The Efficiency and Effectiveness of the K-12 Energy Technology Education Promotion Centers in Taiwan

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Author Note

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Abstract

In order to promote energy literacy for graders K-12, the Ministry of Education (MOE) in Taiwan initiated a K-12 Energy Technology Education Project in September 2010. This 40-month project has one project office affiliated to a university, and 18 promotion centers affiliated to 18 schools - including 5 regional centers for upper-secondary schools and 13 county/city centers for kindergartens, elementary schools and lower-secondary schools. The main duties of promotion centers are: (1) Recruiting seed teachers/teacher leaders for grades K-12; (2) Recruiting volunteers and narrators for promotion centers; (3) Promoting energy education within their regions/counties/cities, and (4) Establishing websites for energy technology education. Yearly key performance indicators (KPIs) of each promotion center are negotiated among the project office and the promotion centers. The 40-month grant for promotion centers will be ended at the end of 2013. The purpose of this paper was to examine the efficiency and effectiveness of the K-12 energy technology education promotion centers. As a result of a document analysis and a gap analysis, the following efficiency and effectiveness of promotion centers are found: (1) Not every center meets its own KPIs, which were negotiated with the project office; (2) All centers meet their KPI targets in the following three duties: establishing energy exhibition space, recruiting and training volunteers or narrators, and building a website; (3) “Recruiting seed teachers” is the most difficult duty to conduct and every year about a half of the centers do not meet their KPI targets; and (4) The rationale for establishing promotion centers is good and well-supported. Based on the above findings, the following conclusions can be made: (1)The efficiency and effectiveness of the promotion centers are satisfactory; (2) The administrative region-based centers need to be reshaped to become cellular station base-oriented to increase the efficiency and effectiveness of promotion centers; and (3) New promotion centers can be required to focus on the following three aspects of energy education in descending order of priority: strengthening daily energy-saving and carbon-reduction, improving existing energy technologies, and developing new energy technologies.

Keywords: energy education, technology education, efficiency, effectiveness

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PURPOSE

Taiwan depends heavily on imported energy (about 99% of total energy consumption). Both broadening the resources of energy and economizing on consumptions of energy have increasingly become a critical issue. In order to respond to the issue, the Ministry of Education (MOE) initiated the "Nurturing Talents for Energy Technology" pilot project in September 2010 to promote energy education for K-12 and college. Targeted at all levels of the K-12 spectrum, the K-12 Energy Technology Education Project (the K-12 project) is one of its two sub-projects. It aims to equip students in grades K-12 with energy literacy, which is “an understanding of the nature and role of energy in the world and daily lives accompanied by the ability to apply this understanding to answer questions and solve problems” (U.S. Department of Energy, 2013).

In addition to working on research and development such as identifying energy literacy for all students (e.g., Lee & Lee, 2013) , assessing students’ progresses in energy literacy and examining effective teaching strategies, the K-12 project has one project office, affiliated to National Taiwan Normal University (NTNU), and 18 promotion centers affiliated to 18 schools - including 5 regional centers for

upper-secondary schools and 13 county/city centers for kindergartens, elementary schools and lower-secondary schools. In 2011, there were 22 promotion centers in total, as shown in Figure 1. The main duties of promotion centers are: (1) Recruiting seed teachers (i.e., teacher leaders) for grades K-12, (2) Recruiting volunteers and narrators for promotion centers, (3) Promoting energy education within their regions/counties/cities, and (4) Establishing websites for energy technology education.

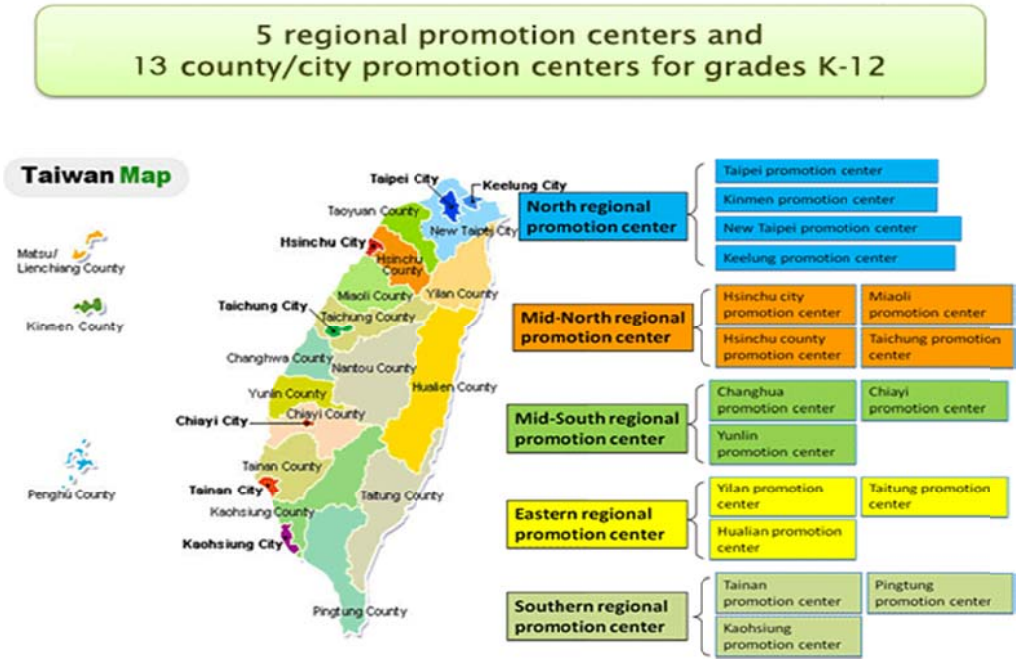

Figure 1. 22 promotion centers in 2011
Source: Energy Education Website, 2011.

The 40-month grant for promotion centers will be ended at the end of 2013. The purpose of this paper is to examine the efficiency and effectiveness of the K-12 energy technology education promotion centers. Efficiency refers to “doing the things right” or “the ratio of output to input” and focuses on “getting the maximum

output with minimum resources" while effectiveness refers to "doing the right things" or "the extent to which the actual output meets the desired output" (DifferenceBetween.net, u.d.).

METHODS

Gap analysis is the comparison of current situation (or actual performance) with ideal situation (potential performance). In order to examine the efficiency and effectiveness of the K-12 energy technology education promotion centers, a gap analysis model such as the concept shown in Figure 2 was employed.

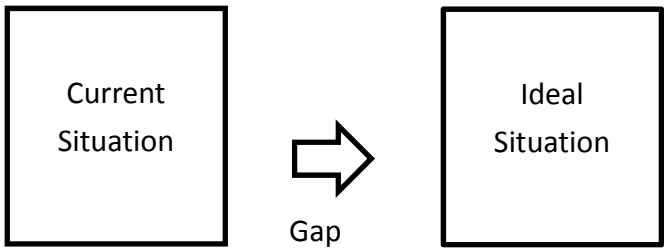

Figure 2. A conceptual model of gap analysis

A detailed description of current situation and ideal situation (i.e., the intended result or outcome) and some strategies to close the gap can be obtained from the quarterly reports submitted from the promotions centers to the project office and the site-visit reports completed by the external reviewers. The promotion center site-visit has been periodically conducted by the project office. The external

reviewers of site-visit have been nominated by the project office and approved by the MOE. Thus, the methods used in this paper include document analysis and gap analysis.

FINDINGS

As a result of a document analysis, the following accumulated outcomes were accomplished by the promotion centers between September 2010 and August 2013:

1. Established about 20 energy technology promotion centers, 251 partner schools and 38 exhibition spaces equipped with hardware and software resources, to implement and promote energy technology education.
2. Recruited and trained 501 seeds teachers and 652 lesson planning teachers, developed 705 creative lesson plans and 210 digital teaching materials, for enriching teaching resources and equipping students with energy competence and literacy through formal curricula to promote their actions of energy-saving and carbon-reduction.
3. Recruited and trained 1,785 volunteers or narrators who have led energy technology education from initial sowing, to sprouting, growing vigorously, flowering and fruiting everywhere.
4. Held 355 workshops for teachers and 179 teaching demonstrations, which

allowed many teachers to take part in energy technology education.

5. Held 441 diverse, interesting and hands-on energy technology activities to enhance the energy literacy of teachers, students and the public through learning by doing.
6. Formed energy drama teams and performed about 41 shows on different campuses, which remind teachers and students to value energy and energy-saving through lively dramas.
7. Held 96 student energy technology education contests to attract nation-wide students and their teachers to participate in and be keen on energy issues, energy-saving and carbon-reduction approaches.
8. Created and maintained 25 energy technology education websites (including Google sites and social networking sites), which share and promote energy technology education, and have accumulated 1,676,580 person-time visitors in total.
9. Published 15 energy technology education monographs or books, which promote energy technology education or record what have been done by the project.
10. Demonstrated other features such as publishing picture books, constructing energy resource maps, conducting related research studies, etc.

As a result of a gap analysis, the following efficiency and effectiveness are found:

1. Not every center meets its own KPIs, which were negotiated with the project office.
2. All centers meet their KPI targets in the following three duties: establishing energy exhibition space, recruiting and training volunteers or narrators, and building a website.
3. “Recruiting seed teachers” is the most difficult duty to conduct. Every year about a half of the centers do not meet their KPI targets.
4. The rationale for establishing promotion centers is good and well-supported.

CONCLUSIONS

Based on the above findings, the following conclusions can be made:

1. The efficiency and effectiveness of the promotion centers are satisfactory. Although “not every center meets its own KPIs,” the external reviewers of site-visit are satisfied with the efficiency and effectiveness of the promotion centers. For example, the reviewers pointed out that many promotion activities/measures need strong supports from local educational authorities. Therefore, a part of performance deficiencies should not be totally attributable to promotion centers.

2. The administrative region-based centers need to be reshaped to become cellular station base-oriented to increase the efficiency and effectiveness of promotion centers.

   It is criticized that a region/county/city is too large to be served well by a promotion center located in the region/county/city. Thus, a cellular station base-oriented promotion center is suggested for further consideration.

3. New promotion centers can be required to focus on the following three aspects of energy education in descending order of priority: strengthening daily energy-saving and carbon-reduction, improving existing energy technologies, and developing new energy technologies.

   Because the scope of energy technology is broad, some promotion centers do not prioritize what they have to do. It is clarified that the following three domains should be focused on in descending order of priority: strengthening daily energy-saving and carbon-reduction, improving existing energy technologies, and developing new energy technologies.

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