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## The Impacts of a Project-Based Research Course: A Mixed Method Survey of Students, Alumni, and Teachers in Li-Shan High School, Taipei, Taiwan

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**The Impacts of a Project-Based Research Course: A Mixed Method Survey of  
Students, Alumni and Teachers in Li-Shan High School, Taipei, Taiwan**

By

Peiyu Lee

Submitted in partial fulfillment of the requirement for the  
Degree of Master of Science  
in Experiential Educational

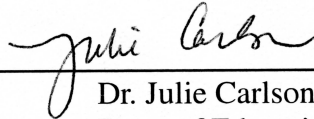
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November 2010

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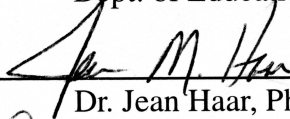
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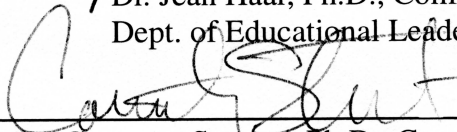
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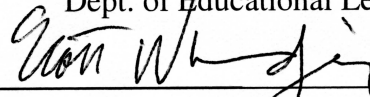
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### **Abstract**

This thesis presented the results of a mixed-method study of the impact of a Project-based Research course in a public high school in Taipei, Taiwan. The purpose of this study was to examine the impact of the Project-based Research course from the perspectives of the current students, alumni, and teachers. The high school incorporated traditional education and project-based learning models as their teaching methods. When both students and teachers had to face the dual pressure of adhering to both models, it was unknown if the project-based learning had the same influence as indicated in the research literature on project-based learning. The findings from the study indicated the Project-based Research course helped students to develop life-long skills such as critical thinking, collaboration, and communication skills, as well as academic skills such as speaking and writing. Additionally, teachers' responses reflected that the Project-based Research course provided them another lens through which to view learning and teaching.

### **Acknowledgements**

First, I would like to express my heart felt gratitude and appreciation to President Chen and Director Lai of Li-Shan Senior High School for helping this study completed.

Next, I want to thank the pre and current director of Li-Shan Alumni Association. Thanks for helping me to deliver the information to all alumni. Also thanks to all participants who spent your time to fill out the survey.

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## Chapter I: Introduction

### Background of the Research

Historically, Taiwan's education was led by credentialism that means its society emphasized credentials (such as college degrees) as prerequisites to employment. Fifteen years ago, a group of people started an education reform movement in Taiwan. At the same time, the only way for students to be accepted into higher education was to take the national entrance examination of high schools and colleges. The original purpose of the education reform movement was to create a healthy, proactive, innovative, and plural-learning environment for students. Students could apply to senior high school or college based on their academic performance in school, or they could attend national entrance examinations. An inter-ministerial Commission for Promoting Education Reform was formed by the Ministry of Education to investigate feasible strategies for reorganizing the school system. In 1999, the group launched the *Twelve Education Reform Mandates* that included flexible entrance exams into high schools and higher education, nine-year integrated curricula, and renovation of teacher education and in-service training programs. Also included were the promotion of diversified vocational education, lifelong learning projects, and expansion of access to colleges and universities. However, those policies did not improve the education situation. Both teachers and students had greater workloads and pressure from conducting examinations (Yang, 2001).

Recently, many of Taiwan's parents, teachers, scholars and experts in education have reflected on the influence of the previous movement of education reform and on ways Taiwan's education can help students face the challenges of the 21<sup>st</sup> century. As a result,

there has been a new education reform movement happening in Taiwan. Local and overseas service learning, outdoor adventure programs, and project-based learning have been applied in different educational fields and classrooms. Educators have begun to pay attention to the concept of experiential education. Some research shows that experiential education helps students not only to improve their academic achievement but also to foster their life skills (Frank, Lavy & Elata, 2003; Kohn, 1991; Lin, Huang, & Yang, 2007). Life skills help students adapt and succeed in the workplace in the future.

### **Purpose of Research**

In Taiwan, most schools are part of the traditional education system. The system focuses on intellectual learning and teaching students how to succeed on standardized tests. Moreover, the system evaluates and determines the value of students solely by their academic achievement. The impact of the system is that it creates students who do not care about their intrinsic values but are concerned with extrinsic ones. However, the needs are changing and this educational system does not fit the requirement of current society and industries. According to the 2008 survey results of *Common Wealth Magazine*, an authoritative publication in Taiwan, the three most desired characteristics in an employee are self-directed learning, flexibility, and teamwork characteristics required by most industries and companies.

Li-Shan Senior High School (LSSH) is a public school in Taipei, Taiwan. Their focus is on science education. All students are required to take a class titled “Project-Based Research” within which they develop their own project in their first and second years at the school. Every student takes three hours of Research Methods class per week

besides their regular academic schedule. The school holds a final presentation conference at the end of every spring semester. The students have a chance to present their projects. LSSH is the only school that combines project-based learning and traditional education models in northern Taiwan. It is believed by many teachers at the school that the project-based learning used in the Project-based Research course helps students to develop more holistically in life skills such as managing resources, handling information, integrating systems, applying technology, and working with others. It is also believed that the Project-based Research course helps in developing academic skills and personal qualities. However, before encouraging other schools in Taiwan to adopt similar project-based approaches, it is important to determine what positive effects, if any, the Project-based Research course may have on students.

The purpose of this study is to examine the impact of a Project-based Research course from the perspectives of Taiwanese high school students, alumni, and teachers.

The research questions are

1. What impacts or influences do current students, alumni, and teachers perceive that the Project-based Research course has on students?
2. To what extent do current students, alumni, and teachers perceive that students develop more academic skills, life skills, and personal qualities as a result of participating in the Project-based Research course?

### **Definition of Key Terms**

**Project-based learning.** Project-based learning (PBL) is a model that organizes learning around projects. The projects of PBL have five criteria: (1) the center of

curriculum, (2) a driving question or problem, (3) a constructive investigation, (4) student-driven projects, and (5) real-life application (Thomas, 2000).

**Academic skills, life skills, and personal qualities.** *What Work Requires of Schools*, published by The Secretary's Commission on Achieving Necessary Skills (SCANS, 1991), determined the skills that young people need to promote success in the working world. The report highlighted that a high-performance workplace requires workers who have not only solid foundational skills but also have five domains of competence. The foundational skills include reading, writing, arithmetic and mathematics, speaking, listening, creative thinking, decision-making, problem solving, self-esteem, self-management, and integrity. The five domains of competence are: (1) how to manage resources, (2) how to handle information, (3) how to integrate different systems, (4) how to apply technology, and (5) how to work with others.

For this study, the skills of reading, writing, arithmetic and mathematics, speaking, and listening are categorized as *academic skills*. Other skills identified by SCANS (1991) that are needed throughout life such as creative thinking, decision-making, managing resources, and working with others is categorized as *life skills*. Attributes that are more character or personality oriented such as self-confidence and self-management are referred to in this study as *personal qualities*.

## Chapter II: Review of Literature

### Definition of Project-Based Learning

Project-based learning is becoming a more popular teaching approach in mainstream schools in the United States (Wurdinger & Carlson, 2010). The first school that applied the project-based learning as its teaching method was the Massachusetts Institute of Technology in 1864. At that time, the term “*project*” was used to describe activities including making clothes, natural observing activities, ironwork or carpentry. This teaching method was supported by most of teachers and schools. Some universities also set it as the requirement that students had to complete projects before they graduated. However, because of large class sizes, limited time, and over-controlling administration structure, only a minority of teachers continues adopting the project-based learning as their teaching method in the early 1900s (Barron, 1998; Wurdinger & Carlson, 2009).

In the last two decades, research studies and organizations provided clear definitions of project-based learning and approved the effectiveness of this learning model. The Buck Institute for Education (BIE) is an organization that highly promoted the project-based learning in their publication, *Project-based Learning Handbook: A Guide to Standards-Focus Project-based Learning for Middle and High Schools Teachers*. BIE provided a clear definition of project-based learning as “a systematic teaching method that engages students in learning knowledge and skills through an extended inquiry process structured around complex, authentic questions and carefully designed products and tasks” (Markham, Larmer, & Ravitz, 2003, p. 4).

Blumenfeld, Soloway, Marx, Krajcik, Guzdial, and Palincsar (1991) defined the

project-based learning as a comprehensive teaching approach. They mentioned two key elements of project-based learning: a driving question that is related to the real world and final products. In order to solve the question, students would define the question and seek the solution. During the process, students are actively engaged in their learning and develop the cognitive skills such as problem solving, creative thinking, and analysis information. Project-based learning also provides a chance for students to connect all knowledge that they had learned in classroom to real life. At the end of the project, students produce a final product to present the solution of the driving question. The final product may be an artifact, presentation, performance, or videotape. The products demonstrate how students generate their knowledge and how deeply they learn.

Wurdinger, Haar and Bezon, (2007) conducted research to help a mainstream middle school integrate project-based learning into their curriculum and to evaluate the effectiveness. In this research, their definition of project-based learning was “a teaching method where teachers guide students through a problem-solving process which includes identifying a problem, developing a plan, testing the plan against reality, and reflecting on the plan while in the process of designing and completing a project” (p. 151).

### **Why Project-Based Learning Works In High Schools**

According to *The Silent Epidemic: Perspectives of High School Dropouts*, the major factor identified by students for dropping out of school was that classes were not interesting. This comprised 47% of all surveyed students (Bridgeland, Dilulio, & Morison, 2006). However, the major purpose of schools is education. When students are disinterested in learning or classes, both schools and teachers have lost their function. A

school and teacher's first priority is to induce student interest in learning. But how do school teachers increase students' interest and motivation in learning? Based on the provided definitions of project-based learning presented above, this project-based learning model provides several features that could help stimulate students to engage in their learning.

**Freedom of choice.** A key factor of project-based learning is to allow students to make their own decisions (Bell, 2010). Students can select the driving question, activities related to their project, and whether to work alone or with a team, and how to present their final result. During the process, teachers play the role of a facilitator to guide them through each step. One study showed that students' motivation to learn was promoted by personal choice of topics and activities of study and by personal involvement in the curriculum (Nelson & Frederick, 1994). Other studies revealed that when students were required to sit in classrooms and passively accept information, they became bored. They lost interest and motivation to learn. However, when teachers allowed students to make decisions by themselves such as setting studying goals, rules, and methods, students internalized those experiences. The students developed higher self-esteem and confidence in academic achievement, respected others, had a higher sense of belonging, and contributed to the learning process (Kohn, 1991; Lin, Huang, & Yang, 2007).

**Relevance to real life experience.** An additional reason that students described school and learning as boring was that they felt the material they were taught in school was not relevant to their lives. According to Harada, Kirio and Yamamoto (2008), once students pick one project that is related to their personal life, they will develop higher

ownership and responsibility in their learning. Because the project is related to their real lives, students have increased interest and motivation learning. Students would like to do more research and learn deeper. Also, the project can be based on one discipline or cross several disciplines. Students learn how to integrate the knowledge they had learned in the classroom. Moreover, the real-life project provides an opportunity to develop students' cognitive skills such as organization, analysis information, critical thinking, and problem solving (Bell, 2010).

**Helping the development of self-regulation.** As reported by Vukman and Licardo (2010), self-regulation is an ability to regulate one's mental activities and transform them into the goal-directed tasks. Self-regulation is encompasses the three areas "cognitive/metacognitive, motivational/affective and behavioral" (p.260) and the ability develops gradually over the age, especially in adolescence and early adulthood. Vukman and Licardo further indicated what kind of learning model could help learners to develop their self-regulation ability. The effective learning models should have the following premises:

- activity, constructivity of learners in the learning process,
- potential for learners to monitor, control, and regulate certain aspects of cognition, motivation, and behavior,
- some type of criterion against which comparisons are made in order to assess whether the process should continue or a change is necessary,
- self-regulatory activities there are directly linked to outcomes such as achievement. (p. 260)



Furthermore, other research stated metacognition, a component of self-regulation, “refers to higher order thinking which involves active control over the cognitive processes engaged in learning” (Livingston, 1997, n. p.). The metacognitive activities include planning how to access the learning task, tracking the progress, evaluating, and reflecting their learning outcomes. Self-regulated learners usually have effective study strategies, can determine what strategies are workable or not, evaluate outcomes of their efforts, and modify their learning strategies (Laskey & Hetzel, 2010; Livingston, 1997). The self-regulation helps learners to become more engaged and motivate in their own learning.

According to these provided definitions of project-based learning, this learning model provides an opportunity that students can decide and control what they want to learn. Also, they can design the whole process of their learning and track the final results. These advantages are fitting the assumptions of effective self-regulation learning models. It means project-based learning models can help students develop their abilities of self-regulation.

Liu and Hsiao (2002) conducted a project-based learning study with middle high school students to prove that a supportive learning environment can help middle high students to develop their cognitive skills. Cognitive skills are required for human mind to work. They stated the cognitive skills were different levels mental skills and a sophisticated learning process could help develop them well. In this study, the participating students were asked to complete a multimedia design project. During the project, the students worked with the professional multimedia designers and their

teammates to finish their assignments in the project. When they finished their project, researchers found that the students exhibited higher self-esteem and internalized design skills and knowledge. They also developed higher cognitive abilities, such as problem-solving skills, reflection, effective decision-making, and the ability to motivate others.

### **The Benefits of Project-Based Learning**

According to the definition of project-based learning, projects should be the center of the curriculum, have a driving question, be student-centered, require constructive investigation, and provide linkages to real-life. This section presents benefits that students gain when they learn through the project-based learning model.

In 2004, Hmelo-Smith pointed out that the problem-based learning was one kind of instructional method of experiential education. In problem-based learning, a complex problem is a trigger that can lead students to learn the process of problem solving. This learning model helps students to develop 1) flexible knowledge, 2) effective problem-solving skills, 3) self-directed learning skills, 4) effective collaboration skills, and 5) intrinsic motivation.

Frank, Lavy and Elata (2003) implemented a project-based learning course with engineering freshmen. Through student interviews, the researchers found that students had benefited from this course by gaining an improved ability of thinking, problem-solving, constructing knowledge, active learning, and increasing one's motivation to learn. The students were more involved, persistent, and responsible for the learning process. On the other hand, the teachers observed that students developed a deep, integrated understanding of the content and process, and they learned to work as a team through the

project-based learning course.

Furthermore, Wurdinger and Rudolph (2009) conducted a survey in a charter school that used project-based learning as their main teaching method. They asked students, alumni, teachers, and parents to rank the most important things they learned in the school. The top three items they listed were responsibility (16%), self-directed learning (15%), and time management (13%) (p.121). Generally, 85% of the participants who completed the survey identified life skills as the most important thing they learned in school. These life skills included creativity, finding information, problem solving, and learning how to learn. The research also asked participants to define *success*. The responses revealed that *success* was not only attained in finding a job but also in happiness, in meeting personal goals and in helping others.

Besides learning life skills, the project-based learning also helps students to improve their academic performance. Barron, Schwartz, Vye, Moore, Petrosino, Zech, and Bransford (1998) found that using project-based learning greatly improved students' academic performance. In the study, all students were divided into low, average, and high achievement groups. Each of the three groups completed two projects. The first project required students to finish a blueprint of a chair that was for young children. The second project asked students to design a playground and playhouse that could actually be built for a community center if the design was satisfactory. Researchers found when students understood their project could be used in the real world, they had higher motivation to learn. When completing the second project, researchers observed students could transfer knowledge and skills of measurement they learned in the first project to the

new one. Researchers also measured students' concepts of geometry and skills of measurement in the low, average, and high achievement groups before and after completing of their projects. The results showed that all three groups had significant improvement after they used the project learning method.

In addition, businesses have different expectations for the future workforce. Based on the report published by The Secretary's Commission on Achieving Necessary Skills (SCANS) in 1991, businesses and industries expect students to have professional knowledge as well as life skill competencies such as: creative thinking, teamwork, identifying and organizing different resources, evaluating risks and making decisions, and identifying and solving problems (SCANS, 1991). These skill sets are not always taught in a traditional classroom setting but are incorporated into project-based learning models.

As students engage in this project-based learning process, they become active and self-directed learners, instead of simply listening to the teacher lecture. They have enhanced self-determination, have higher intrinsic motivation and self-efficacy, feel responsible, and decide what they want to learn (Newell, 2003; Thomas, 2000). All of these life skills can be applied in the future workplace, and these skills also meet the requirements of employers.

### **Summary**

Compared to traditional education models, project-based learning is active, student-centered, has driving questions, and is relevant to real-life learning environment. It makes students to increase motivation, engagement, and involvement in their learning. Project-based learning also provides an opportunity to help students develop their self-

regulation ability well. The self-regulation is a process that students use to manage and organize their thoughts and convert them into skills used for learning. When students acquire the high level ability of self-regulation, they can develop better learning strategies and will gain higher academic performance in their learning. When students go through the process of project-based learning, they benefit from not only these life skills such as problem solving, creative thinking, time management, and teamwork, but also earning better academic grades. In conclusion, the project-based learning is useful on two very important levels. It engages students' learning so they feel that learning is fun. Secondly, learning is no longer a boring experience, and therefore students are retained in their schools and classrooms.

### **The Intersection of the Literature to the LSSH Study**

These literatures confirmed these benefits and advantages of project-based learning models through different perspectives and programs in different schools, groups, and systems in the United States. Li-Shan Senior High School (LSSH) provides a different learning environment from other schools in Taiwan and the United States. On one hand, it is still a traditional public school like other high schools in Taiwan. Students have to sit in classroom to accept lecture classes. On the other hand, students can freely work their projects and present their projects in the end of school year. This study tries to examine if the project-based learning still influence to students when they are under the traditional education system. Can students increase these life skills and improve their learning motivation mentioned above? If the answer is positive, what are differenced learning outcomes between the Taiwanese students and American students?

### **Chapter III: Design of the Study**

Li-Shan Senior High School (LSSH) in Taipei, Taiwan was the first high school that required a research methods course for all first and second year students. Students still have traditional classroom experiences, but in addition, take a project-based research methods class three hours per week as a requirement of their studies. The Project-based Research course was based on the concept of project-based learning. All students can select one academic field and create their own project. Over a two-year period, students need to learn the basic concepts of research design a research plan and find out the result or have a product. The connection of experiential education and project-based learning ignited my curiosity to study the effectiveness of the Project-based Research course for students at LSSH.

#### **Participants**

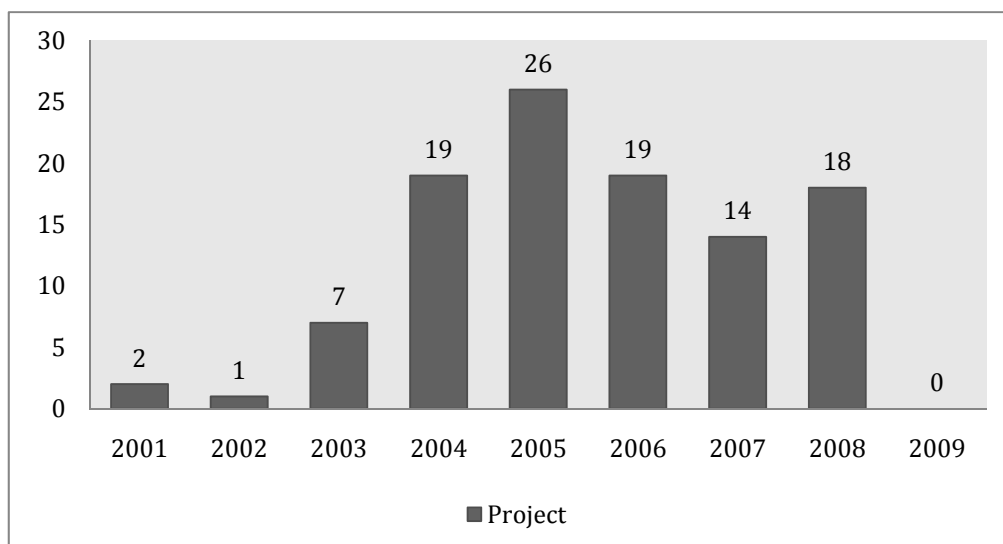
The participants of this study included three groups. The first group was the second year students of LSSH. The second year students were chosen because they had taken the Project-based Research course and completed their project over a two-year period. Therefore, they would have more experience and more feedback to give. There were 290 students in attendance at LSSH during the 2009-10 academic year, of which 123 responded to this survey. There were 95% students under 18-years-old and 5% were 18-years-old.

The second group of participants was alumni of LSSH who graduated from 2001 to 2009. This study contacted alumni through the Li-Shan Alumni Association which was established in 2008. The mission of the Li-Shan Alumni Association is to provide a

network to connect every high school graduate student, to assist alumni in adapting to college life and to help with career development. The Association administered the PTT Bulletin Board System (PTT) and a Facebook Page as its key media to deliver information to alumni. The PTT is a popular computer system on campus in Taiwan. It provides a quick, instantaneous, and open online forum community. In the study, the PTT and the Facebook Page provided the link to the survey. The alumni participants were those who joined the Facebook Page or PTT system. There were 106 alumni participants who took the survey. Figure 1 shows the number of alumni who finished their projects in various years. At the time of completing the survey, 93% of alumni enrolled in college and graduate school, 6% were employed, and one percent was unemployed.

Figure 1

Number of Completed Projects by Year for Alumni



The third group of participants included 20 current teachers who previously taught in the Project-based Research course at LSSH. Based on the survey responses, their teaching experience is shown in Figure 2 and teaching experience of the Project-based Research course presented in Figure 3.

Figure 2

Teachers' Years of Experience

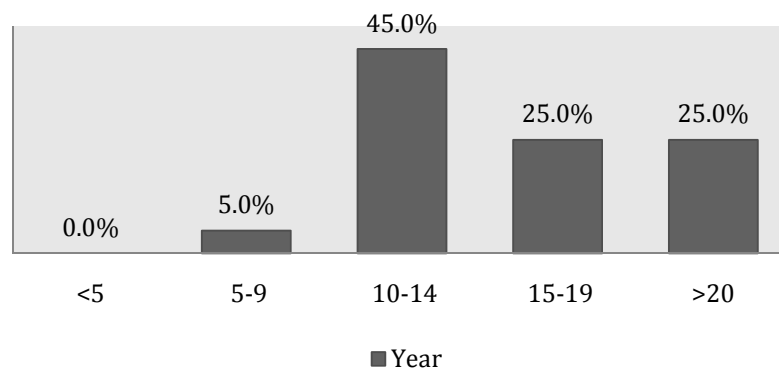
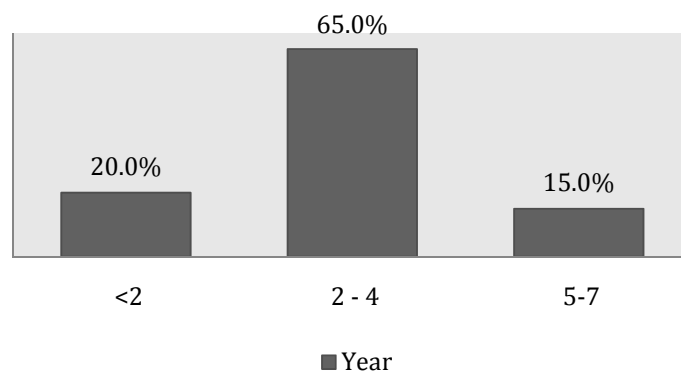


Figure 3

Teachers' Years of Teaching the Project-based Research course





## **Data Collection**

This study was designed to understand what impact the Project-based Research course had on students, alumni, and teachers perceptions at LSSH. The data for this study came from a quantitative survey with open-ended questions. Having quantitative and qualitative data helped to provide a better picture in answering the research questions for this study.

It utilized a perception-based survey that included Likert scale questions and open-ended questions. The survey included four major parts: 1) Academic skills evaluation, 2) Life skills evaluation, 3) Personal qualities evaluation, and 4) Open-ended questions. The survey asked current students and alumni to rank their level of different skills and qualities using 17 questions. The open-ended questions asked their respondents for further insights of the Project-based Research course (see Appendix A and B). The Likert scale was based on the following rating: 0= No preparation, 1=Poor, 2=Fair, 3=Satisfactory, 4=Good, 5=Excellent. Teachers were given a similar survey, but asked to rank current and past students' performance levels in the different areas and answer a few additional open-ended questions. Teachers and alumni also were asked about their teaching and educational background (see Appendix B and C). The questions of the survey were based on the publication, *What Work Requires of Schools*, which identifies foundational skills and workplace competencies that high school students should have for their future employment (SCANS, 1991). Because all participants were Taiwanese, this survey was administered in Mandarin and translated to English for the analysis of the results.

The survey was delivered and processed in two different ways. Current students and teachers at LSSH were provided a paper version of the survey. The students' packet included a cover letter, a parent consent form, and a survey questionnaire. The teachers' packet included a cover letter, a consent form and a survey questionnaire. Both packets were sent to the Department of Students Academic Affairs on March 9, 2010. The director of the Department of Students Academic Affairs helped to deliver them to all second year students and teachers. All returned packets were collected on March 16, 2010. At the end, the results of the paper version questionnaires were transferred to workable files in Excel.

For the alumni, the survey was designed using a web-based survey system known as Qualtrics and was delivered and processed through Li-Shan Alumni Association network which incorporated Facebook and PTT. The survey was deployed electronically on February 21, 2010. Data collection for the electronic survey was completed on May 21, 2010.

### **Data Analysis**

The quantitative data contributed to the evaluation of the performance of students and alumni in three major sections in the survey questionnaire. All data came from the 17 Likert scale questions and was analyzed through Excel and SPSS computer software. Descriptive statistics and frequency distribution tests were conducted to identify means among the three participant groups. The results were aggregated across all of the three subject groups: current students, alumni, and teachers. Specifically, a one-way Analysis of Variance (ANOVA) was also used to compare the difference between the three groups.

After further investigation, due to the low response rates from teachers, an independent *t*-test was used to compare responses from the students and alumni. The data were used to make inferences regarding the capabilities of project-based learning and the Project-based Research course in developing specific academic skills, life skills, and personal qualities.

The qualitative analysis was employed with the open-ended questions. Data was analyzed using open and axial coding and identifying main themes (Creswell, 1998). In the open coding step, all responses to all questions were listed, then, the repeating terms were identified. These repetition terms were categorized into matrix form (axial coding). Several main themes emerged from the open-ended questions. The three questions were asked of all three groups (Appendix A, B, and C) and analyzed for collective prevalent themes. Two additional questions only asked of the teachers group and also analyzed for themes. The information intended to reveal teachers' perspectives of teaching after they taught the Project-based Research course. These themes were explained in the Finding and Discussion section.

## Chapter VI: Findings and Discussion

### Findings from Quantitative Data

The responses to the 6-point Likert scale questions provided the quantitative data for this study. For the quantitative data, Excel and SPSS were used to analyze the following three areas: academic skills, life skills and personal qualities. Excel was used to calculate the Mean scores by sections, questions, and groups. The comparison of Mean scores is represented on Table 1, 2, 3 and 4.

An ANOVA test was used to determine if there was significant difference between the three groups. The results showed that there was no statistically significant difference between the three groups (see Table 5). The responses by the students, alumni, and teachers were similar in perception of the Project-based Research course.

Table 1

Means and Standard Deviations of Three Main Skills Sections

| Group            | Skills          |      |             |      |                    |      |
|------------------|-----------------|------|-------------|------|--------------------|------|
|                  | Academic Skills |      | Life Skills |      | Personal Qualities |      |
|                  | Mean            | SD   | Mean        | SD   | Mean               | SD   |
| Teacher (n=20)   | 3.68            | 0.83 | 3.84        | 0.88 | 4.08               | 0.65 |
| Student* (n=123) | 3.69            | 1.11 | 3.75        | 1.02 | 3.65               | 1.12 |
| Alumni (n=106)   | 3.59            | 1.13 | 3.85        | 1.07 | 3.85               | 0.97 |

Notes: \*Student means the second year students in LSSH in 2010.

Table 2

Means of Academic Skills by Questions

| Groups   | Academic Skills |          |         |         |                           |
|----------|-----------------|----------|---------|---------|---------------------------|
|          | Listening       | Speaking | Reading | Writing | Calculating & Mathematics |
| Teachers | 3.60            | 3.70     | 3.75    | 3.95    | 3.40                      |
| Students | 3.63            | 3.82     | 3.85    | 4.07    | 3.06                      |
| Alumni   | 3.43            | 3.82     | 3.58    | 3.77    | 3.36                      |

Table 3

Means of Life Skills by Questions

| Groups   | Life Skills |      |      |      |      |      |      |      |      |
|----------|-------------|------|------|------|------|------|------|------|------|
|          | CT          | PS   | DM   | R    | KHL  | RM   | IP   | IM   | TM   |
| Teachers | 3.65        | 4.10 | 3.35 | 3.70 | 4.10 | 3.45 | 4.20 | 4.20 | 3.85 |
| Students | 3.65        | 4.02 | 3.72 | 3.54 | 4.00 | 3.62 | 3.97 | 3.89 | 3.33 |
| Alumni   | 3.59        | 4.03 | 3.72 | 3.68 | 3.97 | 3.56 | 3.90 | 3.85 | 3.39 |

Notes: CT=Creative Thinking; PS=Problem Solving; DM=Decision Making; R=Reasoning; KHL=Knowing How to Learn; RM=Resources Management; IP=Interpersonal; IM=Information Management; TM=Time Management.

Table 4

Means of Personal Qualities by Questions

| Groups   | Personal Qualities |                 |                 |
|----------|--------------------|-----------------|-----------------|
|          | Accountability     | Self-Confidence | Self-Management |
| Teachers | 4.10               | 4.10            | 4.05            |
| Students | 3.84               | 3.46            | 3.67            |
| Alumni   | 4.05               | 3.78            | 3.72            |

Table 5

A One-Way ANOVA Comparing the Three Groups.

|                | Sum of Squares | df  | Mean Square | F    | Sig   |
|----------------|----------------|-----|-------------|------|-------|
| Between Groups | .279           | 2   | .139        | .146 | .864* |
| Within Groups  | 234.741        | 246 | .954        |      |       |
| Total          | 235.020        | 248 |             |      |       |

Notes: \*  $p > 0.05$

Table 6

Students and Alumni Groups Correlations (*t*-test)

|          | N   | Mean  | SD    | F    | Sig.  |
|----------|-----|-------|-------|------|-------|
| Students | 123 | 3.713 | 1.064 | .688 | .887* |
| Alumni   | 106 | 3.718 | 1.074 |      |       |

Notes: \*  $p > 0.05$

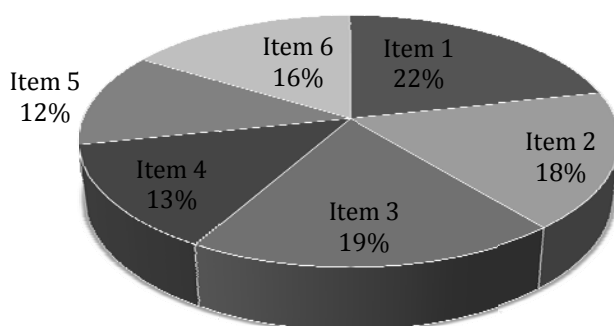
In furtherance of comparing the student and alumni perceptions of the Project-based Research course, an independent *t*-test was used to analyze the difference between the two groups. The result showed that there was no statistically significant difference between the student and alumni groups (see Table 6). Current student and alumni had the similar perception of the Project-based Research course.

In order to examine that the Project-based Research course was based on the concepts of project-based learning, teachers were asked to identify which concepts they applied in their teaching. This question was based on two references. One is “the pattern

of inquiry” (Mcdermott, 1981, p. 223) and the other is “the five criteria ...centrality, driving question, constructive investigation, autonomy, and realism” (Thomas, 2000, p. 3) (see Appendix C). For this question, teachers can choose more than one item. Figure 4 showed the result of percentage of concepts that teachers applied in their courses.

Figure 4

#### Concepts of the Project-Based Research Course



Notes: The explained the content of Items 1 to 6 showed in Appendix D.

#### Findings from Qualitative Data

How do all participants in this study perceive about the Project-based Research course? The quantitative data can measure the level that participants had learned. The qualitative data used open-ended questions that can help participants to reflect on their personal experience and provided more insights and perceptive information. Both the quantitative and qualitative data can scaffold a whole picture of this study. The major qualitative results are summarized in the order of open-ended questions appeared on the survey.

All of the qualitative data from the groups was transcribed and translated from

Mandarin to English. As much as possible, the intent of the messages was directly translated.

**Learning in the Project-based Research course.** All survey participants in their respective groups were asked to list the three most important things students learned in the Project-based Research course. Students and alumni identified these things based on their direct experiences in the Project-based Research course. Conversely teachers gave their perceptions as to what they believed were the most important things their students learned. These responses of three groups in percentage form are shown in Table 4 and the interpretation of the qualitative data will be presented in the Discussion below.

Table 7

Percentage of the Most Important Learning

| Items (%)                               | Teacher           | Student           | Alumni            |
|---|-------------------|-------------------|-------------------|
| Presentation and communication skills   | 20 <sup>(1)</sup> | 23 <sup>(1)</sup> | 22 <sup>(1)</sup> |
| Cooperation and how to work with others | 16 <sup>(2)</sup> | 14 <sup>(3)</sup> | 16 <sup>(2)</sup> |
| Handling information                    | 9                 | 21 <sup>(2)</sup> | 16 <sup>(2)</sup> |
| Problem solving                         | 13 <sup>(3)</sup> | 8                 | 7                 |
| Academic writing skills                 | 11                | 6                 | 8                 |
| Self-directed learning                  | 13 <sup>(3)</sup> | -                 | 3                 |
| Applying technology                     | -                 | 12                | 5                 |
| Laboratory skills                       | 4                 | 4                 | 8                 |
| Time management                         | 6                 | 9                 | 7                 |
| Creative thinking                       | 9                 | 3                 | 7                 |
| Accountability                          | -                 | -                 | 3                 |

Notes: 1. <sup>(1)</sup><sup>(2)</sup><sup>(3)</sup> Presents the three highest ranking for each group.

2. Percentage totals may be greater than 100% due to rounding.



**Descriptions of learning after the Project-based Research course.** The survey was also designed to determine current students, alumni and teachers' perceptions of "learning" after they participated in the Project-based Research course. Most participants recognized the advantages of the Project-based Research course and changed their perspective of learning. In the teacher group, their answers were varied. One teacher said, "*Learning should be student-centered and the teacher's role should be a coach.*" Another teacher thought, "*Learning how to learn was more important than content areas students had been taught.*" One more teacher pointed out, "*Lecture is not the only way of education. Learning should not be limited in textbook and classroom.*" Students and alumni groups agreed they had different concepts of learning after they took the Project-based Research course. After integrating these two groups' responses, there were four main themes presented as following.

**Critical thinking.** Both students and alumni mentioned that the course trained them how to question information and data they found in the library or on the Internet. Even more, through their projects, they learned to think progressively, to analyze what teachers provided, and solve more challenging questions.

- *I had courage to question the 'standard' answer and try to find any possible answers after the Project-based Research course. This learning attitude helped me a lot when I studied in college.*
- *...learning should not be limited to textbooks only, it can be obtained from different areas and resources.*
- *This course trained me how to think independently and understand and*

*practice the process of problem solving.*

**Active learning.** To compare their previous learning model, students and alumni found they had higher motivation to learn. They were allowed to explore themselves in any subjects they were interested in. They could also solve problems they found and did not need to wait for teacher's permission and instruction.

- *I am not used finding out the answers or solutions spontaneously when I have some questions and not actively looking for more information. However, after the Project-based Research course, I would not depend on teacher to provide me solutions instead of searching information and solutions by myself.*
- *The Research course helped me to realize that active learning was very important. I would look for more information to enrich my knowledge automatically without teacher's requirement.*
- *This Project-based Research course was not only a class to learn some professional knowledge, but it also pushed us to learn more. For example, in order to prepare a presentation, my teammates and I had to learn how to use computer software and some equipment such as GSP.*

**Ownership.** Because of the independent nature of the projects, students and alumni claimed they became more engaged and had more ownership in their learning. When they faced challenging problems, they had high persistence and resolution to clarify and solve them and would not give up easily. They learned for themselves.

- *I found I was more involved in my learning after the Research course.*
- *I can decide the topic and what I want to do in my project. Even though I*

*needed to spend extra time to finish my project. I felt satisfied and fulfilled when I got any results.*

- *Learning was my own responsibility, not the teacher's! I learned for myself.*

**Collaboration.** *Working with others* was a common expression and the most important experience when students worked on their projects. They worked not only with classmates or schoolmates but also with outside experts, such as college students and professors. In the process of collaboration, they learned something that they could not learn from the traditional classroom such as communication skills and better attitudes toward learning. They all agreed these skills would be carried into their future workplaces.

- *I really enjoyed working with my teammates. I liked the small group discussion, brainstorming, and figuring out what is the best solution together. And we always could motivate and inspire each other when we met difficult questions or situations. We would not give up quickly. I realized that cooperative learning was better than the independent learning that I used to do.*
- *Cooperative learning was better than competitive learning. Through the project, I learned how to work as a team member and that peers could encourage and inspire each other.*

**Connections to future academic life in college and the workplace.** When the survey asked “Do you agree that the Project-based Research course can help you to adapt to your future life in college or the workplace?”, the majority of participants in all three groups agreed that the skills they learned in the Project-based Research course were

very helpful for a future life in college and the workplace(see Table 8). From the responses of students and alumni, two prevalent themes emerged: development of practical skills and teamwork. Additionally, they also listed time management, problem solving, interest discoveries, accountability, self-confidence, self-directed learning, and critical thinking skills as benefits they learned from the Project-based Research course. Even though the teachers strongly recognized the advantages of the Project-based Research course, their responses did not show conspicuous themes. In conclusion, teachers thought the Project-based Research course can help students to apply their knowledge in real life, to cultivate better learning habits, and to develop competences for future life.

Table 8

Percentage of Agreement of the Benefits of the Project-based Research course

| Group   | Agree | No Comment | Disagree |
|---------|-------|------------|----------|
| Teacher | 75    | 25         | 10       |
| Student | 81    | 13         | 6        |
| Alumni  | 89    | 5          | 6        |

***Development of practical skills.*** In order to complete their projects, students and alumni indicated they had to learn other skills in addition to the professional knowledge. These skills included presentation skills, organizing and analyzing information, academic writing skills, and laboratory techniques. These are all skills that they can practically apply in their current and future learning. Presentation skills were mentioned most frequently. The writing skills they developed helped them understand and complete

assignments and papers in other courses more easily in college.

- *Because of the Project-based Research course, I got chances to present in public in Li-Shan. So, when I was in the first year of college, I felt it became easier and had more confidence to present my papers or any assignments for my classes.*
- *For the final presentation, I needed to integrate all information I got from my project to make a clear presentation material to present in front of my schoolmates. I thought it was a very important skill and it helped me to adapt my college more easily.*
- *I learned how to write an academic paper in this course. I thought this skill would be very helpful in the future college learning.*
- *In comparison with my classmates, I was more familiar with the process of research and using some equipment in laboratory in my first year of college.*

**Teamwork.** Both students and alumni agreed on the advantages of working in a group. As mentioned previously, they felt they can now work more skillfully and comfortable with other professional people outside school. Besides communication skills, social skills and leadership were other valuable things they learned when they worked with others. The alumni responded showed they could easily transfer these experiences into college life, especially in communicating with professors and in directing activities on campus.

- *I found that I had more opportunity to interact with other classmates and learned what effective communication is. I thought these skills were very*

*useful to my future life.*

- *When our team worked on our project, I realized it was not easy to be a leader and leadership was a very important topic in the workplace. I was glad that I had this experience and I think it would be helpful for my future.*
- *Through the project, I became able to work with others who had different personalities and opinions, and made gains in my ability to communicate, handle conflicts, and summarize our discussion. I can carry these skills to my future work.*
- *I learned some communication skills when I worked with my teammates. This experience helped me to handle a lot of things in college, for instance hosting department activities.*

However, there were some of the participants who disagreed or had no comment about the effectiveness of the Project-based Research course. For example, some of opinions expressed by the teaches were,

- *I agree that these skills they learned through this course would help them in the college. But I didn't think it would help in the working field.*
- *If the student put much effort in the research class, they would neglect their academic study. Otherwise, I did not think this course could help students a lot.*
- *I agree, but only for those students who took seriousness in their projects. For some students who didn't care about this course, it just wasted our time.*

Some students and alumni also complained that the Project-based Research course did not help or benefit them. These students and alumni argued,

- *It depended on which topics you chose. I did not think I could learn in the research course.*
- *I did not think there was any connection between the Project-based Research course and skills for college.*
- *I did not agree that the Project-based Research course was very helpful unless you had a high level of interest in research.*
- *I had barely time to finish my homework and prepare my tests, at the same time, I also needed to work on the project. The research class just wasted my time!*

In summary, this qualitative section indicates that most participants felt that the Project-based Research course was useful and included transferable skills that would be used in their future endeavors. The data revealed prevalent themes that emerged from the open-ended questions asked of the current students, alumni and teachers who experienced the Project-based Research course. Themes pertaining to the most important learning outcomes were presentation and communication skills, cooperation, handling information, and self-directed learning. The themes that emerged from changes in how learning was described and perceived were critical thinking, active learning, ownership, and collaboration. Two themes that were identified regarding college and future employment were developing practical skills and teamwork.

## **Discussion**

According to the quantitative and qualitative data, current students and alumni had similar conclusions, but teachers provided slightly different answers. When the survey asked current students and alumni to list the three most important things they had learned

in the Project-based Research course, they indicated presentation and communication skills, handling information, and collaboration (see Table 7). Moreover, when asked if the Project-based Research course could help them in their future life, 81% of the student participants and 89% of the alumni participants gave positive responses (see Table 8). They also identified presentation skills, academic writing and laboratory techniques as the most helpful skills for their future college life. Comparing the quantitative data, the speaking ( $M_{\text{alumni}}=3.82$ ) and writing skills ( $M_{\text{student}}=4.07$ ) were the highest scores in the academic skills section among these two groups. These results were not surprising for the alumni group. Based on their reported educational background, 93% of alumni were currently enrolled in colleges and graduate schools. They indicated that their experiences in college were more positive due to the Project-based Research course they took in high school. The majority revealed that the skills they attained in the Project-based Research course were transferred into their current lives, an assumption also stated by the majority of the current student group. This information can provide powerful evidence to encourage current students, the school, and the future students who will enroll in LSSH to keep involved in the Project-based Research course. On the other hand, teachers pointed out that problem solving and self-directed learning were the most valuable skills students learned in the Project-based Research course, in addition to the presentation and communication skills (see Table 7). In the academic skills section, teachers gave the highest score to writing skills ( $M_{\text{Teacher}}=3.95$ ).

Why are the presentation and communication skills highlighted by all three groups? From the responses of open-ended questions, all three groups indicated the semester-end



presentation workshop. In order to have a successful presentation, students had to learn presentation skills, such as organizing their data and information, making appropriate presentation material, and speaking clearly and steadily. Due to the final presentations, all students had an opportunity to publicly present their projects. It was a great opportunity to integrate and practice all skills through the Project-based Research Course.

To further analyze these findings, the data reflected that current student and alumni focused more on those skills that could help them earn better academic performance in current and future learning environments. However, in contrast, the teachers held a more holistic view of the students' performance. In the personal qualities section, all teachers recognized that students improved their self-confidence, accountability, and self-management after they took the Project-based Research course. The teachers rated "Self-confidence" ( $M_{\text{teacher}}=4.08$ ) the highest among all three participant groups. Conversely, although current students agreed there was a positive impact from enrolling in the Project-based Research course, they had the lowest score in the "Self-Confidence" item ( $M_{\text{students}}=3.65$ ) among the three groups.

Evidence can be found in the answers of open-ended questions from all participants to explain why the current student group did not rate the Project-based Research course as high as the other groups in increasing their levels of self-confidence. This evidence may not have been directly related to the instruction activities that took place in the Project-based Research but could show some external factors to influence students' self-evaluation. The first major reason is that some students felt they received less attention and help with their research. There were some participants in the three groups that

indicated that the many research projects disadvantaged some of the students. They claimed that the faculty did not have enough time to commit to their project because they were busy with other student projects. Also, the school selected some of the students with better projects to present at national or worldwide science competitions. Teachers spent a great deal of time helping students compete in these competitions and therefore had less time to work with the students who were not in the competitions. Secondly, academic performance on national exams is still the major criteria to evaluate students in Taiwan. Students were required to work on their projects and also keep up with requirements for their other classes such as academic studying, assignments, and tests required by teachers. Every student was forced to face the multiple pressures of finishing their projects, completing their homework, and passing their exams in LSSH. If students could not pass the tests, they could not attend a good college even though they may have had impressive social and life skills. National testing still determines if students will be recognized as “successful” or “unsuccessful”. These reasons could answer why students had lower scores in “self-confidence” compared to the other two groups.

Additionally, all the teachers were asked two questions that were not asked of the other groups. These were, “What have you learned from teaching the Project-based Research course?” and “Have you changed your thoughts or methods of teaching as a result of the Project-based Research course?” In response to the question about their personal learning, many teachers mentioned in order to teach the Project-based Research course, they had to learn new technologies, accept some training courses, and integrate other disciplines into the research topics. It was a challenge but ultimately, they

expanded their capabilities and comfort zone.

Some teachers agreed that they changed their perspectives of teaching when they prepared and went through the process of creating the Project-based Research course. For instance, they modified their role from a knowledge provider to a facilitator or guide and agreed that effective learning should be student-centered instead teacher-centered. Several teachers stated they had different points of view of how to evaluate student's performances. One teacher said, "*Scores, are not the only way to evaluate students' performance. In this course, we assessed students by their products such as poems, photography, or presentations.*" The other teacher claimed, "*Project-based learning can make students have higher satisfaction in learning*". Furthermore, in the Project-based Research course, they all needed to learn how to facilitate every individual student. It was a very different experience from their past teaching pattern. In the traditional class, they could ignore the individualization but they had to face it in the Project-based Research course. Although, teachers recognized these benefits of the Project-based Research course, some of them indicated that they still have the pressure of adhering to the scheduled curriculum.

In a succinct summary of the result, the quantitative and qualitative data presented in this study indicate that the Project-based Research course had benefits to current students, alumni and teachers at LSSH.

## Chapter V: Conclusion

Li-Shan Senior High School (LSSH) incorporated traditional education and project-based learning as their teaching method since its beginning. Both students and teachers faced increased stress due to maintaining high performance in academics and completing projects. However, the data of this study confirms that most of the participants in this study recognized the advantages of the Project-based Research course.

Current students and alumni stated that the Project-based Research course provided them an opportunity to develop more life-long skills than the traditional education environment. These skills included presentation and communication skills, knowing how to learn, and critical thinking. In academic skills, the results showed agreement their speaking, reading, and writing improved after the training in the Project-based Research course. Furthermore, from the alumni's points of view, the qualitative data confirmed that the skills mentioned by all participants were feasible and transferable. Alumni highlighted skills they had learned in high school that helped them to adapt to college life easier.

On the other hand, the data also indicated that teachers at LSSH found teaching was not a monologue anymore. Instead, teachers were able to provide a different kind of stage where the actors could engage in their best performance. They could discover students' potential, but this potential would not be realized in the traditional education system. Teachers' past teaching experiences were overridden. The research questions: "What impact or influence do current students, alumni and teachers perceive of the Project-based Research course?" and "To what extent do current students, alumni and

teachers perceive that students develop more academic, life skills and personal qualities as a result participating in this course?” were answered. The Project-based Research course changed the perceptions of learning and teaching of students, alumni, and teachers.

### **Implications**

Although, both quantitative and qualitative data showed the positive impact of the Project-based Research course, there were some discrepancies in this survey. The most frequent complaint was regarding the science competitions. The school wanted to earn the best place in any competition, but it meant that they had to sacrifice some students' projects because of the limited manpower and resources. This favoritism was against the student-centered focus of experiential learning, but it is impossible to ask the school not to attend any science competitions. Based on some students' suggestions, it was recommended that the school modify their goal of the Project-based Research course. In the second semester, all students could work on a small project to arouse their interests. In the second year, if some students were selected to attend the national or worldwide science competitions, teachers could work with these students more intentionally. Other students could keep working on small projects that would link to their current curricula. When students work on their homework or prepare for their tests, the projects could help them to understand deeply and make the learning more interesting.

### **Limitations**

There are some limitations in this study. First of all, this study only focused on one school without comparison to other schools. The data cannot provide any objective evidence to indicate that students who studied or graduated from LSSH had better

performance than other high schools. Secondly, there was no pre-evaluation done. Therefore, the survey results for the second year students and alumni only revealed their final learning outcomes. Thirdly, this survey could only be accessed by alumni who joined the alumni association such as the Facebook Page or the PTT. It is possible that these alumni approached the survey with higher regard for the school and the Project-based Research course. The results were lacking some opinions and may have produced bias. The data from teachers reflected that they had pressure both in the progress of curricula and attending different kinds of science competitions. In addition, they only taught one specific subject and may have paid more attention to students' abilities related to their own subject. It is difficult to provide a general observation of students' change. Conversely, parents only concentrate on their children, and they could have provided more objective information of the Project-based Research course. However, this survey missed the voices of parents.

Although, this study asked teachers to select which concepts they applied in their classes, and tried to clarify if teachers followed the concepts of project-based learning from their choice. However, these findings can only provide very limited information of teachers' teaching methods. There was no chance to observe all teachers' teaching methods before and during this study either because this was an oversea study. Different levels of teaching methods of project-based learning will produce different results of student's learning.

### **Recommendations for Further Research**

Based on the limitation of outline above, there are five recommendations for

further research that include the following:

- (1) Implement pre- and post- evaluation of the Project-based Research course for current students. It could provide more accurate data and also could measure the difference of perception of learning before and after completion of the Project-based Research course.
- (2) Investigate the tertiary education entry rate of students who graduate from LSSH. This could be objective evidence to confirm whether students have better academic performance besides life-long skills development.
- (3) Track the performance of alumni after they graduate and find the percentage of college completion and employment.
- (4) Implement the survey with other public high schools who apply the project-based learning model to compare the results with those from LSSH survey.
- (5) Investigate each teacher's teaching methods of the Project-based Research course before implementing the survey to conform every teacher applies the same concepts of project-based learning model and to reduce the inconsistencies.

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## Appendix A: Current Students Survey

### Personal Information

1. Age:
  - I am under 18 years of age and have an attached signed consent form from my parents or guardians to complete this survey.
  - I am at least 18 years of age.
  
2. Your chosen project is in which field?
 

|                                 |                                       |                              |
|---------------------------------|---------------------------------------|------------------------------|
| <input type="radio"/> Chinese   | <input type="radio"/> Biology         | <input type="radio"/> Math   |
| <input type="radio"/> English   | <input type="radio"/> Geography       | <input type="radio"/> Others |
| <input type="radio"/> Physics   | <input type="radio"/> Life Technology |                              |
| <input type="radio"/> Chemistry | <input type="radio"/> Social Science  |                              |

### Academic Skills

Please rank the following statements according to your perspective, using the 0-5 scale: 0 = No preparation, 1= Poor, 2=Fair, 3=Satisfactory, 4=Good, 5=Excellent

The level that the Project-based Research course prepared me

1. to interpret and analyze information that was provided in the class.      0 1 2 3 4 5
  
2. to organize my ideas and present appropriately in different situations.      0 1 2 3 4 5
  
3. to learn from text by determining the main idea or essential message more efficiency.  
0 1 2 3 4 5
  
4. to know how to present my thoughts, ideas, information and messages in writing.  
0 1 2 3 4 5
  
5. to use basic numerical concepts; choose appropriate mathematical techniques; and use tables, graphs, diagrams and charts to organize data.      0 1 2 3 4 5

### Life Skills

Please rank the following statements according to your perspective, using the 0-5 scale: 0 = No preparation, 1= Poor, 2=Fair, 3=Satisfactory, 4=Good, 5=Excellent

The level that the Project-based Research course taught me the following life skills:

1. Creative Thinking      0 1 2 3 4 5
  
2. Problem Solving      0 1 2 3 4 5

- |   |             |
|---|-------------|
| 3. Decision Making  | 0 1 2 3 4 5 |
| 4. Reasoning  | 0 1 2 3 4 5 |
| 5. Knowing How to Learn   | 0 1 2 3 4 5 |
| 6. Resources Management (Resources including human resources, money, materials and facilities ) | 0 1 2 3 4 5 |
| 7. Interpersonal (e.g. working with others and communication skills)                            | 0 1 2 3 4 5 |
| 8. Information Management and Applying Technology   | 0 1 2 3 4 5 |
| 9. Time Management  | 0 1 2 3 4 5 |

#### Personal Qualities

Please rank the following statements according to your perspective, using the 0-5 scale: 0 = No preparation, 1= Poor, 2=Fair, 3=Satisfactory, 4=Good, 5=Excellent

The level that the Project-based Research course helped me to develop the following personal qualities:

1. Accountability (showing responsibility and ownership of one's actions) 0 1 2 3 4 5
2. Self-Confidence (belief in one's self and ability, belief in one's own self-worth, and a positive view of one's self) 0 1 2 3 4 5
3. Self-Management (self-control, accurate self-assessment, personal goal setting, and monitoring self-progress.) 0 1 2 3 4 5

#### Open-ended Questions

Please answer the following questions based on your learning experiences.

1. What is or was the title of your research project? \_\_\_\_\_ .
2. Please list the three most important things you have learned from participating in the Project-based Research course.
3. How do you think about or describe "learning" now that you have participated in the

Project-based Research course ? Please list three things.

4. Do you agree that the Project-based Research course can help you to adapt to your future life in college or the workplace? Why or why not?

You have now completed the survey. Thank you for your participation. The information you contributed will help in understanding the effectiveness of project-based learning used in the Project-based Research courses at Li-Shan Senior High School.

## Appendix B: Alumni Survey

### Personal Information:

1. Please choose the option that best describes your educational attainment after high school and write in your area of study.

- Did not attend college after high school.
- Undergraduate – currently enrolled.  
Area of study – please specify: \_\_\_\_\_
- Undergraduate – graduated.  
Area of study – please specify: \_\_\_\_\_
- Graduate school – Masters Program.  
Area of study – please specify: \_\_\_\_\_
- Graduate school – Masters program, graduated.  
Area of study – please specify: \_\_\_\_\_
- Graduate school – PhD or post-Masters program.  
Area of study – please specify: \_\_\_\_\_
- Graduate school – PhD or post-Masters program, graduated.  
Area of study – please specify: \_\_\_\_\_

2. Working status

- Presently working  
Current occupation: \_\_\_\_\_
- Unemployed

3. When you studied in Li-Shan Senior High School, your chosen project was in which field?

- |                                 |                                       |                              |
|---------------------------------|---------------------------------------|------------------------------|
| <input type="radio"/> Chinese   | <input type="radio"/> Biology         | <input type="radio"/> Math   |
| <input type="radio"/> English   | <input type="radio"/> Geography       | <input type="radio"/> Others |
| <input type="radio"/> Physics   | <input type="radio"/> Life Technology |                              |
| <input type="radio"/> Chemistry | <input type="radio"/> Social Science  |                              |

4. When did you finish your research project?

- |                            |                            |                            |
|----------------------------|----------------------------|----------------------------|
| <input type="radio"/> 2001 | <input type="radio"/> 2004 | <input type="radio"/> 2007 |
| <input type="radio"/> 2002 | <input type="radio"/> 2005 | <input type="radio"/> 2008 |
| <input type="radio"/> 2003 | <input type="radio"/> 2006 | <input type="radio"/> 2009 |

### Academic Skills

Please rank the following statements according to your perspective, using the 0-5 scale:

0= No preparation, 1= Poor, 2=Fair, 3=Satisfactory, 4=Good, 5=Excellent

The level that the Project-based Research course prepared me

1. to interpret and analyze information that was provided in the class. 0 1 2 3 4 5
2. to organize my ideas and present appropriately in different situations. 0 1 2 3 4 5
3. to learn from text by determining the main idea or essential message more efficiency.  
0 1 2 3 4 5
4. to know how to present my thoughts, ideas, information and messages in writing.  
0 1 2 3 4 5
5. to use basic numerical concepts; choose appropriate mathematical techniques; and use  
tables, graphs, diagrams and charts to organize data. 0 1 2 3 4 5

### Life Skills

Please rank the following statements according to your perspective, using the 0-5 scale:

0= No preparation, 1= Poor, 2=Fair, 3=Satisfactory, 4=Good, 5=Excellent

The level that the Project-based Research course taught me the following life skills:

1. Creative Thinking 0 1 2 3 4 5
2. Problem Solving 0 1 2 3 4 5
3. Decision Making 0 1 2 3 4 5
4. Reasoning 0 1 2 3 4
5. Knowing How to Learn 0 1 2 3 4 5
6. Resources Management (Resources including human resources, money, materials and  
facilities ) 0 1 2 3 4 5
7. Interpersonal (e.g. working with others and communication skills) 0 1 2 3 4 5
8. Information Management and Applying Technology 0 1 2 3 4 5
9. Time Management 0 1 2 3 4 5

### Personal Qualities

Please rank the following statements according to your perspective, using the 0-5 scale: 0

= No preparation, 1= Poor, 2=Fair, 3=Satisfactory, 4=Good, 5=Excellent

The level that the Project-based Research course helped me to develop the following personal qualities:

1. Accountability (showing responsibility and ownership of one's actions) 0 1 2 3 4 5
2. Self-Confidence (belief in one's self and ability, belief in one's own self-worth, and a positive view of one's self) 0 1 2 3 4 5
3. Self-Management (self-control, accurate self-assessment, personal goal setting, and monitoring self-progress.) 0 1 2 3 4 5

#### Open-ended Questions

Please answer the following questions based on your learning experiences.

1. What was the title of your research project? .
2. Please list the three most important things you have learned from participating in the Project-based Research course.
3. How do you think about or describe "learning" now that you have participated in the Project-based Research course? Please list three things.
4. Do you agree that the Project-based Research course can help you to adapt to your future life in college or the workplace? Why or why not?

You have now completed the survey. Thank you for your participation. The information you contributed will help in understanding the effectiveness of project-based learning used in the Project-based Research courses at Li-Shan Senior High School.



## Appendix C: Teachers Survey

### Personal Information:

1. How long have you been a teacher?
  - Over 20 years
  - 15-19 years
  - 10-14 years
  - 5-9 years
  - Less than 5 years
2. How long have you taught the “Project-based Research course”?
  - 5-7 years
  - 2-4 years
  - Less than 2 years
3. Which field do you teach?
 

|                                 |                                  |                                      |
|---------------------------------|----------------------------------|--------------------------------------|
| <input type="radio"/> Chinese   | <input type="radio"/> Biology    | <input type="radio"/> Social Science |
| <input type="radio"/> English   | <input type="radio"/> Geography  | <input type="radio"/> Math           |
| <input type="radio"/> Physics   | <input type="radio"/> Life       | <input type="radio"/> Others         |
| <input type="radio"/> Chemistry | <input type="radio"/> Technology |                                      |
4. When you teach “Project-based Research course”, which of the following project-based concepts do you regularly apply which concepts? (you can check more than one item)
  - The project is the center of Research Method course curriculum
  - There is a major question or problem to drive students to encounter the central concepts of a discipline.
  - The project involves students in a constructive investigation.
  - The project is primarily driven by students.
  - The project is related to real-life.
  - The project follows a general pattern of identifying a problem, design a plan, investigating the problem, identifying solutions to the problem, and reflection.

### Academic Skills

Please rank the following statements according to your perspective, using the 0-5 scale: 0 = No preparation, 1= Poor, 2=Fair, 3=Satisfactory, 4=Good, 5=Excellent

The level that the Project-based Research course prepared students

1. to interpret and analyze information that was provided in the class. 0 1 2 3 4 5
2. to organize their ideas and present appropriately in different situations. 0 1 2 3 4 5

3. to learn from text by determining the main idea or essential message more efficiency. 0 1 2 3 4 5
4. to know how to present their thoughts, ideas, information and messages in writing. 0 1 2 3 4 5
5. to use basic numerical concepts; choose appropriate mathematical techniques; and use tables, graphs, diagrams and charts to organize data. 0 1 2 3 4 5

### Life Skills

Please rank the following statements according to your perspective, using the 0-5 scale: 0 = No preparation, 1= Poor, 2=Fair, 3=Satisfactory, 4=Good, 5=Excellent

The level that the Project-based Research course taught students the following life skills:

1. Creative Thinking 0 1 2 3 4 5
2. Problem Solving 0 1 2 3 4 5
3. Decision Making 0 1 2 3 4 5
4. Reasoning 0 1 2 3 4 5
5. Knowing How to Learn 0 1 2 3 4 5
6. Resources Management (Resources including human resources, money, materials and facilities) 0 1 2 3 4 5
7. Interpersonal (e.g. working with others and communication skills) 0 1 2 3 4 5
8. Information Management and Applying Technology 0 1 2 3 4 5
9. Time Management 0 1 2 3 4 5

### Personal Qualities

Please rank the following statements according to your perspective, using the 0-5 scale: 0 = No preparation, 1= Poor, 2=Fair, 3=Satisfactory, 4=Good, 5=Excellent

The level that the Project-based Research course helped students to develop the following personal qualities:

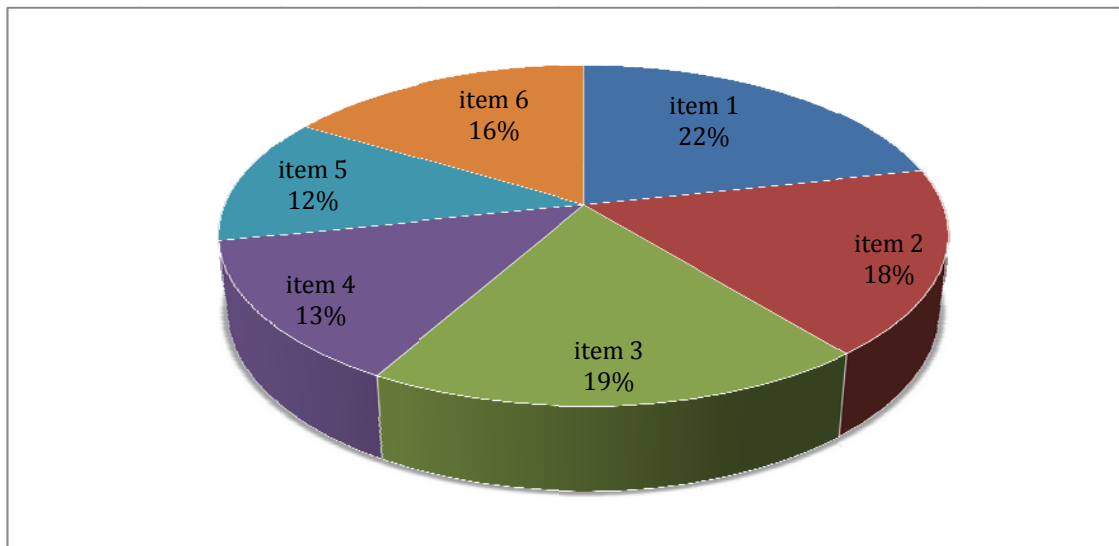
1. Accountability (showing responsibility and ownership of one's actions)  
0 1 2 3 4 5
2. Self-Confidence (belief in one's self and ability, belief in one's own self-worth, and a positive view of one's self) 0 1 2 3 4 5
3. Self-Management (self-control, accurate self-assessment, personal goal setting, and monitoring self-progress.) 0 1 2 3 4 5

#### Open-ended Questions

Please answer the following questions based on your teaching experiences.

1. Please list the three most important things you think that students learned from participating in the Project-based Research course
2. How do you think about or describe "learning" now that you have taught the Project-based Research course? Please list three things.
3. Do you agree that the Research Method class can help students to adapt to their future life in college or the workplace? Why or why not?
4. As a teacher, what have you learned from teaching the Project-based Research course ?
5. As a teacher, have you changed your thoughts or methods of teaching as a result of the Project-based Research course?

You have now completed the survey. Thank you for your participation. The information you contributed will help in understanding the effectiveness of project-based learning used in the Project-based Research courses at Li-Shan Senior High School.

**Appendix D: Explanation of Figure 4**

Item 1: The project is the center of the Project-based Research course curriculum

Item 2: There is a major question or problem to drive students to encounter the central concepts of a discipline.

Item 3: The project involves students in a constructive investigation.

Item 4: The project is primarily driven by students.

Item 5: The project is related to real-life.

Item 6: The project follows a general pattern of identifying a problem, design a plan, investigating the problem, identifying solutions to the problem, and reflection.