2 = 0.23$
Interest	$2.85\ (1.24)_{23}$	$3.71\ (1.05)_{13}$	$4.77\ (1.11)_{12}$	3.80 (2, 896)*	Welch's $F(2, 218) = 122.14$***	$\eta^2 = 0.24$
Self-efficacy	$3.04\ (1.20)_{23}$	$3.95\ (1.04)_{13}$	$5.07\ (1.02)_{12}$	1.14 (2, 896)	ANOVA $F(2, 896) = 161.21$***	$\eta^2 = 0.27$
Mastery goal	$3.31\ (1.19)_{23}$	$4.12\ (1.03)_{13}$	$5.06\ (0.98)_{12}$	1.94 (2, 896)	ANOVA $F(2, 896) = 122.20$***	$\eta^2 = 0.21$
Performance goal	$4.38\ (1.62)_{23}$	$4.95\ (1.19)_{13}$	$5.76\ (0.98)_{12}$	15.82 (2, 895)***	Welch's $F(2, 216) = 65.59$***	$\eta^2 = 0.13$

Notes: Grade: 1 = Grade 12, 0 = Grade 11; Gender: 1 = Girl, 0 = Boy. Subscripts 1–3 indicate statistically significant differences ($p < 0.05$) compared with the other profiles based on the Hochberg's GT2 or Games–Howell post-hoc tests.
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

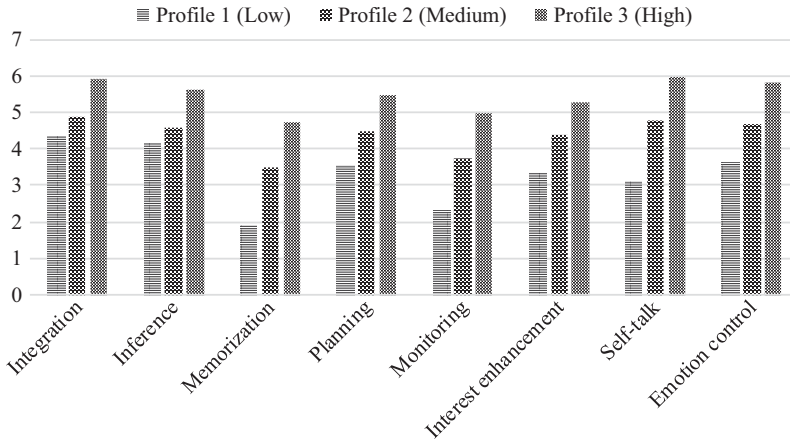

Figure 1. Mean-level comparisons of self-regulated learning strategies among the three profiles.

This indicated a significant difference in the percentages of boys and girls (3.8 and –3.8 adjusted residuals, respectively) for Low Profile only.

Table 6 summarizes the results of our covariate analysis predicting SRL-profile membership, with High Profile serving as the reference group because of the pivotal role of SRL strategies in academic learning. The magnitudes of effect sizes were indicated by odds ratios, which were also transformed into η^2 for easier interpretations (Lenhard & Lenhard, 2016). The significant predictors were grade, utility, interest, self-efficacy, and performance goal ($p < 0.05$). Specifically, being an 11th grader significantly increased the likelihood of being a member of Low Profile ($B = -1.04$, $SE = 0.49$, $p < 0.05$) but not of Medium Profile ($B = -0.11$, $SE = 0.34$, $p > 0.05$), in comparison with High Profile. The all negative coefficients on utility, interest, self-efficacy, and performance goal, however, indicated that these constructs positively predicted membership of High Profile as opposed to the Low/Medium Profile. Furthermore, the effect sizes of utility (OR = 0.18/η^2 = 0.18 [Low Profile], OR = 0.39/η^2 = 0.06 [Medium Profile]), self-efficacy (OR = 0.22/η^2 = 0.15 [Low Profile], OR = 0.45/η^2 = 0.05 [Medium Profile]) and performance goal (OR = 0.39/η^2 = 0.06 [Low Profile], OR = 0.52/η^2 = 0.03 [Medium Profile]), with reference to the cutoff scores of 0.01, 0.06, and 0.14 for small, medium, and large sizes of η^2 (Cohen, 1988), indicated that these three constructs were the most powerfully predictive for both pairs of groups.

Given that reading achievement is a central construct in relation to strategy use, but that our between-profile mean comparisons and covariate analysis did not support its very discriminative role, we further explored the finer-grained, subprofile distributions of students with different reading proficiency levels, which were indicated by every 10 percentiles of all students' reading scores (from high to low). As seen from Table 7, students of each 10 percentiles could be found in every profile. However, for the most competent readers (top 30%), their subprofile proportions for each 10 percentiles were still larger for the High and Medium Profiles than the Low Profile; whereas for the least competent ones (bottom 30%), Low and Medium Profiles demonstrated greater proportions.

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Qualitative results

After the quantitative phase, sixteen students were randomly selected for semi-structured interviews (six, six, and four from High, Low and Medium Profiles, respectively) to gain further insights into the disparities in their SRL-strategy use; this sample size would be sufficient in our scenario (see Guest et al., 2006). We also examined their background characteristics of grade, gender, and reading proficiency level (see Appendix 2). For ease of understanding, we coded the participants as, for example, P1-L for a Low Profile student with low reading proficiency. If there were several such students, then codes would be P1-L1/L2/L3 and so on. The "M" and "H" denoted moderate and high reading proficiency, respectively. Selected translated excerpts are reported below after being slightly tidied up.

To commence, each interviewee generally confirmed the profile they belonged to. Interestingly, all students expressed familiarity with the strategies for learning to comprehend passages, that, integration, inference, and planning, but reported different frequencies of usage corresponding to their assigned profiles. The reasons for these differences diverged according to students' reading achievements. For example, a competent reader in the Low Profile claimed, "I did not use [the strategies] often … because I just kept reading and then I could understand the meaning" (P1-M), and another stated, "I do not really need the strategies, because I have a large vocabulary for an easy understanding" (P1-H). In contrast, a less competent reader in Low Profile explained, "Too many unknown words prevented me from applying [the strategies]" (P1-L1). Low-proficiency readers were also found in High Profile, such as P3-L2, who stated, "I particularly resorted to the strategies of repetitive reading and making connections when I came across many new expressions." As for strategies to motivate learning, all students seemed to hold a mature attitude toward *gaokao* by persuading themselves to work intensively and trying to make their learning more enjoyable, for example, by listening to English-language music (P1-L3), watching English-language videos (P3-H2), and choosing interesting texts (P3-L2).

Next, the students were asked to elaborate on their experiences of memorization and monitoring. They described similar experiences, irrespective of their profile membership. The students emphasized the importance of practice for English reading and admitted not having memorized much for this subskill, as there were not many notes to digest. However, they all claimed that they still remembered materials diligently in study halls, chiefly for vocabulary and composition samples. None of them had made systematic plans or monitored/self-evaluated their reading during the learning process. Their reasons for this omission included not knowing how to do so (P1-M, P1-L3), not having enough time (P2-H1, P2-M2, P2-H2, P3-H3), and not needing to do so ("No need yet because my English is fine as long as I follow what my teacher teaches in class") (P3-H1, P3-M, P3-L2).

Concerning individual factors, utility powerfully predicted SRL-strategy grouping, which was reflected in the students' fundamental attitudes toward English learning. Although their teachers often did not require the students to review/recite reading notes, a few interviewees (P1-M, P2-M1, P3-H2, P3-L2, P3-H3) added that they sometimes paid extra attention to complicated or well-written expressions and sentences as exemplars for composition writing. Those with such positive attitudes often belonged to the higher-achieving cohorts or were more competent strategy users. While they were extrinsically oriented by the pressure of *gaokao*, many students (P1-M, P1-H, P2-H1, P2-M2, P3-H1, P3-H2, P3-M, P3-L2, P3-H3) mentioned their interest in learning English. Some could trace their interest back to childhood and had since

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Table 5. Post-hoc test for gender across the profiles

		Gender		
		Boy (0)	Girl (1)	Total
Profile 1	Count	57	29	86
(Low, 9.57%)	Expected count	40.2	45.8	86.0
	%	66.3%	33.7%	100.0%
	Adjusted residual	3.8	−3.8	
Profile 2	Count	239	301	540
(Medium, 60.07%)	Expected count	252.3	287.7	540.0
	%	44.3%	55.7%	100.0%
	Adjusted residual	−1.8	1.8	
Profile 3	Count	124	149	273
(High, 30.36%)	Expected count	127.5	145.5	273.0
	%	45.4%	54.6%	100.0%
	Adjusted residual	−.5	.5	
Total		420	479	899

Table 6. Results of covariate analysis predicting profile membership

	Profile 1 (Low, 9.57%)			Profile 2 (Medium, 60.07%)		
Predictor	B (SE)	OR	Effect size (η^2)	B (SE)	OR	Effect size (η^2)
Grade	−1.04 (0.49)*	0.36	0.07	−0.11 (0.34)	0.90	0.00
Gender	−0.64 (0.44)	0.53	0.03	0.18 (0.29)	1.19	0.00
Reading	−0.01 (0.04)	0.99	0.00	−0.03 (0.03)	0.97	0.00
Utility	−1.71 (0.35)***	0.18	0.18	−0.96 (0.25)***	0.39	0.06
Interest	−0.75 (0.29)**	0.47	0.04	−0.57 (0.18)**	0.57	0.02
Self-efficacy	−1.51 (0.27)***	0.22	0.15	−0.80 (0.19)***	0.45	0.05
Mastery goal	−0.44 (0.29)	0.65	0.01	−0.21 (0.24)	0.81	0.00
Performance goal	−0.95 (0.22)***	0.39	0.06	−0.65 (0.18)***	0.52	0.03

Notes: $n = 877$. Reference group: Profile 3 (High, 30.36%). OR = odds ratios.
*$p < 0.05$;**$p < 0.01$;***$p < 0.001$.

consistently received satisfactory English scores (P3-H1, P3-H2). However, others had lost interest over time. For example, P2-M1 said, "I was interested in English when I was in primary school. But I often failed to improve my grades. I lost confidence and my interest gradually decreased." All these may indicate that students' strategy use, academic achievement, and motivational attributes (e.g., interest, self-efficacy) are often intertwined with each other.

Discussion

Self-regulated learning profiles

The typology of our identified profiles of Chinese high-school EFL readers' SRL-strategy use belongs to the trichotomy family, as the respondents' profile performance for all SRL indicators fitted a high-, medium-, and low-ranking order. Reassuringly, competent self-regulated learners in our study occupied 30.36% of the sampled population, a higher percentage than that of comparable learners in many other studies (e.g., Abar & Loken, 2010; Chon & Shin, 2019; Liu et al., 2014; Ning & Downing, 2015; Schwinger et al., 2012), and the minimally self-regulated accounted for only 9.57%, a

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Table 7. Distributions of students with different reading proficiency levels among the profiles

Reading proficiency	Profile 1 (Low, $n = 81$)		Profile 2 (Medium, $n = 528$)		Profile 3 (High, $n = 269$)		Effect size (η^2)			
							Overall	P1 vs. P2	P1 vs. P3	P2 vs. P3
M (*SD*)	51.87 (7.48)		53.43 (7.10)		55.71 (6.29)		0.18	0.03	0.13	0.13
Percentile%	n	%	n	%	n	%				
10	6	7.41	59	11.17	37	13.75				
20	6	7.41	42	7.95	36	13.38				
30	5	6.17	49	9.28	36	13.38				
40	7	8.64	43	8.14	33	12.27				
50	12	14.81	62	11.74	29	10.78				
60	4	4.94	41	7.77	26	9.67				
70	7	8.64	55	10.42	23	8.55				
80	11	13.58	61	11.55	20	7.43				
90	9	11.11	60	11.36	14	5.20				
100	14	17.28	56	10.61	15	5.58				

lower percentage than that in many studies (e.g., Abar & Loken, 2010; X. Chen et al., 2019; Csizér & Tankó, 2017; Liu et al., 2014; Muwonge et al., 2020; Ning & Downing, 2015). This may indicate decent SRL development among our cohort of learners.

We observed nuanced patterns in the profile shapes that reflected the focal language subskill and educational environment. First, the majority (High and Medium Profiles) of the English readers showed moderate to high levels in making integration, inferences, and plans when comprehending texts. In contrast with the consistently low to moderate levels of SRL on all subscales in X. Wang's (2018) investigation of Chinese junior secondary (grades 7–9) students' English reading, our cognitive and metacognitive strategy measures demonstrated salient improvements. China has undergone a decade's reform of English education (from primary to secondary schooling) that has emphasized students' overall competency of "language skills, language knowledge, affective attitude, learning strategies, and cultural awareness" (Q. Zhang & Kim, 2013). Both our quantitative and qualitative findings testify to this generation's strategic language learning and challenge the assertion of scholars such as X. Chen et al. (2019) and Guo et al. (2018) that Chinese students often do not use efficient strategies for EFL learning.

Certain findings merit particular elaborations. First, memorization, which has been seen as typical of Chinese learners (X. Wang, 2018), was the least frequently used strategy. Combining our interview results and other literature (e.g., Ding, 2007), we conclude that Chinese EFL learners still frequently employ this bottom-up strategy but are selective in applying it to specific language subskills, with vocabulary as the favored target. Good learners, also as sophisticated SRL-group members, further attend to texts by appreciating, remembering, and imitating the collocations and sentence patterns therein for future productive use (Ding, 2007).

Second, our participants were found to be rather weak in monitoring/self-evaluating their learning process. This is not surprising, given the controlling nature of China's high-stakes testing system, which prioritizes teacher- and classroom-centered learning, leaving little space/need for students to establish their own study plans (Yu et al., 2018). However, caution is warranted; such testing system adversely affects students' metacognitive awareness of and skills in EFL learning, which may stagnate even into their

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college years, as suggested by Teng's (2021) and Teng and Zhang's (2016a, 2018) studies of Chinese tertiary EFL learners.

Third, regarding the less documented strategies for regulating motivation in EFL learning, most of our high-school readers displayed moderate to high levels, comparable to those reported for college writers by Teng and colleagues (Teng, 2021; Teng & Zhang, 2016a, 2018; Teng et al., 2020). Furthermore, we observed very consistent trends in the use of motivation-regulation strategies and many other (meta-) cognitive strategies within each profile, demonstrating for the first time the close interplay of various SRL aspects in an L2 scenario from a person-centered perspective. Motivation-regulation strategies often work as antecedents of or interact with (meta-)cognitive strategies that are inherently effort- and time-consuming (Pintrich 2004; Teng & Zhang, 2018).

Associations between individual factors and self-regulated learning profiles

While the more self-regulated participants obtained higher mean reading scores, the only significant differences were between High Profile and Low/Medium Profile. This finding diverges from the significant differences identified between all profiles in many other studies (e.g., X. Chen et al., 2019; Chon & Shin, 2019; Dörrenbächer & Perels, 2016; Karlen, 2016; Ning & Downing, 2015). Furthermore, reading proficiency failed to significantly predict whether an individual belonged to High or Low/-Medium Profile. One reason could be that many other factors may intervene in the relationship between L2/motivation behaviors and learners' actual competencies (Csizér & Tankó, 2017; Schwinger et al., 2012), such as L2 linguistic constraints and learning styles. Another speculation, as supported by our profile member distribution and interviews, involves the heterogeneity of readers' proficiency levels within each profile. Less proficient readers in High Profile may have been motivated to use strategies frequently but ineffectively. Meanwhile, relatively proficient readers in Low Profile may either have been selective in applying strategies due to high metacognitive awareness, have needed few strategies due to their large vocabulary, or have used such strategies automatically without realising it. Additionally, the comprehension task type (multiple choices in our study) might also influence the associations between strategy use and reading performance (Li et al., 2022). Therefore, it is illogical to expect linear, additive associations between strategy use and language performance (Yamamori et al., 2003).

We identified group tendencies for all motivational constructs; specifically, there were significant bilateral mean differences across the three profiles, with more self-regulated groups showing higher motivation, consistent with relevant studies (e.g., Abar & Loken, 2010; Csizér & Tankó, 2017; Dörrenbächer & Perels, 2016; Muwonge et al., 2020; Ning & Downing, 2015). Moreover, all studied elements except mastery-goal orientation significantly predicted an individual's SRL-profile membership, which echoes the findings of Muwonge et al. (2020). However, our study offers a distinct picture from related variable-centered research. For instance, Bai and Wang (2021, 2023) found that interest and self-efficacy significantly affected many SRL strategies, while the effects of perceived usefulness/importance were minimal for Hong Kong primary EFL writers. Teng (2021) reported that task value, mastery-goal orientation, and self-efficacy significantly predicted all SRL substrategies of college EFL writers in mainland China. In our study, however, apart from self-efficacy, which was a persistently powerful predictor, perceived usefulness/importance and performance-goal

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orientation (i.e., extrinsic motivation) were the most predictive of discriminating SRL "strategy chains." This inconsistency may be due to methodological differences, that is, variable-centered versus person-centered approaches. Another consideration is the particularly high-stakes educational environment where our participants learned English for external rewards of attaining admission to a prestigious university and a good career.

Whilst intrinsic motivation has traditionally been a robust predictor of deep learning and academic performance (Huang & Chen, 2018), the extrinsic form may be more adaptive for controlled classroom learning (C. Wang, 2013). Evidence of this has accumulated from similar CHC systems such as South Korea (Chon & Shin, 2019). However, we found that interest also predicted profile membership, albeit to a lesser extent, and that both interest and mastery-goal orientation showed significant mean differences across the profiles. This supports the postulation that intrinsic and extrinsic forms of motivation may coexist, with the former buffering the coercive effects of the latter (Chon & Shin, 2019).

Ultimately, our study did not reveal very prominent effects of grade and gender, although a larger proportion of lower-grade boys existed in Low Profile. This aligns with variable-centered evidence of the fuzziness of these factors in L2 learners' strategy use (Bai et al., 2020). Meanwhile, in interviews, our participants indicated that they had long acquired most of the focal (meta-)cognitive strategies and regulated their motivation for exam preparation. Therefore, the students were not in the developmental stage of the examined strategies, which may have lessened inter-individual differences in their strategy adoption. However, as L2 learners' strategic behaviors generally correlate with their language competency, the relative advantages of female and higher-grade students in reading performance found in our study may have put their counterparts at a disadvantage in terms of their learning strategies.

Conclusion

Focusing on Chinese EFL learners' self-regulated reading in a high-stakes testing environment, this mixed-methods study explored learners' strategies for regulating cognition, metacognition, and motivation from a person-centered perspective, as well as investigating the associations between their strategy profiles and a range of individual factors. Several important findings were generated. First, three SRL profiles were identified, characterized by high, medium, and low levels of strategy use. Most learners used most of the SRL strategies with a moderate to high frequency but used memorization and monitoring/self-evaluation strategies least frequently.

Second, reading proficiency did not significantly predict an individual's SRL-profile membership; however, the learners in High Profile still showed significantly higher reading scores than did their counterparts in the other groups. Heterogeneity in reading competency was observed within each profile.

Third, self-efficacy and extrinsic motivation most significantly predicted SRL-profile membership; nevertheless, intrinsic and extrinsic motivation variables were significantly higher for learners from the profile of more strategy use.

The identified associations between individual factors and students' SRL-strategy use have practical implications for researchers, who may wish to integrate these findings into more effective intervention schemes to facilitate students' strategic behaviors. Furthermore, the results may help practitioners to personalize their reading instruction on the basis of profile traits to strengthen their teaching efficiency. Extra

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attention should be paid to commonly weak learning strategies, such as setting goals and monitoring progress. In addition, given the significant effects of intrinsic motivation as a group tendency, teachers should continue to orientate students toward mastery goals and increase their enjoyment of learning to mitigate the pressure associated with preparing for exams.

The study's limitations are as follows. First, its quantitative results indicate only correlations between the study constructs; further experiments and longitudinal tracking are needed to establish causal relationships. Second, the use of convenience sampling to select participants from two grades at one high school restricted the findings. For better generalizability, future research could include adult or even younger EFL learners with different socioeconomic or academic backgrounds. Third, as we used only frequency data to measure learners' strategy use, we may have overlooked the quality aspect of their decision making. Future research could include quality-related indices to better describe students' strategic behaviors. Moreover, students self-reported their strategy use through retrospective survey answers, which may have distorted or missed certain results. Future work could use more data elicitation tools such as verbal reports (e.g., think-aloud protocol, stimulated recall) to reveal a fuller picture.

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Appendix 1

Interview protocol sample

1. We have found three types of SRL-strategy use (showing the mean plots of SRL indicators for each profile). Which group do you think you belong to?
2. What strategies do you often use when trying to comprehend a reading passage? Why are they useful? Did your English teacher teach you these strategies?
3. Do you have the habit of setting up a learning plan and monitoring/self-evaluating the progress? Why or why not?
4. Do you memorize many notes and materials to improve your reading? During study halls, what do you most often recite or review?
5. Are you interested in reading English? Do you think interest is important/necessary to the process of learning to read English? Do you have ways to enhance your interest?
6. How much pressure do you feel from exam preparation? Do you often talk to yourself to keep motivated? If so, how?
7. Are you confident in your reading performance? Are there any factors that have influenced your confidence?

Appendix 2

Interviewees' background information

	Participant code	Grade	Gender	Reading proficiency
Profile 1	P1-M	12	Girl	Moderate
(Low, 9.57%)	P1-L1	12	Boy	Low
	P1-L2	11	Girl	Low
	P1-L3	12	Boy	Low
	P1-H	11	Girl	High
	P1-L4	12	Boy	Low
Profile 2	P2-H1	12	Boy	High
(Medium, 60.07%)	P2-M1	12	Girl	Moderate
	P2-M2	12	Girl	Moderate
	P2-H2	12	Girl	High
Profile 3	P3-L1	11	Boy	Low
(High, 30.36%)	P3-H1	12	Boy	High
	P3-H2	12	Girl	High
	P3-M	11	Girl	Moderate
	P3-L2	12	Boy	Low
	P3-H3	12	Girl	High

Note: The high-proficiency readers were those with reading scores ranked in the top 10%, the low-proficiency readers were in the lowest 10%, and the moderate-proficiency readers were those ranked between the high- and low-proficiency ones.

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