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# A study of project-based learning to intermediate EFL learners in reading class: enhancing self-regulated learning of post-secondary students in Macao

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## Abstract

This study explored two new pedagogical conceptions—project-based learning (PBL) and self-regulated learning (SRL), to enhance effective English teaching and learning in Macao, and to prepare EFL learners for life-long learning. PBL makes English instruction engaging and SRL empowers learners to take ownership of their learning process. The combination of these two methodologies can facilitate students to develop into independent and efficient English learners. The study, guided by Zimmerman's cyclical phase model of SRL and English and Kitsantas' PBL/SRL model, was action research which aimed to investigate whether PBL could positively influence the development of intermediate EFL learners' SRL ability at the post-secondary level in Macao. Research instruments included questionnaires, interviews, students' reflective notes and teacher's field notes. Both qualitative and quantitative findings indicated improvement in the students' SRL ability, reflected in three aspects—motivation, metacognition, and behaviors. The students' motivational beliefs were significantly strengthened, and more self-regulated behaviors were generated. Though the use of metacognitive strategies did not showcase as significant enhancement as the former elements through the study, the experimental group made progress in using some specific strategies, such as evaluating learning outcomes and making study plans. The summary of the study is that PBL was beneficial to the development of SRL. This research endeavor not only contributes to the existing body of knowledge but also serves as a catalyst for educators to advocate policy reforms, fostering the design of learner-centered, flexible, and coherent post-secondary EFL curricula.

**Keywords:** Project-based learning, Self-regulated learning, Action research, Intermediate EFL learners

## Introduction

Most students are required to study a foreign language in many tertiary education settings around the world, because bilingualism (or even multilingualism) is considered as an essential skill a person should possess for his career success in today's globalized society. But how can teachers assist students to learn a foreign language effectively and

efficiently? It is believed that “learning is more effective when learners are active in the learning process, assuming responsibility for their learning and participating in the decisions which affect it” (Sheerin, 1997, p. 56). Teaching students to be self-regulated learners is probably the answer to the question. But the difficulty of the task varies when different students are involved. Advanced EFL students are usually successful language learners, since they are highly motivated in language learning and they can direct their study under different circumstances (Nunan, 2001). However, most EFL learners’ self-regulatory capacity are generally low, with a deficiency in the capacity to exclude distractions, set and achieve study goals, and regulate emotions during the English learning process (Li et al., 2024).

In the case of Macao, the unique context of English teaching and learning contributes significantly to the problem. Macao enjoys an international fame as a popular tourist destination with rich cultural diversity. English functions as *de facto* official language<sup>1</sup> (Moody, 2008) and a *lingua franca* (Yan, 2017), playing an important role in communication among speakers of many different first languages. However, due to historical and social factors, English teaching and learning is a complex issue. During the colonial period, the Macao-Portuguese government prioritized the occupation of resources over education (Lau, 2009). English learning was marginalized when the city was under the ruling of Portugal (Jeong, 2000). Though English was a compulsory subject at different levels of schools in Macao, there was no officially standardized curriculum or clear guidelines across the board by the government. As a result, different schools established their own school curricula, using different materials and applying different approaches to teach English (Lau, 2009). It directly impacted students’ English proficiency: students from different schools varied greatly in English competence (Lau, 2009). After 1999 when Macao was returned to Chinese government, especially after the launch of the development of Great Bay Area, Macao S.A.R. government has been increasingly aware of the importance of the language, but it is not easy to transform the present situation: non-unified English curriculum remains in local tertiary institutions, and there is a trend that some local universities have decreased the credit hours of English learning in recent years as a compromise to students’ major subject study (Cao, 2020). In addition, Macao has a special linguistic environment: Chinese (mainly Cantonese) is in dominance in everyday communication, and English is seldom used in daily life, so students hardly have any opportunity to practice the language after class (Young, 2011).

Under the impact of these factors, improvement of English teaching and learning is challenging. In a study, Tang summarizes the problems that English teaching and learning in Macao tertiary education faces, two of which are as follows: first, students are not motivated to learn English; second, teaching methods are didactic, traditional, outdated and teacher-centered, which emphasize passive recitation instead of active learning and application (Tang, 2003). Another research on students’ autonomy in English learning in Macao shows that students’ ability to learn autonomously is weak, and the reasons are the didactic teaching methods and a lack of communication between teachers and students (Huang, 2012). There is also research indicating that

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<sup>1</sup> The official languages in Macao are Portuguese and Chinese.

students at tertiary levels in Macao have language barrier in academic studies with English-medium instruction (EMI) (Botha, 2013).

To address this unique challenge, English teachers in Macao can use project-based learning (PBL) as an effective approach to help students master the language. PBL, which means that learning takes place through doing projects, is not a new idea. It has gained popularity worldwide in recent years (Boss & Larmer, 2018). It is different from traditional instruction in ways that teachers' roles shift from knowledge providers and authority to facilitators and guides (Boss & Larmer, 2018; English & Kitsantas, 2013); English learning becomes more relevant to students' personal life and the real-life scenarios with authentic learning environment (Madoyan, 2016; Reid-Griffin et al., 2020); passive learning switches into active learning and students' differences are advocated to meet their individual needs (Fried-Booth, 2002). Foreign language learning "is more complex than simply mastering new information and knowledge ... (and) it involves various personality traits and social components" (Dörnyei, 2012, p. 16). Being a student-centered approach that celebrates collaboration and uses authentic materials to connect learning with the real world, PBL has turned out to have a positive influence on students' learning, especially in enhancing their interest in learning English and abilities to manage study (Astawa et al., 2017; Busciglio, 2015; Grant, 2017; Kavlu, 2017; Zhang & Lin, 2018). The researcher sees in it its potentials to facilitate intermediate EFL learners at tertiary level in Macao, especially in the aspect of boosting their self-regulation in learning English. As a result, an action research study was conducted to investigate how PBL enhanced intermediate EFL learners' ability in self-regulatory English learning at post-secondary level. This study represents a pioneering effort in Macao to explore the application of PBL within the context of English language instruction. Furthermore, it introduces an innovative perspective by examining the potential impact of PBL on the development of SRL among intermediate EFL learners.

### **Project-based learning**

Though PBL is now considered as an innovative educational approach, the idea has a long-term history. It can be traced back to the progressive education movement in the early twentieth century in America, when William Heard Kilpatrick proposed the use of projects for educational purpose (van Lier, 2006). Dewey is another major contributor as he advocates the necessity of combining collaborative, constructive, and real-world doing in a child's learning experience to make effective learning happen (Benson et al., 2007). His idea "learning by doing" has been adopted as the cornerstone of this learning method, implemented as a key instructional strategy in schools and other educational settings worldwide to replace traditional, teacher-centered instruction with more creative, student-centered teaching and learning (Boss & Larmer, 2018).

During its development in the recent decades, PBL has been given different definitions by scholars—as a Constructivist-based method (Mohamadi, 2018; Reid-Griffin et al., 2020) or as a Process-based approach (Boss & Larmer, 2018; Price et al., 2019; Sahli, 2017; Wolpert-Gawron, 2016). There are four hallmarks of PBL summarized from past studies on PBL.

- Student-centered project—students are the agents in the learning process, and they take ownership in the completion of challenging projects.
- Sustained inquiry—activities are designed throughout a project to engage students in a sustained investigation on the open-ended driving questions.
- Authenticity—projects are designed based on the real-world contexts.
- Collaboration—projects are done in the forms of pair or group work in which students' collaboration plays a crucial part.

In light of these features, PBL can be defined as a student-centered pedagogy which advocates the use of projects in which students are engaged and work collaboratively for sustained inquiry in authentic contexts.

PBL was first introduced into second or foreign language education as a student-centered approach in the 1980s in Europe and in the 1990s in North America (Wang, 2020). As a member of communicative language teaching, PBL has been proven to be an effective language instructional method. PBL has positive influences on foreign language teaching and learning from linguistic, cognitive, affective and social perspectives, such as the improvement of language skills (Argawati & Suryani, 2020; Astawa et al., 2017; Sadeghi et al., 2016; Zhang & Wang, 2016), motivation, (Assaf, 2018; Kartika, 2020), autonomy (Busciglio, 2015; Grant, 2017), critical thinking (Rochmahwati, 2015), and collaboration (Lubis & Lubis, 2019; Morales et al., 2013). As PBL creates an authentic and communicative learning environment, it offers extensive opportunities for students to have comprehensible language input and output. Unlike most class activities in traditional foreign language classroom setting that focus on the use of language forms or language skills independent of real-world situations, PBL advocates learning English through doing projects that are rooted in authentic context. Therefore, it may be a motivational drive to learn the foreign language and an efficient approach to master it, because what students face in the classroom is what may happen in the real world.

There are mainly two ways to integrate PBL into current curriculum. In a typical PBL class, teachers transform teaching contents into different projects, and students learn through making inquiries to questions in completing projects. It is completely different from traditional classes where teachers make teaching plans and students follow set learning procedures in class. PBL classes feature changes and uncertainty, which boost independent and individualized learning. In Bell's opinion, "PBL is not a supplementary activity to support learning. It is the basis of the curriculum" (2010, p.39). However, this idea of "all or nothing" is questionable as it denies the potential values of traditional instruction with well-organized activities and clear learning goals. The essence of PBL is not about the change of instructional forms but the change of students' learning beliefs (Lenz et al., 2015). Therefore, a less typical, but probably more practical form of PBL is proposed by educators—a combination of PBL and traditional instruction.

The second form of PBL, the less typical one, is believed to be more suitable to the EFL class in the present study. PBL offers supplementary in-class and out-of-class activities to traditional instruction. It also offers the convenience for educators without much prior PBL experience as there is no need to have a major overhaul of the curriculum. Integrating PBL with traditional instruction can draw on the strengths of both parties. PBL excels in practicing the target language, and positively influencing the development of

study habits, while traditional instruction is highly effective in teaching language skills. It is believed that instruction becomes more efficient and effective when PBL and traditional instruction are combined (Xu et al., 2017). Moreover, it is beneficial to students, especially to recent graduates from Mainland Chinese high schools. A study on how PBL affects EFL learners' target language use and performance shows that many freshmen in universities find it hard to adapt to PBL because they are more used to structured and exam-oriented language learning environments (Kelsen, 2018). Therefore, blending PBL with traditional instruction not only creates a friendly learning environment by building on methods that students are already familiar with, but also increases engagement by introducing students to an innovative learning mode.

### Self-regulated learning

The history of self-regulation in learning dates back to the nineteenth century when students were expected to acquire “desirable personal habits, such as proper diction and handwriting” as the ways to “overcome their individual limitations” because back then it was believed that personal constraints, intelligence for example, were the dominant factors in determining a student's success rate in academic study (Zimmerman, 2002, p.65). However, the development of psychological and educational studies has proven that learning is a much more complex process and students' success rate can be attributed to many other factors such as cognitive and metacognitive skills (Bryce & Whitebread, 2012; Kyriakides et al., 2020). It is widely acknowledged nowadays that “students can learn how to become more successful learners by using appropriate strategies to manage their ... learning” (Dembo & Seli, 2013, p.4).

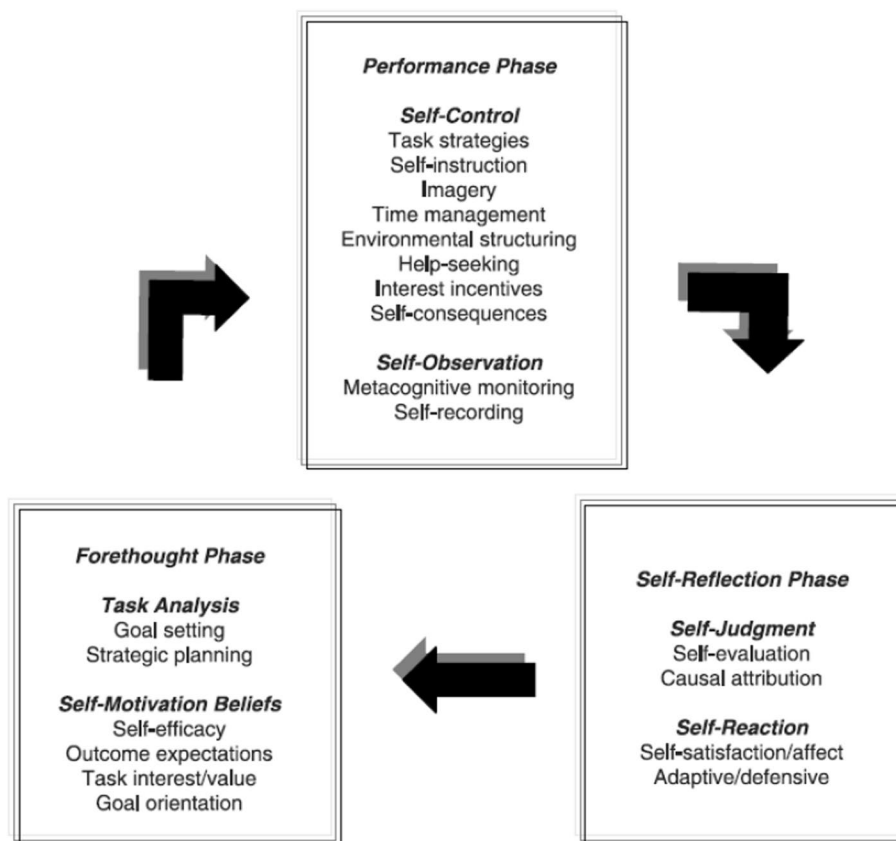
Influenced by Bandura's Social Cognitive theory (1986), Zimmerman, a leading figure in the field of SRL research, states that SRL is the “self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals” (2000, p. 14), which consists of metacognitive, motivational, and behavioral actions and processes (Zimmerman, 1986, 2013). He also believes that SRL is the result of students' interaction with the environment (Zimmerman, 2009).

The significance of SRL has captured the attention of a wide range of researchers, leading to varied SRL learning models (Boekaerts, 2005; Pintrich, 2004; Winne & Hadwin, 1998; Zimmerman, 2000). Among them, one of the most influential is Zimmerman's SRL cyclical phases model.<sup>2</sup> This model has “the highest number of citations” in research papers, because it is more comprehensive and easier to apply by educators in classroom contexts, and it consists of “a more complete vision of different types of sub-processes” (Panadero et al., 2015, p. 17). In this model there are three phases of self-regulation—a forethought phase, a performance phase, and a self-reflection phase—which reveals the essential proactive efforts students make to achieve knowledge and skills (Fig. 1).

Forethought phase, performance phase, and self-reflection phase in Zimmerman's SRL model occur in different stages of a learning task and they are cyclical. Students' self-reflection on a learning task influences the subsequent forethought process in a new cycle. In this way, each phase is closely linked with the next. These SRL

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<sup>2</sup> The SRL cyclical phase model was first proposed by Zimmerman in 2000, and then updated in 2009 by Zimmerman and Moylan.



**Fig. 1** Zimmerman's SRL cyclical phase model (Zimmerman & Moylan, 2009)

processes become a guideline for educators “to formulate intervention programs in schools for children who display lower levels of self-regulatory development” (Zimmerman, 2002, p. 69).

Self-regulated learners can use SRL strategies to regulate the learning processes so that they can achieve desired academic outcomes (Zimmerman & Martinez-Pons, 1986). These strategies can be divided into three categories—metacognitive strategies, motivational strategies, and behavioral strategies.

*Metacognitively, self-regulated learners are persons who plan, organize, self-instruct, self-monitor, and self-evaluate at various stages during the learning process. Motivationally, self-regulated learners perceive themselves as competent, self-efficacious, and autonomous. Behaviorally, self-regulated learners select, structure, and create environments that optimize learning (Zimmerman, 1986, p. 308).*

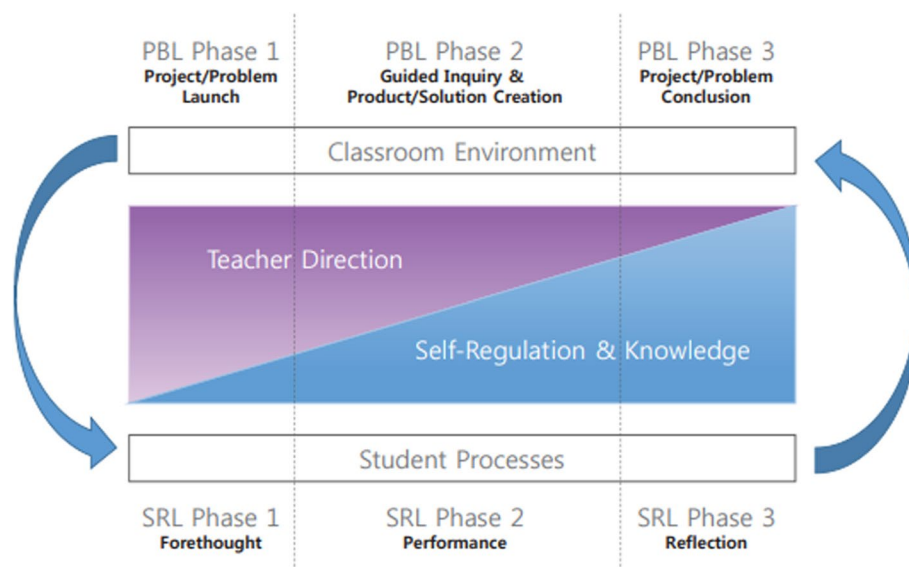
Metacognition, motivation and behaviors not only reflect learners' SRL abilities, but also are important components in SRL processes. They can be taken as the important factors that make SRL visible.



### Comparison of SRL and PBL phases

Projects in PBL vary in forms, though in general they feature a series of activities that are organized into a process, such as design and plan projects, manage activities, assess student learning, and so on. These activities can be categorized into three PBL phases: a project/problem launch, guided inquiry and product/solution creation, and project/problem conclusion (Mergendoller et al., 2006). This three-phase PBL process coincides with Zimmerman's three SRL cyclical phases: forethought phase, performance phase, and reflection phase. English and Kitsantas notice the similarity between the two, who then proceed to propose a model (2013) to illustrate how the development of SRL matches the course of a project (Fig. 2).

In phase one of PBL—project launch, students have to be prepared cognitively and affectively for the project (Boss & Larmer, 2018; Mergendoller et al., 2006). In the forethought phase of SRL, goal setting, strategic planning and motivational beliefs are involved (Zimmerman & Moylan, 2009). PBL facilitates SRL by providing opportunities for students to practice setting learning goals, making plans, establishing collaborative relationship among team members, etc. Teachers play an important part in the first phase, especially for students who are new to PBL, to assist students to identify their “already know” and “need to know”, and provide explicit instruction and modeling (English & Kitsantas, 2013). That's why in the first phase teacher direction dominates. The second phase of PBL is the process in which students are engaged in the project to finish learning tasks and create the final product (Mergendoller et al., 2006). It supports the performance phase of SRL as self-control and self-observation are exercised when students control volition, choose specific learning strategies, construct meaning, seek help, and revise ideas during the project (Zimmerman & Moylan, 2009). Though teachers' scaffolding still plays a significant part in the second phase, students are the agents of the action (English & Kitsantas, 2013). Thus, the proportion of teacher direction decreases. In the third phase of PBL, students share their final product of the project and reflect on



**Fig. 2** English and Kitsantas' model depicting the relationships among the phases of PBL and SRL (2013)

the learning process (Mergendoller et al., 2006). This phase of PBL corresponds to the reflection phase of SRL in which self-judgment and self-reaction are involved (Zimmerman & Moylan, 2009). Reflections on what works well and what doesn't impact students' learning goals and plans in forethought of a new round of SRL process. Consequently, learning becomes a cyclical experience. It is also the phase when teacher direction is mostly replaced by students' SRL (English & Kitsantas, 2013).

English and Kitsantas' model demonstrates the close relationship between PBL and SRL. SRL provides the tools for the implementation of PBL, and PBL is the practice to improve SRL skills.

Though the history of research on PBL in foreign language teaching and learning contexts is short, the numbers of studies in this field have increased in recent years (Wang, 2020). Topics of research on PBL in language education vary "from the benefits or problems of implementing project work to the effects of computer-mediated PBL" (Wu, 2012, p.31). Among these, there is the correlation between PBL and different elements of SRL, indicating that SRL is often the bi-product of a quality PBL class (Dippold, 2015; Martin, 2020).

To evaluate the influence of PBL on language students' life skills development, Wahbeh et al. (2021) conduct a two-month case study in two Arabic language classes with a total of 80 students. The findings show that PBL not only improves language students' collaborative skills, but also enhances their confidence and self-regulation in language learning. But it causes confusion because "self-regulation", which in the study refers to students' discovery of their strengths and weakness in learning and peer learning, is used interchangeably with a different concept "self-direction". The complexity of SRL is not reflected in this study. The reason might be that SRL is not the main research focus.

In an autoethnographic study, Busciglio (2015) tries out PBL in an Italian class with 14 students to investigate how PBL impacts on students' social agency. The results suggest that project-based instruction guided by teachers significantly enhances students' autonomy as they are involved in planning study, monitoring the learning process, and evaluating the learning content. These are essential elements of SRL. However, this study is purely descriptive, and there are only a small number of students involved in the study, so further research would be required to establish definitive conclusions.

Sever (2015) explores how PBL affects high school students' experience in English learning in her study. The qualitative data collected from class observations and interviews show that PBL is "culturally and linguistically appropriate" for English learning (Sever, 2015, p. 147). The essential elements of PBL and the elements of effective language learning are complementary in nature. Furthermore, PBL fosters the development of an academic identity by allowing students to actively engage with the learning process, building confidence in their ability to succeed academically. That means students' self-efficacy is boosted. Since self-efficacy is an important predictor of SRL abilities (Irvine, 2018; Zimmerman, 2000), Sever's study implies a potential positive impact of PBL on SRL. But PBL is not directly linked with SRL in this study.

The study of PBL in English education is under-explored in Macao. Only one academic paper on this topic has been identified thus far. Grant (2017) uses questionnaire and teacher's reflections to investigate students' perceptions of PBL in an English writing program in a Macao university. He finds out that PBL increases students' language



output and boosts their confidence in language learning. Personal constructs like motivation and autonomy are also enhanced. However, due to its small sample size (16 research participants), short-term research period (one project in four weeks), and lack of reliability analysis on questionnaire data, the results might be debatable.

Due to the fact that the empirical research on how PBL fosters EFL/ESL learners' SRL abilities in target language learning is under-explored, especially the study on the implementation of PBL in EFL settings in Macao tertiary education, the present study aims to bridge the gap in current research.

## Research methods

### Research questions

The present study was action research that investigated how PBL enhanced intermediate EFL learners' ability in self-regulatory English learning at post-secondary level in Macao. The research questions are:

What are the characteristics of intermediate EFL learners' SRL?

Is PBL an approach that can foster intermediate EFL learners' SRL in English learning?

How can PBL affect intermediate EFL learners' SRL?

### Participants

The course under study was "Reading" in the pre-university English program in a Macao private comprehensive university. It was an intensive reading course that aimed to develop students' English proficiency with the focus on reading and writing. The subjects were the students from the researcher's two reading classes who enrolled in this program. One class with 40 students was assigned as the experimental group, while the other class with 39 students was the control group. Both groups exhibited similar scores on a placement test at the beginning of the semester, indicating that their English was at the same intermediate level.<sup>3</sup> Furthermore, the majority of the participants stated that their English classes before university were traditional and exam-oriented. Only three students in the experimental group reported having some prior PBL experience in high school. In the present study, the teaching content, requirements, and summative assessment in both classes were almost identical. The only difference was that the lessons for the control group were taught in the traditional ways, while the lessons for the experimental class were integrated with PBL. The control group served as a benchmark to compare with the PBL class, showing whether learning English through doing projects could increase students' self-regulation in foreign language study. For ethical reasons, the aim of the research and what they were required to do during the research were explained to all the participants in both groups in detail at the beginning of the semester. They were informed that their participation was on a voluntary basis, and all the information would only be used anonymously for research purpose. They were also

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<sup>3</sup> According to the information provided by the publisher of the placement test, if the students' scores fall into the range from 41 to 55, their English level should be A2 or B1 according to CEFR. If the scores fall into the range from 56 to 70, their English level should be B1 or B2 according to CEFR. The means of scores of both control group and experimental group are 57.46 and 55.95. It means the English level of the participants was around B1 according to CEFR.

entitled to ask questions about this research at any stage and had the right to withdraw from the research at any time. Print-outs of participant information sheets were distributed in class. All the subjects—79 students—signed the consent forms to take part in this research, and none of them withdrew before the end of the study.

### Research instruments

In order to study the effectiveness of PBL in promoting intermediate EFL students' SRL ability, both quantitative and qualitative measures were adopted in this action research to collect data.

Questionnaire—the Scale of Language Learner Autonomy (SLLA). Based on Zimmerman's cyclical SRL model, SLLA is a questionnaire designed by Lin and Reinders (2017) to reflect students' SRL from three subscales—motivation, metacognition, and behavior. The participants from both the control group and the experimental group took this questionnaire twice—one at the beginning of the semester and the other at the end.

Reflective notes. The students in the experimental group were required to keep reflective notes about their PBL experience.

Field notes. The teacher's field notes focused on general comments on the projects from the perspective of a teacher and a researcher (they are the same person in the study), including students' reaction to the learning activities in different PBL phases, and the problems detected. A teacher scale designed by Zimmerman and Martinez-Pons (1988) was used to guide the observation.

Follow-up interviews. At the end of the semester, an individual semi-structured interview was given to each of the students in the experimental group. The questions focused on the participants' ideas about English learning, their reflection on the PBL learning experience and their opinions on the effectiveness of PBL in improving SRL ability. The interviewees were informed in advance that the interviews would be recorded, and the recordings were only used for research purpose.

### Research procedures

The action research was conducted for one semester (15 weeks) with three cycles. Each cycle consisted of one project, which was progressive and designed to supplement the compulsory textbook teaching. The first project was about natural disaster. The students were tasked with creating an English brochure that included facts about severe weather and survival tips. The second project was about the differences between Chinese culture and English culture. The students were tasked with writing emails to an English native speaker living in England, in which they explained the cultural difference between the UK and China, and provided travel tips for his upcoming trip to China. The third project was about movies. The students had to do research on university students' preferences on English movies, based on which they wrote proposals for the first movie club in the university, including suggestions on an English movie exhibition and other club activities. English and Kitsantas' model (2013) of PBL and SRL phases guided the design of the projects. It means that each project consisted of three phases, in which SRL integrated with PBL. The researcher made observations during the process, reflecting on the effects

and problems that arose. The researcher then made adjustments and changes, and initiated another new cycle.

Data was collected as follows. In the first class of the semester, students completed a one-hour closed-book placement test, followed by the SLLA questionnaire as a pre-treatment investigation. Starting from the second week, teaching and PBL activities commenced. The control group received traditional instruction, while the experimental group experienced the implementation of PBL. Following the completion of each project, participants were requested to provide reflective notes in which they answered questions about their PBL experience and SRL. During the PBL process, the researcher meticulously observed students' responses and performance, documenting these observations as field notes. In the final class, participants from both the control and experimental groups completed the SLLA questionnaire as a post-treatment investigation. Individual semi-structured interviews were conducted afterwards.

### Data analysis

The researcher carefully read and reviewed multiple times the qualitative information collected from students' reflective notes and the teacher's field notes to gain a thorough understanding of the content and context. Then the information was analyzed by being coded into three main themes: metacognition, motivation, and behavior, according to Zimmerman's definition (Zimmerman, 1986, 2013).

For the purposes of confidentiality, a table of citation codes was created, as shown in Table 1.

The quantitative data were collected from SLLA, and the results were analyzed with SPSS 26 (Statistical Package for the Social Sciences) for Windows. They served as supports to the qualitative findings.

## Results

### Qualitative findings

The qualitative findings, which address research question 1, 2 and 3, indicate a low level of self-regulated capacity among the students before PBL and an enhancement of the students' SRL ability after their engagement in PBL for one semester.

Motivationally, the students were more willing to learn. More than 90% of the students stated that they preferred PBL to traditional learning. Students provided various reasons, among which three were most frequently mentioned in their reflective notes.

- (1) They were drawn to the interesting project activities.
- (2) They found joy in collaboration with peers.
- (3) They found that PBL could make English learning more effective.

**Table 1** Qualitative data citation codes

Instrument type	Data source	Citing code
Students' reflective notes	Students from the experimental group	SR 01-40
Students' interviews	Students from the experimental group	SI 01-40
Teacher's field notes	Course instructor	TN

In fact, students had low motivation in learning English before PBL. 65% of the students admitted in the interview that they were lazy learners. Even though they understood the importance of learning English, they preferred other activities such as playing video games or hanging out with friends over practicing the language. Besides, 45% of the students did not like traditional English classes, which, in their description, were “exam-oriented”, “didactic”, “filled with loads of paper-based exercises”, and “boring”. But after the implementation of PBL, students’ motivation was significantly boosted. First, the real-world tasks, characterized with interaction, creativity, and challenges, were completely different from the traditional learning and teaching mode that the students were familiar with. In PBL, they did not passively listen to teacher’s lecture, but were actively engaged in different forms of communication. This enjoyment they experienced in PBL boosted their intrinsic motivation in learning English. The words like “like” (58 times), “enjoy” (19 times), “interesting” (28 times), and “fun” (23 times) repeatedly appeared in their notes. The teacher’s observations also indicated that students were more enthusiastic and attentive during project work compared to their usual performance in traditional language exercises. Second, collaboration with peers also contributed to boosted motivation. 60% of the students reported that collaboration with peers had varied benefits for them. In the reflective notes, one student (SR 2) stated: “Compared to study alone, I prefer to work with my teammates, because it makes learning more interesting, and it is also good for thinking.” Another student (SR 27) stated: “I was not creative so I was lost when I got this assignment. But I got a lot of help from my teammates, and finally, we successfully completed the project.” Collaboration was beneficial because it made learning more interesting; it reduced academic stress; and the students got support to deal with the problems they encountered during the projects. Third, project tasks provided many opportunities for the students to learn and use the language. They could access to authentic materials and apply what they learned to real-life communication. For example, more than 50% of the students commented on the second project as practical. One student (SR 3) wrote in the reflective note: “I like it because what we learn is very practical. I am sure I will use it in the future.” Additionally, 95% of the students stated that they preferred the choices they had in learning to traditional teacher-centered learning. One student (SR 7) wrote: “I think that choosing different learning materials and different ways to present the project are necessary. If all the students use the same materials and get almost the same result, the report will be very boring and repetitive, and we cannot learn from other students.”

In addition, the second and the third project show that engaging native speakers or professionals in PBL could increase the students’ motivation. In order to create authentic language tasks, an English native speaker was invited to take part in the second project and a professional in the related field was invited to join the third project. They interacted with the students in English throughout the projects in various ways. It not only enhanced the authenticity of the projects, but also made the tasks more challenging. For example, one student (SR 19) stated in the reflective notes about the second project: “I was extremely excited when I knew that I was going to write an email to a foreigner. This was the first time I communicated with a native English speaker, and I didn’t want to make any mistakes.” Another student (SI 20) commented on the third project: “Talking about movies with your friends is one thing. But talking to an expert is another. Bluffing

won't work, right? But I felt very excited to share my ideas on movies with a professional. That was why I made great efforts to complete the last project." The authenticity of PBL also made learning practical. When the students realized that what they did in PBL was probably what they would do in the future, their extrinsic motivation was increased. Like one student (SI 2) said: "The activities we used to have in English class, such as role-plays and group discussions, were mostly mimetic practices of the real life. But it was not real life. In this semester, we had opportunities to solve authentic problems, especially the last project in which we used English to handle a complex project ... to help a movie club in our school. It was a new experience to me. And I loved it! It made learning English meaningful. Now I really want to learn it well." Furthermore, other motivational constructs—self-efficacy and causal attribution—were also positively affected by PBL. On the one hand, the students' confidence in learning English and overcoming difficulties increased. On the other hand, they tended to attribute the problems they encountered in PBL to the controllable factors such as "lack of practice" (30% of the students), "the use of wrong methods" (45% of the students), and "laziness" (20% of the students). Only 2 students, out of 79, stated that learning English was difficult due to their inadequate learning abilities.

Metacognitively, the students used strategies more frequently.

- (1) They were able to set their own study goals.
- (2) They were able to make their study plans according to different tasks, and enhance time management skills.
- (3) They were able to better monitor their study progress by using more SRL strategies, such as reviewing, outlining and self-evaluation.
- (4) They gained deeper understanding of their strengths and weaknesses in English learning.
- (5) Self-reflection and self-evaluation were more effective.

The majority, accounting for 92.5%, of the students had never had any PBL experience prior to university because in high school English learning was primarily exam-oriented and teacher-dominant. Furthermore, none of them received any form of training that taught them how to learn. As a result, there was confusion among students over PBL in the first project. Although they knew the requirement of the projects, they did not know how to regulate their own study. For example, after the class when the first project was launched, the researcher wrote in the field notes: "Many students raised hands right away asking me questions ... But some said they were confused because they had never done any project before and they had no idea how to get started." One student (SI 13) stated in the interview: "I was so used to following teachers' instruction, so when I was firstly required to complete a project, I was lost." But the confusion gradually dissipated in the second and third project. Especially in the final project, the students worked more purposefully and became more organized in PBL because they were able to use more metacognitive strategies, as mentioned above. However, the findings also indicate that the changes depended on the teacher's scaffolding. Unlike the increase in motivation which was primarily attributed to the nature of PBL, the development of metacognition needed support. In this study, when the researcher realized that the students lacked the

skills to self-regulate their language learning when they were responsible for regulating their own study, SRL strategies instruction, including how to set a study goal, make a study plan, and manage study time, was added to the second and the third project. After implementing SRL instructions and practicing these strategies through the second project, an improvement was observed. The students became more organized in learning. From the researcher's observation during the second project, efficiency was greatly improved compared to the first project. Instead of putting off the task until the last minute, more students proactively organized their learning by planning in advance and taking early action. The observation was evidenced by the students' reflective notes. For example, one student (SR 16) stated: "I never gave much thought to making study plans before. In the first project, our group delayed the tasks till the last minute. We completed the brochure hastily so the result was awful. This time we have to make changes. ... Plans help to divide a project into parts, so it is easier for us to solve problems. They are also cures for procrastination." The numbers of students who mentioned "goals" (30%) and "plans" (45%) in the reflective notes greatly increased, compared to the first project (setting goals—2.5%, making plans—12.5%). The students became more focused on the tasks, and more efficient in collaborating with their teammates and organizing their study. PBL contributes to the improvement by providing learners the opportunities to practice strategies. However, educators should be aware that the students need to learn these strategies in the first place by instruction and guidance.

Behaviorally, the findings reveal that prior to the PBL experience, the SRL behavior that the students frequently performed was seeking social help from peers and teachers. But PBL could further increase their occurrence (from 37.5 to 67.5%) so the students were more skillful in doing it. Additionally, more SRL behaviors were observed due to PBL.

- (1) Use visual medias for information.
- (2) Study cultures to learn language.
- (3) Seek help from native speakers.
- (4) Review notes and new words.
- (5) Practice speaking English.

The findings show that PBL also encouraged the students to seek opportunities to practice English outside of class in the future. In the final interview, one student (SI 34) said: "Last weekend, I went running at our school stadium. There was an international student running, too. Just two of us at that time. When we stopped for a rest, I saw him smiling friendly to me. You know, I am shy and not confident about my English. I would probably avoid further contact under this circumstance in the past. But I just interviewed many students for an English project and I found that talking to strangers in English was not that hard. So, I smiled back, and then we had a great time talking to each other. My broken English did not hinder the communication. It was an interesting experience." Similarly, another student (SI 24) said: "I used to watch many movies, not for study, but solely for fun. So I always read the Chinese subtitles. But after the third project, I realized that I could use movies to learn English. Some classmates said that they would read the English subtitles to learn English expressions, or they would not read any



subtitles at all but only listen to it to practice the listening skills. I will try these methods.” PBL is advantageous for developing positive new learning habits, aiding students in becoming independent EFL learners who are likely to continue practicing the language on their own after class. They became more receptive to new learning methods and they were more willing to go through trails and weigh the effectiveness. For example, after the third project, more SRL behaviors were reported—searching written information over the internet (65% of the students), using visual media for information (72.5% of the students), and practicing speaking English with others (17.5% of the students). However, the exercises that the students reported they would do after the PBL experience were mainly about reading, listening and speaking. Only one student (SI 22) mentioned practicing writing afterwards because she intended to become a journalist. It implies that even though English writing was integrated into the three projects in this research, it had a limited impact on students’ motivation to practice this skill independently. They would complete their writing assignments as required for a project, yet such compliance did not evolve into a voluntary SRL behavior.

### Quantitative findings

The quantitative findings, which address research question 1 and 2, provide more insight into the influence of PBL on enhancing students’ SRL ability.

In the questionnaire with 32 items, 7 items (Item 1 to Item 7) are about motivation, including learner’s belief, self-efficacy, and intrinsic motivation; 13 items (Item 8 to Item 20) are about learner’s metacognitive strategies in managing study, such as setting study goals, making study plans, and reflecting on his English learning; and 12 items (Item 21 to Item 32) are about learner’s actual English learning behaviors. The score of each item ranges from 5 (strongly agree/always) to 1 (strongly disagree/never). According to the interpretation of the authors of SLLA, if the mean score is between 5 and 4, it means the students are ready for SRL; if the mean score is between 4 and 3, it means they are approaching readiness for SRL; and if the mean score is below 3, it means they are developing readiness. (Lin & Reinders, 2019).

The result of the reliability statistics shown in Table 2 indicates that all 32 items in this questionnaire are correlated with high internal consistency. The Cronbach’s Alpha of Pre-SLLA is 0.911 and the Cronbach’s Alpha of Post-SLLA is 0.949. The items of the three subscales—motivation, metacognition, and behaviour—in pre-SLLA and

**Table 2** Reliability statistics: pre-SLLA and post-SLLA reliability statistics

	Cronbach’s alpha	Item no.
<i>Pre-SLLA</i>	.911	32
Pre-motivation	.719	7
Pre-metacognition	.880	13
Pre-behavior	.791	12
<i>Post-SLLA</i>	.949	32
Post-motivation	.814	7
Post-metacognition	.940	13
Post-behavior	.904	12

**Table 3** Pre-SLLA & Post-SLLA: independent sample t-test

	Control Group (n = 39)		Experimental Group (n = 40)		MD	t (77)
	M	SD	M	SD		
Pre-motivation	4.02	.54	4.06	.46	-.04	-.343
Pre-metacognition	3.62	.54	3.59	.59	.03	.211
Pre-behavior	3.12	.55	3.00	.52	.13	1.043
Post-motivation	4.11	.59	4.37	.41	-.26	-2.253*
Post-metacognition	3.67	.72	3.92	.62	-.25	-1.670
Post-behavior	3.29	.73	3.59	.58	-.30	-2.009*

\* p &lt; 0.05

**Table 4** Comparison of the mean of pre- and post-motivation (the experimental group): paired samples t-test

	Pre-motivation		Post-motivation		MD	t (39)	Cohen's d
	M	SD	M	SD			
Experimental group	4.06	.46	4.37	.41	-.31	-3.981**	0.629

\*\* p &lt; 0.01

post-SLLA were measured with Cronbach's Alpha, too. The Cronbach's Alpha of the three subscales in pre-SLLA are 0.719, 0.880, and 0.791 respectively, and the Cronbach's Alpha of the three subscales in post-SLLA are 0.814, 0.940, and 0.904 respectively. As they are all greater than 0.7, the items are internally consistent to construct these dimensions within a scale.

As shown in Table 3, the students from both the control group and the experimental group exhibited similar SRL abilities, as the means of the three subscales in pre-SLLA show no significant difference. But the results from post-SLLA indicate that for the experimental group, the mean scores of two subscales (motivation and behavior) are significantly higher than that of the control group. However, the mean score of metacognition as a whole does not have a significant difference between the two.

First of all, there is a significant difference between the means of pre-motivation and post-motivation in the experimental group ( $t(39) = -3.981, p < 0.01$ ) (Table 4). The findings show that after studying in this course for one semester, the motivation of the experimental group rose—the mean of post-motivation (Mean = 4.37) is significantly higher than that of the pre-motivation (Mean = 4.06), with a large effect size<sup>4</sup> ( $d = 0.629$ ). As shown in Table 6, the mean scores of all 7 items related to students' motivation including intrinsic motivation (Item 6), self-efficacy (Item 4 & 5), self-encouragement (Item 7) and learners' belief in English learning (Item 1, 2, 3) increase. It should be noted that the mean scores of Item 1, 2, 3 and 6 in the pre-SLLA exceed 4, indicating that the students had a strongly positive perception of SRL in English learning. They acknowledged the importance of interesting topics in increasing their learning motivation, and were

<sup>4</sup> It is the effect size, measured by Cohen's *d*. Hattie (2009) proposes that  $d = 0.2$  is for small,  $d = 0.4$  (ranged from 0.3 to 0.6) is for medium, and  $d = 0.6$  is for large. 0.4 is taken as the hinge point to judge effects of influences in education.

psychologically ready to take responsibility for deciding learning goals, selecting learning materials, evaluating learning outcomes even before PBL. The mean scores of Item 4, 5 and 7 rise from 3 in the pre-SLLA to 4 in the post-SLLA, suggesting an enhancement of self-efficacy and self-encouragement from “approaching readiness” to “readiness” under the influence of PBL.

Second, PBL played a significant role in shaping the students’ SRL behaviors. There is a significant difference between the pre- and post-behavior ( $t(39) = -5.976, p < 0.01$ ) for the experimental group. The mean score of post-behavior (Mean = 3.59) is significantly higher than that of the pre-behavior (Mean = 3.00) (Table 5), with a large effect size ( $d = 0.945$ ). As shown in Table 6, in the pre-SLLA the mean scores of most items, except one (Item 25), are below 4, which indicates that the students were not behaviorally ready to self-regulate the language learning before PBL. The lowest score is found in Item 27, suggesting that they seldom wrote English outside the class. However, in the post-SLLA the mean scores of the all 12 items (Item 21 to 32) rise. The behavior of seeking help from teachers and peers (Item 32) was enhanced from “approaching readiness” to “readiness”, and the behaviors such as using library or internet resources (Item 24), reading (Item 26), seeking opportunities to practice English (Item 28), testing learning outcomes (Item 30) and learning English through cultures (Item 31) were enhanced from “developing readiness” to “approaching readiness”. Although PBL also encouraged students to practice writing, the mean score of Item 27 is still the lowest in the post-SLLA (Mean = 2.65). It means that the frequency of this behavior was still low—between “seldom” to “sometimes”. On the whole, PBL successfully drove the students to take more actions to self-regulate their English learning by seeking difference resources and opportunities.

Finally, the influence of PBL on metacognition was not as significant as that on motivation and behaviors. Although the results of post-SLLA show that the mean score of the experimental group has a higher increase (from 3.59 to 3.92) than that of the control group (from 3.62 to 3.67), no significant difference is found between the control group and the experimental group in the subscale ( $t(77) = -1.670, p > 0.05$ ) (Table 3). Because the mean scores of all 13 items in this subscale are below 4 in the pre-SLLA (Table 6), students were only approaching SRL readiness metacognitively before PBL. However, PBL still positively encouraged the use of some specific metacognitive strategies such as setting task goals (Item 8), evaluating learning outcomes (Item 16), and making study plans for improvement (Item 18 & 19) as the mean scores of these 4 items increase from 3 (“approaching readiness”) to 4 (“readiness”). The mean scores of the other items remain in the range of 3 to 4 in the post-SLLA, suggesting that the students were still not ready to monitor study (Item 9, 13, 14 & 20), set English learning goals (Item 10 & 11), and evaluate of goal achievement (Item 12 & 17).

**Table 5** Comparison of the mean of pre- and post-behavior (the experimental group): paired samples t-test

	Pre-behavior		Post-behavior		MD	t (39)	Cohen's d
	M	SD	M	SD			
Experimental group	3.00	.52	3.59	.58	-.59	-5.976**	0.945

\*\*  $p < 0.01$

**Table 6** Comparison of each item between pre- and post-SLLA (the experimental group): descriptive statistics (n=40)

Items	Pre-motivation		Post-motivation		Pre-metacognition		Post-metacognition		Pre-behavior		Post-behavior	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
1	4.15	.77	4.60	.55								
2	4.05	.81	4.38	.67								
3	4.13	.76	4.38	.59								
4	3.95	.64	4.17	.64								
5	3.67	.89	4.22	.73								
6	4.58	.55	4.67	.47								
7	3.90	.90	4.15	.58								
8					3.73	.88	4.15	.77				
9					3.88	.82	3.98	.70				
10					3.88	.82	3.92	.92				
11					3.52	1.01	3.95	.71				
12					3.20	.91	3.55	.96				
13					3.67	.73	3.75	.87				
14					3.40	.98	3.75	.93				
15					3.40	.96	3.80	.82				
16					3.45	.88	4.05	.68				
17					3.77	.77	3.83	.84				
18					3.77	.86	4.28	.68				
19					3.58	.84	4.15	.77				
20					3.45	.88	3.80	.79				
21									2.70	.88	2.95	.85
22									3.25	1.01	3.65	.77
23									3.08	.86	3.77	.77
24									2.95	1.04	3.63	.84
25									4.08	.89	4.38	.70
26									2.92	1.05	3.60	.71
27									1.93	.94	2.65	1.14
28									2.98	1.05	3.90	.74
29									3.50	.82	3.70	.82
30									2.52	.85	3.25	1.10
31									2.63	1.15	3.33	.92
32									3.45	.88	4.25	.71

To sum up, the quantitative results show great improvement in motivational beliefs and SRL behavior changes, which support the findings from qualitative data. Although the students also reported improvement in implementing metacognitive strategies, the statistic results show that the change was not as significant as that in motivation and behaviors.

**Discussion**

Both qualitative and quantitative findings provide evidence to support that PBL had a positive influence on improving the students’ SRL in English learning.

**RQ1: characteristics of intermediate EFL learners' SRL**

The first research question is "What are the characteristics of intermediate EFL learners' SRL?" The qualitative and quantitative findings show that prior to PBL experience, there was a conflict between what they believed and what they did in SRL.

In a previous study, Chinese tertiary EFL students are found to be psychologically, but not technically or behaviorally ready for SRL (Lin & Reinders, 2019). The present study supports this finding. First, there was a strong belief in the importance of SRL, but a lack of knowledge and motivation to do so among the students. Most intermediate EFL participants did not have any PBL experience or training in SRL in the past because English teaching and learning was primarily teacher-centered and exam-oriented. As a result, though they strongly believed that learners should take on the responsibility to self-regulate their learning, particularly as they entered university, they were disoriented and did not know what to do when given the opportunity to take ownership during PBL. Some were influenced by laziness or a lack of self-control. In other words, they did not possess many SRL strategies. It explains the confusion they experienced when the first project was assigned.

Second, they were not ready to perform SRL behaviors to support their English studies. They were accustomed to following teachers' guidance and engaging in rote learning, so they had not developed the habits of seeking opportunities to practice English beyond the classroom. Some behaviors, such as reading in English, previewing before class, learning cultures to enhance English learning, and testing learning outcomes, showed intermittent development of SRL readiness, as these behaviors occurred only sometimes or seldom. They seldom or never independently practice English writing.

**RQ2: PBL approach to foster intermediate EFL learners' SRL in English learning**

The second research question is "Is PBL an approach that can foster intermediate EFL learners' SRL in English learning?" According to the results, PBL was effective in enhancing intermediate EFL learners' SRL in English learning, which is reflected in both qualitative and quantitative findings.

The findings from qualitative data analysis show enhancement in the students' motivation and self-efficacy in English learning after the PBL experience. This is in line with the findings from previous studies that PBL can foster language learners' motivation (Assaf, 2018; Kartika, 2020) and self-efficacy (Dippold, 2015; Sever, 2015). The students in the study were more willing and confident to not only become engaged in the project activities, but also take up the responsibility to control their learning during the process. The reports of using metacognitive strategies also gradually increased during the PBL process. The students became more capable of setting goals, making study plans, monitoring, and reflecting on learning. But the findings suggest that although PBL provided the opportunities to practice, the mastery of these strategies required teacher's scaffolding. This supports the previous research which indicates the importance of teachers' scaffolding in helping students develop self-regulated learning (Boss & Larmer, 2018; Martin, 2020). There was also a positive influence on the increase of SRL behaviors. The types of SRL behaviors and their occurrence increased during PBL. In addition, many students stated that they would look for different opportunities to practice English in the future. It is also noteworthy that the influence of PBL on enhancing students' writing

behaviors was limited. This is different from Grant's findings (2017) which show a significant positive influence of PBL in teaching writing and increasing EFL students' willingness in writing. The reason may be that most students found writing difficult due to its high demand on one's language proficiency. Although PBL showed students the possibility of making a writing assignment interactive and authentic, it did not reduce the difficulty of the writing task itself. It was also less entertaining compared to talking to others or watching movies. In addition, the projects in the study were designed with consideration for integration with textbooks and aspects such as reading and writing, rather than focusing solely on writing. Therefore, the impact on improving writing skills was not significant.

The results from quantitative data analysis support the findings discussed above. PBL was proven to be more effective than traditional teaching methods in enhancing students' motivational beliefs and increasing the occurrence of SRL behaviors. The improvement in the use of metacognitive strategies was not as noticeable in the experimental group compared to the control group. This is partially aligned with previous study (Busciglio, 2015). The evidence shows that the experimental group made significant progress in one semester in some metacognitive aspects, such as evaluating learning outcomes, understanding one's study, and making study plans for improvements. However, there were no significant changes in the abilities of monitoring study (which is different Busciglio's findings), setting goals for English learning, and evaluating goal achievement. The reasons might be the lack of training in the related abilities during PBL. These findings provide additional empirical evidence in the effect of PBL on EFL learners' use of metacognitive strategies.

### **RQ3: How PBL affects intermediate EFL learners' SRL**

The third research question is "How can PBL affect intermediate EFL learners' SRL?" The answer to this question lies mainly in the findings from qualitative data in the study.

First of all, featuring interesting topics, authentic language learning tasks, and "learning by doing", PBL effectively enhanced EFL learners' motivation. In the study, the topics of the three projects were designed based on the course curriculum. They were also related to the students' interest and relevant to their life, which are congruent with previous studies supporting the benefits of linking language learning with students' daily life in PBL (Soykurt, 2011). Especially in the last project, when the students had the liberty in choosing the topics, they were intrinsically motivated to assume the responsibility to finish the projects. In addition, integrating authentic language learning tasks in each project created a real-world learning environment, which transformed rigid language exercises into challenging tasks that the students might encounter beyond the classroom. This supports the findings from other studies in which the importance of authenticity to the successful implementation of PBL is emphasized (Boss & Larmer, 2018; Madoyan, 2016). The students' motivation was further boosted when a native English speaker (the second project) or a professional (the third project) was invited. The finding is in line with other studies which show that interaction with native speakers (Su, 2018; Yoshida, 2022) and people with relevant expertise (Steinberg, 1997) can increase EFL learners' interest and confidence in language learning. In this way PBL increased the students' initiative in seeking different solutions to the problems so that they could complete the projects



successfully on their own. Furthermore, because PBL features “learning by doing”, the students had to use the language as a tool for various tasks. Thus their motivation was enhanced when they witnessed how useful the language was in communication.

Second, PBL emphasized inquiry and problem-solving, which created opportunities for EFL learners to put into practice how to self-regulate English learning. Similar conclusions can be found from other studies (Soykurt, 2011; Stefanou et al., 2013). Each of the three projects in the study consisted of a series of tasks such as information searching, reading, summarizing, writing, speaking, etc. When the projects were launched, the students took ownership of the learning by selecting learning materials, creating suitable learning environment, making study plans, seeking solutions to problems, and reflecting on the performance to make improvement in the next project. It required the ability to use metacognitive strategies for completion of the projects. Although the improvement in using metacognitive strategies was not as significant as that in motivation and SRL behaviors, as mentioned above, there was a growing tendency. It could potentially achieve significance if there were more projects to enhance their SRL ability in the future. What’s more, the study shows that the acquisition of these strategies did not happen spontaneously. It required teacher’s scaffolding to provide necessary instruction on the strategies and guidance during the process.

Third, collaboration in PBL facilitated the students in self-regulating their learning. This is also consistent with previous studies that support the beneficial effect of collaborative learning on self-regulation (Boekaerts & Corno, 2005; Wang, 2011). All three projects in the study were implemented in the form of group work. It not only strengthened the students’ ability in communication and cooperation, but also encouraged them to seek social assistance from peers when they encountered difficulties. Additionally, motivation was enhanced through collaborative work as the students found more joy in learning and the project tasks less challenging. Collaboration also played an important role in ensuring the engagement of each teammate and the implementation of the plans each team made.

Finally, the variety and flexibility of PBL inspired the students to use different approaches to learn English. The project tasks in the study were in various forms, including designing brochures, doing peer review, writing emails, doing survey, to name just a few. It showed the students that learning English was not limited to textbooks or traditional language exercises. Instead, there were different resources and approaches beyond the classroom. Successfully completing the projects instilled a sense of confidence in the students, motivating them to experiment with the methods learned or explored new avenues for learning and practicing English independently following this research. Therefore, the occurrence of SRL behaviors increased.

## **Conclusion**

In the endeavor to explore whether PBL benefits intermediate EFL learners, with a research focus on the changes in SRL from three aspects: motivation, metacognition, and behaviors, the current action research compared two groups of students (the control group and the experimental group) in an English reading course of pre-university program for one semester. Both qualitative and quantitative findings indicate improvement in the students’ SRL ability. Prior to the PBL experience, a gap existed

between students' beliefs about SRL and the actual use of SRL. Despite acknowledging the significance of SRL, students struggled to implement it due to a lack of knowledge and motivation. They were not equipped with the specific strategies needed for effective SRL, which left them unprepared to employ SRL behaviors in support of English learning. After the study, the students' motivational beliefs were significantly strengthened, and more self-regulated behaviors were generated. The enhancement of the use of metacognitive strategies was not as significant, but the experimental group showed growth in their ability to apply specific strategies such as evaluating learning outcomes and making study plans. Nevertheless, no significant improvement was observed in the students' abilities to monitor study, set goals for English learning, or evaluate goal achievement.

The results also indicate that PBL's abilities to foster effective learning relies heavily on authentic language learning tasks that are related to students' interests or daily lives. It also depends on the participation of native speakers or professionals in the projects, as well as the guidance and support provided by teachers. Collaboration among students is another crucial factor for successful PBL implementation. The diverse range and adaptable nature of PBL can also motivate students to employ various methods and strategies in their English learning.

The research and its results are significant because they contribute to the limited body of empirical research on how PBL fosters EFL learners' SRL abilities. This study may be one of the first attempts in Macao to investigate the implementation of PBL in English class at post-secondary level and its effects on fostering intermediate EFL learners' SRL. PBL and SRL are new concepts in EFL classes in Macao, so it offers teachers the alternatives beyond traditional approaches in English teaching and showcases the importance of SRL training in classes. It may inspire educators to explore and examine these new effective methods in their classes, and shift their teaching focus from what do learn to how to learn. More teachers may be encouraged to undertake further research in the field, too. Thus it holds significance for the development and improvement of English language learning and teaching in Macao. Secondly, it is a message to policy makers in Macao to consider policy and curriculum reform. The success of PBL and the training of SRL do not and cannot depend solely on teachers' effort. Effective implementation of PBL and SRL hinges on strong policy support. This study can advocate for curriculum reform by urging policy makers to provide more support to the development of English learning and teaching and to the design of a learned-centered, flexible and consistent curriculum for post-secondary EFL classes.

However, it is important to acknowledge some limitations. First of all, one limitation of this study is the relatively short duration. The study was conducted for one semester, and its limited time frame might not have captured the full potentials of PBL. If the study had lasted longer, the researcher could have garnered more data and made more data-driven decisions. Second, in the study PBL was conducted in only one class with 40 students at one local university. This relatively small sample size in the study limits the generalizability of the findings to the entire population of intermediate EFL learners in Macao. Finally, the researcher of the study was also the teacher for both the control group and the experimental group. Although the researcher strived for

neutrality during the study, the integration of roles raises potential questions about bias. If further studies are conducted in the future, to mitigate that bias, research could benefit from collaboration among multiple researchers.

#### Author contributions

The research was carried out and the paper was written by Cao. She is the only author of this paper.

#### Funding

Not applicable.

#### Availability of data and materials

Raw data for the study are not publicly available to preserve participants' privacy.

#### Declarations

##### Ethics approval and consent to participate

For ethical reasons, the aim of the research and what they were required to do during the research were explained to all the participants in both groups in detail before the study. This information was also printed out on the participant information sheets which were distributed in class, so they understood that their participation was on a voluntary basis and all the information would only be used anonymously for research purpose. They were also free to ask questions about this research at any stage and to withdraw from the research any time. Consent to participate: All the subjects (79 students who are 18 or 19 years old) signed the consent forms, consenting to take part in this research.

##### Consent for publication

All the subjects (79 students who are 18 or 19 years old) signed the consent forms, consenting to have the results of the study published.

##### Competing interests

The author declares no competing interests.

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