Do Learners' Preferred Learning Styles Affect Learning Outcomes and Satisfaction in PLE:

A Pilot Study of the Supervised-PLE-IELTS Platform

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Abstract: Personal Learning Environment (PLE) enables a knowledge-based, learner-centered lifelong learning which could be successfully integrated with formal education when taking educators' supervision into consideration. But do learners' preferred Learning Styles matter in PLE? To investigate the relationship among learners' Learning Styles, learning outcomes and satisfaction towards the PLE platform, the study constructed and applied a supervised-PLE-IELTS platform. 57 sophomores majored in Business in Wenzhou University took part in a 16-week project. Data were collected by Honey and Mumford's Learning Styles questionnaire for the Learning Styles, post-test of IELTS reading, listening and vocabulary for the cognitive learning outcomes, and Distance Education Learning Environments Survey (DELES) for the satisfaction towards the PLE platform. The results showed: (1) Learning Styles have positive relationship with the cognitive learning achievements in PLE; (2) Learning Styles had no direct effect on satisfaction, and learners of all Learning Styles enjoyed PLE-IELTS platform; and (3) learners who spent more time on PLE platform achieved better cognitive learning outcomes. The paper shed light on the future construction of supervised-PLEs.

Key words: supervised-PLE; the Honey and Mumford's Learning Styles; tertiary education; cognitive learning outcome; satisfaction

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1. Introduction

With the development of Information Communication and Technology (ICT), Personalized web-based learning systems (also called Personal Leaning Environment or PLE) have drawn significant attention from educational organizations due to the potential educational and cost benefits (Monova-zjeleva, 2005; Tseng et al., 2008). Individuals are gradually playing a role in organizing their own learning, including the different contexts and situations where learning takes place and the diversified learning providers in informal learning. The emerging technologies and social software facilitate the realization of this ubiquitous type of learning. A distinguished feature of PLE is learners change their roles from knowledge consumers to producers, through creating and sharing.

The interaction between learning environment and learning outcome has long been discussed by psychologists, educators and researchers, who try to find out the best effect of education for individuals with different personality types, attitudes and Learning Styles. Moreover, the differences in Learning Styles have also caught the attention of all levels of education and teachers have started to respect diversity among learners in course design (Hou, 2015; Kumar, Smriti, Pratap, & Krishnee, 2012). The Learning Style refers to the organization and control of the strategies for learning and knowledge acquisition and it's configured by the cognitive, affective and personality particularities, of the learner (Negovan, 2010). Learning Style is appreciated as one of the most important resources to cope academia (Glenn-Cowan, 1995) which is described as characteristic cognitive, affective, and psychological behavior that serves

as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment (Keefe, 1982; Sims & Sims, 1995).

Given the recognized importance of Learning Style as well as the inter-relationship between learning environment and learning outcomes, others have called for researchers to examine Learning Styles closely in different learning contexts and institutions (Halili, Naimie, Sira, AhmedAbuzaid & Leng, 2015). Learning space taking into consideration of learners' Learning Styles are more productive, create higher satisfaction level, diminish learning time, and increase the academic achievement of learners (Graf, Liu, & Kinshuk, 2010; Popescu, 2010). That means Learning Style is one of the most important parameters of individual differences to be considered while creating adaptive learning environments, which can offer valuable instructions to personalize and optimize learners' learning process. (Graf, Liu, Kinshuk, Chen, & Yang, 2009; Liegle & Janicki, 2006). For instance, Ku and Chang (2011) find that "visual" learners are the most dominant type among online learners, while "sensing" learners felt uncomfortable in a web-based learning environment. Nuzhat et al. (2013) call for research proving whether Learning Style predicts academic success in different environments such as online and traditional classes.

Moreover, research shows that Learning Styles may have an impact on such course outcomes such as satisfaction and performance. A glimpse into the literature review shows that learners' learning achievement depends on various factors, but the effect of Learning Styles is on question (Cuevas, 2015; Ulstad, Halvari, Sørebø, & Deci, 2016). It has been found to have a positive relationship with academic performance and overall success in higher education (Graham, Garton, and Gowdy, 2001; Garton, Spain, Lamberson, and Spiers 1999). However, there are also some scholars such as Kirschner & Merrienboer (2013) who heavily criticize the myth of Learning Style. Will Learning Style affect learning outcomes and satisfaction under PLE context?

Our previous research on the supervised-PLE platform realized an effective integration of the PLE with formal education. However, during the application, it was found that learners achieved different cognitive learning outcomes but their satisfaction towards the supervised-PLE platform were generally high. Pushed by the curiosity that Learning Style may have a role to play in learning outcome and

satisfaction, this study tried to figure out the association among Learning Style, cognitive learning outcomes and satisfaction in the PLE learning environment.

2. Definitions of supervised-PLE and Honey and Munford's Learning Style

2.1 Supervised-PLE

Personal Learning Environment (PLE) is a user customized environment based on the understanding of learning as an ongoing process with numerous resources providers. PLE has two main strands of research, technical aspect and pedagogical aspect (Fiedler & Väljataga, 2010; 2014). The former tackles problems arisen through web 2.0 and Social Media such as the lack of student control and sense of ownership in the traditional Learning Management Systems (LMS); the latter is mainly about the self-regulated learning (Dabbagh & Kitsantas, 2012). This study divides PLE research into knowledge management perspective and technical perspective. PLEs do not represent any specific new category of software but rather a concept or system. Attwell takes PLE as a virtual learning ecological system (Attwell, 2007) which is not simply a technical term, but a display of technique supported individualized Learning Style. Harmelen (2006) defines them as personal e-learning systems that allow users to manage their learning aims, content and process, and take control of their learning. PLEs are built on externally hosted (in-the-cloud) Web 2.0 tools and services designed to help learners aggregate and share resources, participate in collective knowledge generation, and manage their own meaning making (Dabbagh & Reo, 2011; Dron, 2007) instead of integrating different services into a centralized system. From technical perspective, PLE can be viewed as a concept that the learner use technology to choose the appropriate tools and resources to facilitate learning. FitzGerald (2006) defined PLE as "a collection of free, distributed, web-based tools, usually centered around a blog, linked together and aggregating content using RSS (Really Simple Syndication) feeds and simple HTML scripts". The operational definition of PLE in this research was given as follows:

"PLE is a knowledge-based, learner-centered, teaching-assistant platform/system where users realize knowledge sharing, building and creation by customize the open tools and resources in a virtual social community"."

This study integrates PLE with formal education which in the meantime need to be

supervised, that means under the formal education context, the institution or teachers set the learning scope, time and target, and then learners make plans accordingly about the specific learning material, learning schedule and strategies to fulfil the course requirements. Supervision is necessary because formal education has its own requirement in learning scope, time and ability (see Figure 1 below).

Figure 1: PLE integrated with formal education

The above triangle figure shows that, firstly, any course in formal education has its own learning scope; secondly, each course has specific time and resource bound, including learning schedule, course goals, teaching plans, teaching material, etc.; thirdly, learners with different learning backgrounds differ in learning abilities and characteristics which need teachers' supervision or guidance. Besides, each side of the triangle represents the relationship between two angles, for instance, the learning scope and ability require learners to adopt appropriate learning strategies to choose proper learning content; the learning ability and time demand learners to make specific, measurable, attainable, relevant, and timebound plans; the learning scope and time need learners prioritize learning resources. Moreover, since learners have under-developed self-regulation skills, they need supports to manage their learning in highly autonomous personalized learning environments.

2.2 Honey and Munford's Learning Style

Learning Style has been studied in different areas with a variety of definitions. Dunn DeBello, Brennan, Krimsky, and Murrain (1981) describe Learning Style as a way in which the individual takes in new information and develops new skills. Kolb (1999) defines Learning Style as a way to describe individual differences in learning based on the learner's preference for employing different phase of the learning cycle which is influenced by personality, educational specialization and tasks, etc. (P195)

According to Kolb (1999) and Negovan (2010), Learning Style is not a stable trait, but a preference for learning preference that is slowly changing from one situation to another.

Kolb's Learning Style model is regarded as the starting point for experiential-based Learning Style, including models by Allinson and Hayes (1996) and Honey and Mumford (2000). Kolb's Learning Style tool is used in 1004 studies in varying fields, including: education, management, computer studies, psychology, and medicine (Coffield, Moseley, Hall, & Ecclestone, 2004). Peter Honey and Alan Mumford (1986) propose the Learning Styles Questionnaire (LSQ) based on Kolb's original concept of a learning cycle, which is claimed to be more meaningful to managers and management activities. This study adopts Honey and Mumford's Learning Style because all the participants are Business and Management majors. Honey and Mumford's Learning Style is correspondent with Kolb's learning cycle in the following way: Activist =Concrete Experience (CE); Reflector = Reflective Observation (RO); Theorist = Abstract Conceptualization (AC); Pragmatist = Active Experimentation (AE). The characteristics of the four Learning Styles are summarized in the following table:

Table 1: Honey and Mumford's four Learning Styles

Learning Style	Attributes	Activities
Activist	Activists are those people who learn by doing. Activists need to get their hands dirty, to dive in with both feet first. Have an open-minded approach to learning, involving themselves fully and without bias in new experiences.	brainstorming problem solving group discussion puzzles competitions role-play
Theorist	These learners like to understand the theory behind the actions. They need models, concepts and facts in order to engage in the learning process. Prefer to analyze and synthesize, drawing new information into a systematic and logical 'theory'.	models statistics stories

Learning Style	Attributes	Activities
		quotes
		applying theories
Pragmatist	These people need to be able to see how to put the learning into practice in the real world. Abstract concepts and games are of limited use unless they can see a way to put the ideas into action in their lives. Experimenters, trying out new ideas, theories and techniques to see if they work.	self-reflection
		case studies
		problem solving
		discussion
Reflector	These people learn by observing and thinking about what happened. They may avoid leaping in and prefer to watch from the sidelines. Prefer to stand back and view experiences from different perspectives, collecting data and taking the time to work towards an appropriate conclusion.	paired discussions
		self-analysis questionnaires
		observing activities
		feedback
		interviews

These four Learning Styles are assumed to be acquired preferences that are adaptable, either at will or through changed circumstances, rather than being fixed personality characteristics. That means, we all adopt different Learning Styles in diversified contexts. The awareness of Learning Styles helps learners get a better fit between learning opportunities and the way in which they learn easier, more effective and more enjoyable. Meanwhile, it also provides learners with the opportunity to strengthen their weak leaning stages at the learning cycle, and thus they can improve their learning skills and processes, increase their versatility, learn how to learn and finally build up all-round learners. (Honey and Mumford et al, 1992)

3. Research design

3.1 study aims and hypothesis

Study objectives relate to analyze the type of relationship among Learning Styles, cognitive learning outcomes and learners' satisfaction towards the supervised-PLE-IELTS platform. Hypothesis were framed as follows:

-H1 " Learning outcomes may be affected by learners' preferred learning styles."

-H2 "Activists and Pragmatists may be more satisfied with the supervised-PLE platform."

-H3 " Better cognitive learning outcome may be got when learners spend more time on PLE."

3.2 Research methodology

In order to answer our research questions, we have built and applied a supervised-PLE-IELTS platform in Wenzhou University in China. The methodology was divided in five: (1) the design of the supervised-PLE-IELTS platform design; (2) the Honey and Mumford's questionnaire; (3) the application of the supervised-PLE-IELTS platform; (4) the assessment of the cognitive learning outcomes; and (5) the Distance Education Learning Environments Survey (DELES) for the satisfaction towards the PLE platform.

3.3 Design of the supervised-PLE-IELTS platform

The design of the PLE-IELTS platform involved framework design, construction design, course design and content design, where the Honey and Mumford's four-stage Learning Style theory was applied (see Figure 2).

Figure 2: the sprint of Honey and Mumford's four-stage learning cycle

1. Framework design of the supervised-PLE-IELTS platform

For the framework design, a PLE can be developed in several different ways in terms of manpower, skills and financial resources. The present research constructed PLE-ESP platform mainly based on open data such as Camstudio, Jing, Audecity, Livemocha, Vocaroo.com, Audior.ac, Prezi, XMind, Compozer and other software systems. Joomla (an award-winning content management system (CMS), which

enabled one to build Web sites and powerful online applications) was chosen for the construction of the ESPER website. Joomla is ease-of-use, extensible, and most importantly, an open source solution that is freely available to everyone.

The common standard protocols of PLE include Learning Tools Interoperability (LTI), a Sharable Content Object Reference Model (SCORM) through xAPI- and Learning Record Store (LRS) etc. PLE is featured as a loose aggregation of tools, services, people and resources. It's generation, openness, connectivity, intelligence, cohesion and the organic combination of informal and formal learning was distinguished. The Unicom relationship between the model and elements should be contrasted against each other through standardized interfaces and data exchange protocols (see Figure 3).
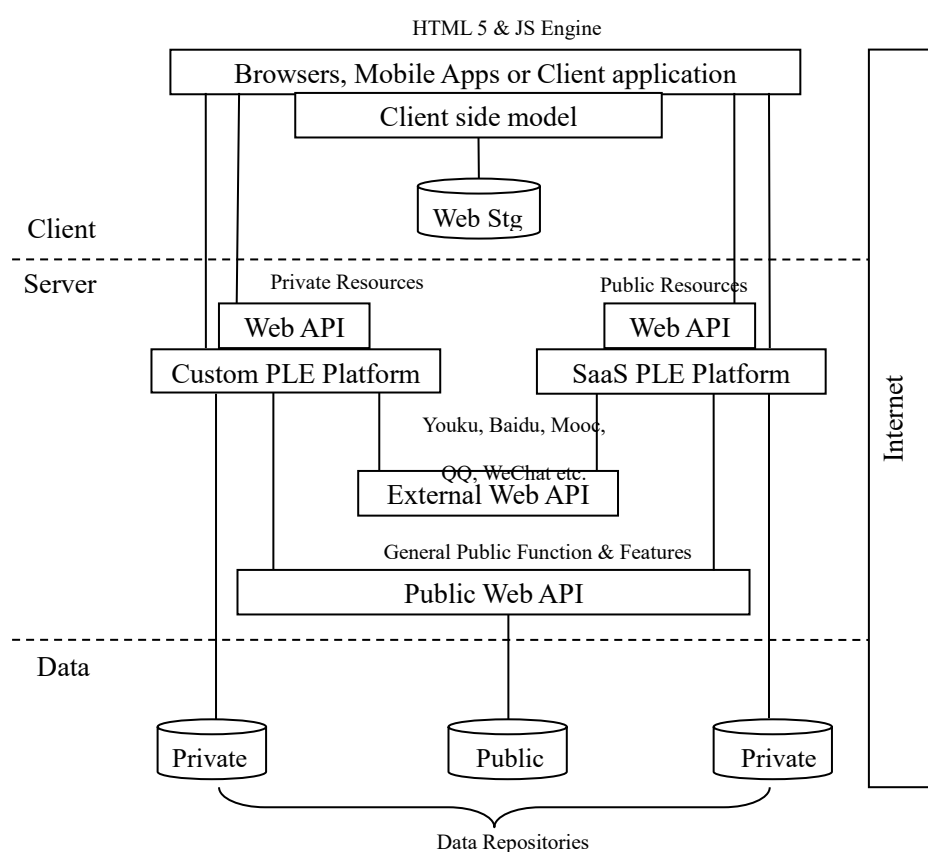

Figure 3: The framework of PLE-ESP platform

2. Course design of supervised-PLE-IELTS platform

The course design of the PLE-IELTS platform was module-based and followed a 9-step template (see Table 2).

Table 2: Template for the course design of the PLE-IELTS platform

PLE course design steps	Templates	Examples	Attributes
1.Analyze learners' needs	-accessibility of the site -course learning outcome -workload -course schedule	-pre-test learners' prior-knowledge of IELTS -survey on learners' Learning Styles using Honey and Mumford's LS questionnaire	-survey on learners' ICT literacy -raise learners' awareness of PLE -upload the instruction of PLE on the platform
2.Construct learning outcomes	-content-based outcomes -cognitive outcomes -application outcomes	-construct learning outcomes based on learners' pre-test scores	- Vygotsky's (1978) zone of proximal development (ZPD) could be applied
3.Discipline-specific capabilities	-capabilities being developed or assessed by each online activity and assessment task -reason to do so	-IELTS speaking part 2 "note taking skills"	-make the purpose and ways to assess the tasks clear to learners
4.Course schedule planning	-weekly based structure of the semester's learning activities (resources/ activities/ assessments/ administration tasks). -teaching strategies used - learning outcomes -estimates of learning hours per component	-IELTS course is based on 16 weeks schedule -teaching strategies vary according to IELTS four skills "reading, listening, speaking and writing"	-all the activities should follow the Honey and Mumford's four stage LS "doing-reflecting-conducting-planning"
5.Create lesson plans	-create a lesson shell -build a lesson -view lesson reports	- use technologies such as Cortex to help tracking learners' progress, to identify where they need additional support and provide targeted instruction	-change lesson plans when necessary according to learners progress

6.Resource planning	-the way to use -accessibility -reusability -the way to upload -resource types -tools -copy right	-one of the IELTS speaking task require learners to record their self-introduction using "Apowersoft", the way to use this software is uploaded on the PLE	When using online resources: -find the publisher of the resource -check the license conditions database for that publisher to see if they are allowed to create a link -find instructions on creating a link to an article or to a publisher's website -place the created link in the appropriate location in the PLE
7.Learner work load planning	-learners' entry level knowledge and skills -learners' familiarity with academic study -learners' technology skills -learners' Learning Styles -complexity of the tasks -reasonable time requirement for students to complete each component (skills) - a written outline of all the course tasks (submission dates, estimated time for completion) -grade assessments appropriately -give feedbacks -flexible access to learning resources	-all the learners' take IELTS pre-test -all the learners attend the LS survey -all the tasks have a deadline and suggested time schedule -all the tasks for IELTS course have been outlined in detail on the PLE beforehand	-Learners need make study plans based on their pre-test score following SMART principle -PLE system would remind learners the tasks before the deadline -instant feedbacks from the system and instructors are necessary for learners to reflect and re-plan their study -learning portfolios are important reference for learners and instructors to regulate progress
8.Designing online assessments and learning	-learning outcomes (What?) -rationale (Why?)	-setting online multiple-choice quizzes with automated marking and feedback can reduce staff	-When design online activities, consider well *if the task really lend itself

| activities | -activities (How?)

-technological tools

-tools related to activities and their contribution to learning outcomes (uses of technology relevant activities (How?); rationale (Why?); desired learning outcomes (What?)

-select assessment technologies

-plan group online tasks

-individual online tasks | marking loads and give students immediate feedback on their learning performance

- technologies such as Education Element's Highlight provides data analytics that can be used to identify and address gaps in learning

-some technologies connect humans with other humans for example, Skooli and Chegg, provide a conduit for learners to work online with experts in a wide range of fields. | to a group effort rather than an individual one?

*how to create an effective team?

*would staged submissions from the group task be helpful?

-PLE can use choice boards which contain four-to-nine options, with each option revealing a separate project that students will complete designed based on learners' Learning Styles

- PLE system based on measurements and quizzes and other data points, automatically show different level of modules to give learners content support tailored to their levels of mastery |
| 9.Assessing Online Participation | -design assessment tasks to test students' achievement of the course learning outcomes

-assess participation in the activity (rewarding a percentage of final marks for online participation)

-make the link between the activities and the assessment tasks very clear to learners | -Around 15 online quiz with automatic system marking is built on PLE for learners to evaluate their progress

-50 sets of IELTS vocabulary quiz are uploaded on the PLE for learners to take whenever and wherever they want

-online self-study counts for 10% of the formative assessment for IELTS | -abundance of quiz and exercise which is easy to access are necessary to facilitate self-regulated learning

-a clear explanation of the percentage of the online study counted in the course assessment is vital important to guarantee a full use of the PLE |

Source: redesigned according to the teaching support website "Teaching at UNSW" (SYDNEY)

3. Content design of supervised-PLE-IELTS platform

The content design of PLE-IELTS platform followed Honey and Mumford's four-stage Learning Style theory (see Table 3 below). Since learners all adopted different Learning Styles in diversified contexts, the learning-cycle-based platform design enabled learners to strengthen their weak learning stages at the learning cycle, and finally built up all-round learners. (Honey and Mumford, 1992)

Table 3: The content design of the supervised-PLE-IELTS platform

Stages	content	functions
Doing	● placement test	-learners know what to learn
	● quiz	-know learners' current proficiency
	● exercise	
Reflecting	● forum	-system gives responsive feedbacks
	● blog	-system's automatic marking
	● discussion board	-group discussion
		-peer evaluation
		-instructor's feedback
Conducting	● lectures	-abundance related resources organized according to learners' language competency
	● videos	
	● audios	-self-evaluation
	● documents	-group discussion
	● URL	-peer feedback
	● RRS	-instructor's feedback
	● Group discussion	-class demonstration/presentation
	● Self-evaluation	
	● Instructor's feedback	
Planning	● Learning portfolio	-use competency-based strategies
	● Timetable	-build learning portfolio

- System reminding   -learners make short-term and long-term plan

- Checklist   -system automatically reminds the deadline of tasks

- Note board   -instructors give passive feedbacks according to learners' portfolio

    -system gives active feedbacks regularly based on learning portfolio

In the doing stage, the instructor deconstructed the learning actions within the learners' zone of proximal development, provide enough practice for improving performance, and give meaningful feedback (Laurillard, 2012). For the IELTS course, the pre-test and the official IELTS benchmark were the base of target goal setting.

In the reflection stage, evaluation checklist or standard as well as instructor's guidance, questions and comments on learners' reflection could be offered to help learners review their experience and generate into theories.

In the conducting stage, lectures, videos and other Open Educational Resources (OER) could be uploaded on the platform for learners to select based on their Learning Styles, levels and pace of study. With the input of expertized learning resources, learners could reconstruct their prior experiences and generate their own theories.

In the planning stage, it was suggested that Specific, Measurable, Attainable, Relevant, and Timebound (SMART) criteria being applied to guarantee the long-term and short-term goals. (Doran, 1981) Specific here meant goals could clearly define what one was going to do; measurable referred to goals were measurable to detect learning progress; attainable meant goals could be catchable with one's knowledge and current skills as a barometer; relevant was about setting up goals that were related to the learners by needs analysis; time-bound indicated that goals could have a timeframe or target date. The PLE-IELTS platform design was shown in Figure 4 below.
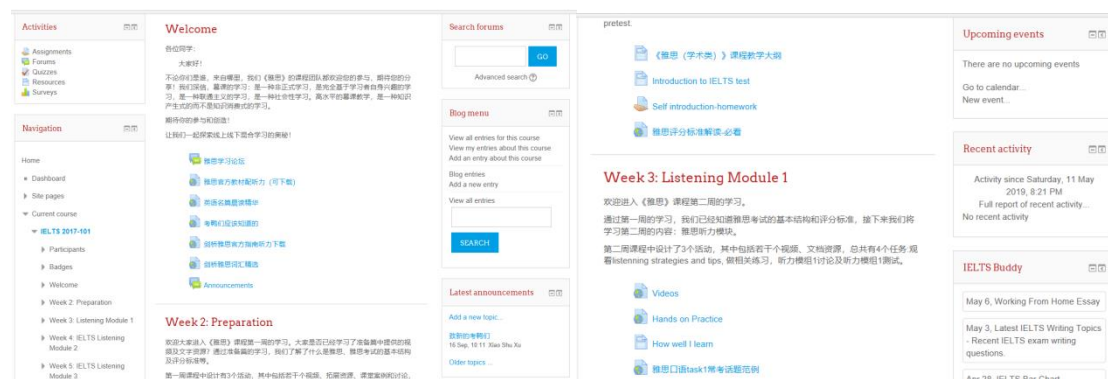
Figure 4: PLE-IELTS learning system design

3.4 Measures

3.4.1 Honey and Mumford's Learning Style questionnaire

Honey and Mumford's Learning Style questionnaire (2000) was used to measure individuals' preferred Learning Styles. Knowing the preferred Learning Style, a person can improve their learning capabilities by approaching new information in a way that best complements their natural Learning Style. There were four different Learning Styles in the Honey & Mumford's model, while an individual may have a combination of the styles, but there would be one style standing out as preferred.

3.4.2 Cognitive learning outcome

Cognitive learning means the transformation of information from the learning environment into knowledge in the mind. Assessment of cognitive achievement was recorded via three post-tests, including Cambridge IELTS real test on Reading, Listening and a 100-IELTS vocabulary test designed by the research group. The reading and listening test were carried out on the PLE-IETLST platform at the last week of the semester, with all the participants gathered in a multimedia room in Wenzhou University for two hours. The 100-IELTS vocabulary test was taken on participants' mobile phones during the class time, lasting for half an hour. The IELTS vocabulary test was composed of 100 words randomly selected among the 5040 core vocabularies. The format of the test was multiple choice (choosing among A-E the right English word for the Chinese meaning). The IELTS vocabulary test had a reliability coefficient of 0.68. The effect of the Learning Styles on cognitive achievement was analyzed using

one-way ANOVA followed by Scheffé's post hoc test if the significant effect is found. The post-test scores of learner's cognitive achievement was the dependent variable, while the Honey and Mumford's Learning Style was the independent variable in PLE learning condition.

3.4.3 Distance Education Learning Environments Survey (DELES)

The Distance Education Learning Environments Survey (DELES) assesses students' perceptions of virtual learning environments using six scales: Instructor Support, Student Interaction and Collaboration, Personal Relevance, Authentic Learning, Active Learning, and Autonomy. DELES has been applied in the United States to compare social work students' perceptions of their learning environments in blended learning (hybrid) class. In this study, the DELES was modified by changing the respond into 5-Likert Scale statements, where 5 (Strongly Agree) represented the maximum score of the scale and 1 (Strongly Disagree) represented the minimum score. The questionnaires issued online had reliability in terms of factor with initiation 0.981.

3.4.4 Participants

Participants in the study were 57 sophomores majored in Business in Wenzhou University, aged between 20 and 21 years, enrolled in the project of PLE-IELTS for one semester (16 weeks).

4. Findings and discussion

The gathered data by applying statistical tools have undergone specific analysis and have obtained the following results.

4.1 Evaluating Learning Style

This study identified all the styles described by Honey and Mumford, and the participants' preferred Learning Styles were distributed as follows: Activist 35.1%, Reflector 40.3%, Theorist 19.3% and Pragmatist 5.3 %. Activists and reflectors were dominant, which revealed that learners of Business in Wenzhou University preferred to learn through doing or observing and thinking. As Sudria et al. (2018) pointed out, the different Learning Styles was likely to be influenced by the academic input of students, the dominant Learning Styles among business majors in Wenzhou University may be related to the academic input, that is input academic ability which represented cognitive

development affects the distribution of Learning Styles in each school (Susilo, 2006). It was interesting to find that only 3 out of 57 participants were in preference of Pragmatist Learning Style, which, to some extent, reflected the Chinese English teaching and learning style—exam-oriented and was weak in practice and problem solving.

4.2 Evaluating Learning outcome

1. Cognitive learning achievement

Altogether, 57 participants were engaged in the supervised-PLE-IELTS course during the 16-week project, and all of them undertook the post-test for IELTS Reading, Listening and Vocabulary. However, because of the limited participants sample, the result could not show significant difference of the cognitive learning outcomes. The Scheffé's post hoc test results of IELTS Reading, Listening and Vocabulary were shown in Table 4-Table 6 below.

Table 4: Summary of the Scheffé's post hoc test results of IELTS Reading

Learning Style	Mean difference	Std. Error
Activist	5.0000	0.2052
Theorist	4.4545	0.2817
Pragmatist	4.3333	0.6667
Reflector	4.9130	0.1796

The Scheffé's post hoc test results of IELTS reading showed that the post-test scores of Activists were the best among the four Learning Styles followed by Reflector, Theorist and Pragmatist. The result could be explained that since Activists tended to be open-minded and thrive on the challenge of new experiences, which was consistent with the task requirement of ELTS reading. The three passages in the IELTS Reading module dealt with various academic subjects which brought new ideas and information and was a good fit for the Learning Style of Activists.

Table 5: Summary of the Scheffé's post hoc test results of IELTS Listening

Learning Style	Mean difference	Std. Error
Activist	4.6000	0.1940
Theorist	4.7273	0.1950
Pragmatist	4.8333	0.3333
Reflector	4.7391	0.1329

The Scheffé's post hoc test results of IELTS listening showed that the post-test scores of Pragmatists were the best among the four Learning Styles followed by Reflector, Theorist and Activist. It could be explained that since Pragmatists were essentially practical, down to earth pile who like making practical decisions and solving real problems (Honey and Mumford, 2000), they believed that practical experience was of the utmost importance, principles and reasoning are secondary. They tended to real-life English learning such as discussion with English speakers (native or non-native), attending lectures by speakers with different varieties of English or learn from News, TED Talks, movies, TV shows, documentaries etc., which would raise their awareness of world Englishes at sociolinguistic perspective. In IELTS listening, the speaker gave a lot of information quite quickly which required a quick brain to keep up with what one heard. This "ear to brain" relationship needed practice and exposure to the language which matched up to the learning preference of Pragmatists. However, the small number of Pragmatists among the participants revealed the status quo of exam-oriented English teaching in China.

Table 6: Summary of the Scheffé's post hoc test results of IELTS Vocabulary

Learning Style	Mean difference	Std. Error
Activist	74.1000	3.1978
Theorist	72.6364	3.2621
Pragmatist	72.0000	4.1633
Reflector	74.7391	2.6399

The Scheffé's post hoc test results of IELTS Vocabulary showed that the post-test

scores of Reflectors were the best among the four Learning Styles followed by Activist, Theorist and Pragmatist. The result could be explained that since Reflectors were thoughtful and cautious people who were good at assimilating information, they would stand back to review their mistakes in vocabulary learning which were carried out in self-developed APP in this project (see Figure 5 below). The constant mistake reflecting and experience summing up reinforced their memory of the 5040 core IELTS vocabularies. The repeated practice way of learning was consistent with the learning preference of Reflectors.
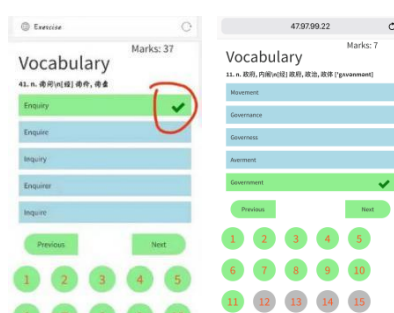

Figure 5: APP for IELTS vocabulary

A survey about the average time spent in the PLE-IELTS platform by week of each learner was carried out (highest score and lowest score deleted) and the result was shown in Table 7 below:

Table 7: Average time spent in the PLE-IELTS platform (hour/week)

Learning Style	Average time/weekly
Activist	1.7h/week
Theorist	2.9h/week
Pragmatist	1.2h/week
Reflector	2.2h/week

The figure showed that participants tending to have Theorist Learning Style devoted the largest amount of time on the PLE, followed by Reflectors, Activist and Pragmatists. This was a little bit unexpected because Activists and Pragmatists were supposed to be more in favor of Personalized online learning due to their learning attributes (see Table 1 above). However, the result may be caused firstly by the fact that

the system and content design of the PLE-IELTS was not adaptive enough to realize personalization; secondly, the small number of participant samples may cause biased result.

2. Learners' satisfaction towards the supervised-PLE-IELTS platform

The survey result showed that the mean scores were above 4.16, which indicated that learners with all four Learning Style tendencies were in general satisfied with the PLE-IELTS platform (see Table 8 below). The statements with highest score were "teamwork is part of my study" (4.71), "the instructor encourages me to take part in learning" (4.61), "I study in my own way" (4.52), and "I could easily get in touch with my instructor" (4.51). The lowest scores were statements "I can relate my learning to the life outside the learning environment", and "I study real cases related to the learning process" (4.13 and 4.14, respectively), followed by "I can relate my study with others' work" (4.26), "I can relate what I have learned to the life outside the learning environment" (4.22), and "I involve real people and facts in my learning activities"(4.25). In sum, participants of all Learning Styles expected more connection between the real-life experience and the learning on the platform and more guidance on how to apply what they have learned into the real world.

Table 8 Learners' satisfaction of PLE-IELTS

Learning Style	Mean difference	Std. Error
Activist	4.1610	0.1209
Theorist	4.7418	0.0682
Pragmatist	4.4706	0.0000
Reflector	4.4000	0.1180

3. Relationships among Learning Style, cognitive learning outcome and learners' satisfaction

Pearson's product-moment correlation coefficients were calculated to find statistical relationships among learners' Learning Style, learning outcome, time spent on PLE and satisfaction. Table 9 below showed the correlation coefficients of the four

relationships. First, a statistically positive relationship was found between satisfaction and learning outcome (r =.01), indicating that learners who reported high level of satisfaction gained better cognitive learning outcome. Second, the relationship between satisfaction and time spent on PLE showed a statistically positive relationship (r=.01). This correlation revealed that learners who reported high levels of cognitive achievement tended to spend more time on PLE. Third, a positive correlation was found among learning outcome and time spent on PLE. This correlation revealed that learners with high cognitive learning outcomes tended to spend more time on PLE. Fourth, the Learning Style was an unordered variable, although it was positively related to satisfaction (r=0.1), the investment time (r=0.1) and learning outcome (r=.03), it had no specific meaning. However, due to the limited number of participants, all these relationships were not statistically significant.

Table 9 Pearson's correlation coefficients

Variables	Satisfaction	Learning outcome	Time spent on PLE (hour/week)	Learning Style
Satisfaction	-	0.014	0.114	0.151
Learning outcome	0.014	-	0.114	0.031
Time spent on PLE	0.114	0.114	-	0.155
Learning Style	0.151	0.031	0.155	-

The table above revealed that Learning Styles had no direct effect on satisfaction. Learners of all Learning Styles enjoyed a learning space which facilitated them to take charge of their own learning. They were satisfied with the learner-centered, personalized learning environment and cooperated well in the learning community. This is, in certain extent, due to the earlier training in the usage of the PLE platform because as Hillman, Willis and Gunawardena (1994) point out, medium can have great negative effects on the forms of interaction particularly when they are unfamiliar with the communication technologies used to deliver instruction.

In terms of the effect of Learning Styles on cognitive learning outcomes, the pilot

study found that Learning Styles had positive relationship with cognitive learning achievement, that was different Learning Styles gained high average scores on different tasks, which proved the "all-round learner" initiative made by Honey and Mumford (1982), that was "expand the 'band width' of experiences from which you derive benefit. Becoming an all-round learner, increases your versatility and helps you learn from a wide variety of different experiences-some formal, some informal, some planned and some spontaneous." "Improve your learning skills and processes. Increased awareness of how you learn, opens the whole process to self-scrutiny and improvement. Learning to learn is your most important capability since it provides the gateway to everything else you want to develop." However, this finding was inconsistent with Chou and Wang's (2000) discovery that Pragmatist (AE Learning Style) had higher e-learning effectiveness in senior high school, and that their e-learning methods and Learning Styles had a significant interaction.

5. Conclusions and limitations

The purpose of this study is to examine the relationship among Learning Style, cognitive learning outcome and learners' satisfaction towards the PLE-IELTS learning environment. The first research hypothesis H1 is "Learners' preferred Learning Styles may affect learning outcomes." Firstly, the research identifies four different Learning Styles in the participants majored in Business, with Activists and Reflectors occupied the largest proportion; secondly, the pilot study finds that Learning Styles have positive relationship with the cognitive learning achievements, that is different Learning Styles gain high scores on different tasks (Activists achieve the highest score in IELTS reading, Pragmatists do best in IELTS listening and Reflectors gain the highest score in IELTS vocabulary) , which is congruent with the "all-round learner" initiative made by Honey and Mumford (1982), that is "becoming an all-round learner increases one's versatility and helps oneself learn from a wide variety of different experience." Meanwhile, the study finds that there are only a very small number of Pragmatists among the 57 participants which should arouse our attention to the drawbacks of Chinese ways of "dumb English" teaching and learning, which was teacher-centered, exam-oriented and taught only British or American English.

The second hypothesis H2 is that "Activists and Pragmatists may be more satisfied

with the supervised-PLE platform." This study shows that learners' enthusiasm for participating in the supervised-PLE platform are not influenced by their Learning Styles. Learners of all Learning Styles enjoy PLE-IELTS platform which facilitate them to take charge of their own learning.

The third hypothesis H3 is that "Learners who spend more time on PLE may have better cognitive learning outcome." A positive relationship is found between time spent on PLE and cognitive learning outcome, that is learners who report high levels of cognitive achievement tend to spend more time on PLE platform.

The above worthwhile findings of the pilot study would give some guidance for education practitioners to design appropriate PLE platforms that meet learners' needs and help them to become "all-round" learners.

As is the case with any empirical study, the results of the current study must be interpreted considering its inherent limitations. First, the study is based on survey results which runs the risks that the participants may fill out the survey quickly without regard to the truthfulness of their response. Giovannella (2012) finds, for example, that responses to these Learning Styles instruments may vary widely after one or two years. Meanwhile, the participants samples were small, thus, the data could not show significant statistical difference. Second, cognitive outcomes are influenced also by other factors like-cognitive factors, motivational- emotional factors, learning behavior which have not been considered in this study. Last but not the least, this polit study focuses on IELTS courses only, further studies might be needed to see if our results can be generalized to students in other courses.

Fund

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