Full Length Research Paper

Overcoming the imbalance in the supply and demand of professionals in the marine industry: Professional development of marine education in Taiwan

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Citizens in Taiwan have been observed to continually have insufficient knowledge about their country’s ocean due to the political issues with China and the Martial Law Order issued in 1949. Not many people are willing to be involved in the marine industry, thus resulting in an imbalance in the demand and supply of high-caliber professionals in these sectors. To overcome this imbalance, teachers need to play important roles in commencing marine related education. This paper focuses on the marine related education of teachers to find out how the central government together with the local governments and universities/schools promote Marine Education Policies. We also used the information resources and test statistics to find out if there is any improvement in teacher professional development. The results show a systemic improvement based on the fact that the government promotes in-service education on teachers’ professional development in marine education following the Ministry of Education issuance of a White Paper on Marine Education Policies in 2007.

Key words: In-service teacher education, marine education, White Paper on Marine Education Policies.

INTRODUCTION

Taiwan is surrounded by sea on four sides, and is a typical island country. Citizens of Taiwan are expected to have marine awareness and knowledge, but this has proved difficult to achieve because of political issues with China and a martial law order issued in 1949 (Blundell, 2012). In addition, the government took the “land is power outlook” to implement education, resulting in a lack of marine education in schools. Fan (2006) pointed out that the textbooks’ content on general marine education was less than 4.3% at all education levels.

Before lifting the curfew placed in 1988, the ocean and coast were strictly controlled, because they were an important part of the nation’s defense. Aside fishermen, people could not easily go close to the ocean. This led to a natural fear of the ocean. Traditionally, marine related science, turbine, shipping and shipbuilding. According to the White Paper on Marine Education Policies in 2007, the traditional industry has shifted to the sunrise industry due to contributions of the knowledge economy and marine, and information technology being applied to marine industry development in recent years. There are five marine senior vocational schools in Taiwan but they have faced the difficulty to recruit students. In 2006, school enrolment in Marine Cluster, Fishery Cluster, and Non-Marine and Fishery Cluster was less than the schools’ expectation to recruit students and they were 13.44, 11.52, and 9.27%, respectively (statistics was taken from White Paper on Marine Education Policies, Ministry of Education). The statistics show that the marine industry lacks high-caliber professionals. According to the Ministry of Education, several complaints have been received from the industry regarding shortages of qualified marine professionals and this has resulted to imbalance of supply and demand.

In 1984, the United Nations implemented the United
Nations Convention on the Law of the Sea (UNCLOS) to provide clear recommendations on the intelligence and qualifications of human resources in the marine industry. The Taiwanese government issued its first White Paper of Ocean Management in 2001, and declares that Taiwan is an oceanic country.

Taiwan should extend its development toward the ocean and create opportunities for its blue territory; to make this happen, marine related education is needed. Thus, the Ministry of Education issued a White Paper on Marine Education Policies in 2007 and a 5-year Marine Education Executive Plan from 2007 to 2011; the purpose is indeed the implementation and evaluation of the objectives of White Paper on Marine Education Policies.

In consideration of the persistently insufficient knowledge of the citizens of Taiwan about the nation’s ocean, and complaints from the industry regarding shortages of qualified marine professionals, and lack of practical experiences by teachers in marine related vocational schools, the Ministry of Education planned and designed from the school curriculums the following agenda: teachers education, teaching innovation, equipment improvement, forming cultivation of students’ ability, teaching assessment or certificate, promotion and other related support.

Teachers play important role in this development; therefore in this study, the researchers focus on teacher education to find out how the central government together with the local governments and universities/schools see to the improvement of teacher professional development of marine education related learning. The rest of this article is structured as follows. First, a conceptual framework of the study comprising a review of related studies and the brief research goals was given, after which the research methods and sources used were explained. This was followed by the interpretation and analysis of data and finally the conclusions were given.

CONCEPTUAL FRAMEWORK OF THE STUDY
Related studies

Linking teacher and student learning to improve professional development in a systemic reform

Fishman et al. (2003) used an analysis of relevant content standards and evidence of student performance to gauge areas of need. They were of the opinion that professional development should be about teacher learning such that there will changes in the knowledge, beliefs, and attitudes towards teaching in developing new concepts and processes. They introduced four professional development design elements: content, strategies, sites, and media. The content of professional development learning is what designers anticipate that teachers would learn from professional development activities with knowledge related to the general enterprise of teaching or skills related to the usage of tools. Strategies are the pedagogical approaches employed to teach teachers professional development activities. A site for professional development is the context in which teacher learning takes places. The media through which professional development might be conducted are: face-to-face interaction, video, audio, computers, or print. The purpose of this paper is to present evidence linking student and teacher learning of value as an approach to design decisions in professional development.

A systemic approach to professional development: Learning as a practice

Knight (2002) used theories that emphasize on learning situated-ness and non-formal qualities, and related writings on knowledge management. He stated that we need a book to suggest ways of connecting all forms of professional development into a systemic relationship. The paper argues that something of importance has been insufficiently considered in policies, practices and books, and that, restricted theories of learning underpin many of them.

Aim of the study

This study aims to find out how the central government links to the local governments and universities/schools to promote teacher professional development of marine education related learning (Figure 1). The researchers would like to find out what policies, decisions and plans were made by the central government, and how the local governments and universities/schools act and co-operate with them following the 5-year Marine Education Executive Plan. Finally, the researchers would also like to find the evidence of Marine education related learning of teachers to see how they promote professional development of marine education.

In this paper, professional development only refers to the first stage of in-service professional development for teachers because much attention has been given to marine education in recent years (the White Paper on Marine Education Policy was enacted and implemented in 2007). Teachers need to deepen their knowledge and improve their skills on the course of their careers. Thus the first stage is to start in-service training in marine education for teachers.

METHODS

This study uses interpretative and comparative analysis to find out how the central government links to the local governments and universities/schools to systematically promote policies. The
statistical methods was performed to find the statistics evidence of improvement of in-services teacher education in marine related training courses before and after the Ministry of Education implemented the “White Paper on Marine Education Policies” in 2007.

**Sources**

The sources of information on policies, decisions and planning, and the sources of our data are shown in Table 1.

<table>
<thead>
<tr>
<th>Information</th>
<th>Sources</th>
</tr>
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<tbody>
<tr>
<td>White Paper on Marine Policies</td>
<td></td>
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<tr>
<td>White Paper on Marine Education Policy</td>
<td></td>
</tr>
<tr>
<td>Marine Education Executive Plan from 2007 to 2011</td>
<td>2007</td>
</tr>
</tbody>
</table>

**Sources of data**

The data were sourced from the In-service Information Web database, National In-service Teacher Education Information Web (2010) the web of the Study Area of Fisheries and Aquatic Science, and the Study Area of Marine Science web. To find evidence of marine education related learning of teachers, the following data items are required:

(1) Number of in-service teacher education of marine education related courses from 2005 to 2010.
(2) Total number of people participating in marine education related courses.
(3) Number of marine education related courses funded by the government.
(4) Number of marine related training courses for teachers provided by organizations or schools.
(5) Number of marine education courses for teachers by the Center of Study Area of Fisheries and Aquatic Science and Study Area of Marine Science.

RESULTS

Instrumentation, statistical method and data analysis

The statistical software R version 2.11.1 was used to apply Poisson regression to the analysis of one dimensional contingency table and then equally testing marine related training courses for in-service teachers before and after the Ministry of Education implemented the “White Paper on Marine Education Policies” in 2007 by testing for details of all zero in the Poisson model. This was done using the null model deviance, or equivalently, the ANOVA table. The analysis of deviance table was given and then the statistical report was prepared.

Interpretation and analysis of data

The policies, decisions, and planning were made by the central government and then passed to the local governments and universities/schools to execute and cooperate. The organizational structure (Figure 2) shows that the Ministry of Education is under the Executive Yuan (Executive, 2012). Executive Yuan is in charge of the nation’s internal affairs. If Executive Yuan implements any educational related planning, decisions, or policies, it will pass the order to the Ministry of Education, who will then follow the order to make the planning, decisions, or policies more specific. Once the planning, decisions, or policies have been made, the Ministry of Education will in turn pass the order to education departments of local governments or directly pass it to schools or universities to execute. The education departments of local governments may then pass the order to schools or universities.

Central government: Policies, decisions and planning

There are five Yuan in the central government and Executive Yuan is one of them. Executive Yuan is the highest administrative organ in Taiwan and the Ministry of Education is under it. The responsibilities of the central government are to create policies, make decisions and planning.

The Executive Yuan issued its first White Paper of Ocean Management in 2001, declaring that Taiwan is an oceanic country. Taiwan should extend its development
toward the ocean and create opportunities for its blue territory. In 2004, “Framework on National Marine Policies” for education aimed at promoting marine scientific research based on national development-orientation, and guide marine education development at all levels to help with training marine professionals. In 2006, “White Paper on Marine Policies” was enacted and implemented. It put the marine development into action generally through various policy planning.

The expectations of marine related policies on marine education are outlined in two phases namely: general education and professional education. For general education, the expectations are: (1) increasing the consciousness of the towards the nation’s ocean, (2) striving to improve education on general knowledge of the ocean, and (3) cultivating and promoting marine culture. For professional education, the expectations are: (1) improving professional training and enrolment mechanisms (sailing, turbine, environmental protection, science and technology, shipping management, tourism, fisheries, and shipbuilding), (2) the need for the school curriculum and content to meet the requirements of industries, (3) coordinating sharing mechanism on marine database and resource, and (4) improving knowledge of marine law and politics management.

According to “Framework on National Marine Policies of 2004” and “White Paper on Marine Policies of 2006”, the primary marine development is to train marine experts and improve the marine knowledge of students at all school levels, to help with the promotion of marine education related policies by Executive Yuan, the Ministry of Education implemented the “White Paper on Marine Education Policies” in 2007. It was based on our existing marine education plans that we went ahead to officially set up goals, directions, and strategies for our future development in marine education, and teacher education is one of the important marine education plans. In addition, the Ministry of Education provides a 5-year Marine Education Executive Plan from 2007 to 2011. The purpose is indeed to implement and evaluate the objectives of the White Paper on Marine Education Policies.

According to the Marine Education Executive Plan, the Ministry of Education gives the subsidy to the local governments, the Center of the Study Area of Fisheries and Aquatic Science and the Center of the Study Area of Marine Science, and conducts the in-service teacher education. The local governments conduct activities about general knowledge of marine, marine education, and teaching demonstrations; whereas the Center of the Study Area of Fisheries and Aquatic Science and the Center of the Study Area of Marine Science conduct activities about professional marine education. The Ministry of Education also encourages universities with teacher education, other universities and vocational schools to conduct related marine education for teachers. The Central Regional Office under the Ministry of Education is the coordinator of the marine education training for teachers of junior high schools who would want to participate in the “experiencing and study camp at sea” and lectures by carriers.

Figure 3 summarizes the policy flow to develop...
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Table 2. General information on in-services teacher education in marine related training courses.

<table>
<thead>
<tr>
<th>Policies</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Year</td>
<td>2005</td>
</tr>
<tr>
<td>No. of courses</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total no. of people that participated</td>
<td>55</td>
<td>76</td>
</tr>
<tr>
<td>Fund</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

1Two additional classes did not close the case; 2one additional class did not close the case; ^3counted in person-time.

Figure 4. Bar graph showing the number of marine related courses for teachers from 2005 to 2010.


Table 2 shows the general information of in-service teacher education in marine related training courses. The table shows that in 2005 and 2006 there was only one marine related course for teachers, but there was a large increase after the Ministry of Education implemented the “White Paper on Marine Education Policies” in 2007. From 2008 to 2010, marine related courses for teachers were between 16 and 20 courses each year (it is also shown in Figure 4 that there is a large increase in the number of courses in 2008). The number of people who participated in the marine related courses increased with the increase in the number of courses. In 2005, it was observed in the person-time scale that only 55 persons participated in the courses but in 2009, the number reached 290 and then dropped to 115 in the subsequent year (Figure 5). From 2005 to 2009, the funding by the government, universities and schools are to execute the activities and co-operate with the central government in order to reach the required expectations. They conduct in-service marine related education in accordance with the White Paper Marine Education Policy of 2007 and the Marine Education Executive Plan.

Role of Local Government

The roles of the education department by the local government, universities and schools are to execute the activities and co-operate with the central government in order to reach the required expectations. They conduct in-service marine related education in accordance with the White Paper Marine Education Policy of 2007 and the Marine Education Executive Plan.
government on marine related education training courses for teachers was increased from 0 to 10 courses. However, only one course was been funded by the government in 2010. According to the Center of the Study Area of Fisheries and Aquatic Science and the Study Area of Marine Science, they used the subsidy from the Ministry of Education to conduct 3 in-service teacher education courses in 2010.

Table 3 shows the analysis of the deviance table by using a statistical technique known as Analysis of Variance. We used this technique to test equally the number of marine education related learning courses for teachers before (2005-2007) and after (2008-2010) the Ministry of Education implemented the “White Paper on Marine Education Policies”. The table shows that the null residual deviance is 44.666 on a 5 degree scale of freedom with a p-value of 1.696352e-08 (1.696352* 10^{-8}). It indicates extremely strong evidence that the number of marine education related learning courses for teachers before the Ministry of Education implemented the “White Paper on Marine Education Policies” is not equal to the number of marine education related learning courses for teachers after the policies were implemented.

Table 4 shows the number of marine related training courses for teachers provided by organizations or schools. It shows 12 training courses supported and provided by the foundation in 2010. Marine related vocational schools were the major training provider. They provided 44 related marine courses in total for teachers from 2005 to 2010. Out of those courses, 15 and 19 were provided in 2008 and 2009 respectively; other secondary schools only provided 4 courses in total.
related courses can be divided into general education for teachers at all school levels and professional education for senior high school or vocational school teachers. Table 5 shows 16 marine related courses in general education for teachers at all school levels from 2005 to 2010. Out of those courses, there were 12 in 2010 and that was the highest number recorded. There were 44 courses in total in professional education for senior high school or vocational school teachers. Out of those courses, there were 14 and 19 in 2008 and 2009 respectively.

### Conclusions

At the beginning of this paper, it can be observed that we only discussed the first stage of in-service professional development for teachers because much attention has been given to marine education in recent years (the White Paper on Marine Education Policy was enacted and implemented in 2007). Thus we only stand on decision makers' point of views and focused on the investment of in-service training on marine education for teachers. The results showed a systemic improvement, based on the fact that the government promotes in-service training on teachers' professional development in marine education since the Ministry of Education implemented the White Paper on Marine Education Policies in 2007 and Marine Education Executive Plan. However, the 5-year Marine Education Executive Plan is the first phase to be executed. This project will end at the end of 2011. To overcome the imbalance in supply and demand, the following outcomes are expected:

1) To improve students' basic knowledge of oceans.
2) To improve the entry-level and quality of high-level professionals in the marine industry.
3) To encourage students and parents to favour marine education and career opportunities.

The development of marine education in Taiwan still has a long way to go. Taiwan needs time to overcome the issue of imbalance in the supply and demand of high-caliber professionals. According to the Marine Education Executive Plan, after the 5-year project has come to its end, the Ministry of Education will continue to give related funding to support marine education. This will encourage related departments, local governments, and schools to arrange their own budgets for sustainable implementation of marine education. However, a further research on the effectiveness of development of marine education and the results obtained in overcoming the issue of imbalance in supply and demand will be required in the future.

### REFERENCES


