# APPLYING GEOGRAPHIC NAMES INFORMATION SERVICE IN HIGH SCHOOL EDUCATION OF TAIWAN

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**Abstract**

Geographic names are reflection of what people think of a particular place, including its surrounding environment, community, culture, and histories. As geographic names carry abundant spatial and historical meanings, study of geographic names may help to understand the characteristics and development of a place. In order to better manage the geographic names in Taiwan, the Ministry of the Interior (MOI) has created a comprehensive geographic names database and established a Geographic Names Information Service (GNIS) website. This research aims to explore the potential of using this website for school education. Specifically, we developed 10 teaching modules that can be used for high school classes and organized a series of workshops for high school teachers. The analysis discussed how these teaching modules and workshops were designed and the results of their applications. In summary, the findings showed that the participants felt very positive to the use of the website above-mentioned and encouraged to introduce it in the classroom. They agreed that geographic names would significantly help to develop the sense of places and strengthen the spatial thinking of students, which are important concepts and skills in geographic teaching.

**Keywords:** geographic names database, high school education

## 1. INTRODUCTION

A geographic name, which is usually given by its residents or settlers, is a major component of the identity of a place. It often portrays the characteristics of the surrounding environment, community, culture, and history of a particular place (Chen, 2006). Because geographic names carry abundant geographical and historical meanings, the study of them may contribute to understanding of the characteristics and evolution of a place (Tsai *et al.,* 2013). Taiwan has great diversity in its geography, history, and culture, so it has accumulated a rich collection of geographic names. These geographic names first appeared on maps in the early 17th century, when the Portuguese, Spanish and Dutch explorers "discovered" Taiwan. However, it was not until the late 19th century that the geographic names of Taiwan began to be surveyed and recorded comprehensively by its ruling powers, namely the Qing Empire, which claimed its sovereignty over Taiwan from 1683 to 1894, and the Japanese colonial government, which ruled Taiwan from 1895 to 1945. Today, the management of geographic names in Taiwan is an important responsibility of the Ministry of the Interior (MOI). Along with the digital archive project and National Geographic Information System project, the government of Taiwan has made great efforts to create and maintain a geographic information database and related websites since 2000. In order to manage these geographic names, which are a precious part of the heritage of Taiwan, the MOI has created a geographic names database, the "Geographic Names Information Service (GNIS)" website[1].This openly accessible website provides a wide range of data and functions. Thus, a major concern of the MOI is the promotion of the application of this website.

Research interests focused on geographic names in Taiwan are diversified. The areas of research topics include the humanities approach, focusing on ethnic issues; the ethnolinguistic perspective, focusing on languages and phonetic issues; and historical perspective, focusing on the evolution of places and names (Tsai *et al.,* 2013; Chen, 2004; Chen, 2007; Lu, 2014; Lu, 2015). In the recent decade, increasing  studies have focused on relevant education issues. Chien (2003) noted the advantages of integrating geographic names into native education in elementary and high school curriculums, yet comprehensive information on the development and transformation of geographic names in Taiwan is lacking. Chen (2005) noted the importance of geographic names in map teaching and created sample teaching materials on classification of geographic names. Yu (2002) also suggested that geographic names are important components of maps and stressed the importance of accurately marking geographic names on maps.

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[1] The website address: http://gn.moi.gov.tw/GeoNames/index.aspx

Supported by the MOI, this research team conducted a series of tasks to promote the GNIS website and database. Among the many possible applications and potential users, we think high school teachers are the most promising targets of promotion. An important reason is that students begin to learn about the history and geography of Taiwan in high school. It should also be noted that, with democratization of the society and the rising awareness of the Taiwanese identity, the emphasis on history and geography in school education has increased over the past two decades. Furthermore, since use of Geographic Information System (GIS) is currently promoted in high school education in Taiwan, open GIS resources such as the GNIS could be an inspiring tool for both teaching and learning.

Therefore, this research attempted to explore the potential for applying the GNIS website to high school teaching. Specifically, we developed 10 teaching modules and organized a series of workshops for high school teachers. The rest of this paper consists of three sections and a conclusion. Section 2 discusses the nature and value of geographic names in Taiwan. Section 3 introduces the content and functions of the GNIS website. Section 4 describes our promotion efforts and the results. The paper concludes with a summary of the study and the important findings.

## 2. GEOGRAPHIC NAMES IN TAIWAN

The geographic names in Taiwan are quite diverse due to both geographical and historical reasons. Geographically, the physical environment and cultural landscape in Taiwan are very rich, thus providing many characteristics that lend themselves to place names. For example, the features of mountains, rivers, plains, vegetation, and local animals have widely been adopted as the names of places. Furthermore, Taiwan is densely populated, with settlements of various sizes spread all over the island. Each place requires a name to differentiate it from others. Historically, in addition to its indigenous people, Taiwan has accommodated explorers or settlers from many different countries, such as Spain, the Netherlands, China and Japan (Abe, 1937; Sun, 2007). These people brought or created names for places in Taiwan. As a result, a single place in Taiwan may have several different names that reveal the environmental perceptions and cultural heritages of the various peoples who once lived here. Even among the Chinese immigrants who immigrated to Taiwan at different times, the Hoklo, Hakka, and Mandarin speakers often used different words in various dialects for the same features (Wei, 2004). All these factors have contributed to the diversity of geographic names in Taiwan.

According to Abe (1938), a Japanese scholar who pioneered the study of geographic names in Taiwan during the Japanese colonial period, Taiwanese

geographic names derive mainly from five sources: natural topography, natural resources, land development and ethnic groups, industrial production, and oral histories. Based on Abe's findings, we further categorized the geographic names in Taiwan into the following six groups:

(1) Topographical features: Located at the boundaries of tectonic plates and strongly influenced by active geological processes, Taiwan has very complicated landform. The terrain of an area may change dramatically within a short distance. These abundant terrain features are often adopted for naming places, such as *San-Jz-Jiao* (山仔腳; foot of hills), *Pin-Ding* (坪頂; top of terrace), *Lun* (崙; hill ) . Overall, topographical features are the most prominent attribute of geographic names in Taiwan(Abe, 1937; Chen, 1993).

(2) Plants /Animals: The flora and fauna of a landscape are commonly adopted in naming places as well. For example, *Citong* (莿桐; erythrina variegata), *Jiadong* (茄苳; autumn maple tree) and *Jiuqiong* (九芎; subcostate crape myrtle) are plant names, while *Lu* (鹿;deer), *Qiang* (羌/羗; muntiac), *Gui* (龜; turtle) are animal names widely used in geographic naming in Taiwan (Wang *et al.,* 2006). These names reflect the local plants or animals of the area. Furthermore, the plant or animal names are often combined with other spatial terms (such as up, down, or foot) to form a full name (Shuie, 2006).

(3) Land Development: Along with the development of land and agricultural reclamation, explorers 200-300 years ago established collaborative organizations to jointly develop areas in Taiwan. The cooperation modes of these organizations were often conferred on the areas being developed, such as *Wugu* (五股; corporation of five interested parties) (Shiu 1996). Besides developments conducted by the private sector, some developments were conducted by official rulers assigning military forces to different areas, resulting in places names such as *Xinying* (新營; New Camp), *Zuoying* (左營; Left Camp) and *Linfengying* (林鳳營, Lin-feng Camp) (Jhang, 2012; Lee, 2008).

(4) Industrial production: This type of geographic name is related to plantations or agricultural productions (Lin, 1997). Since the 17th century, tea, sugar and camphor have been important local industries in Taiwan. Therefore, many places names are associated with these economic activities, such as *Zhangliao* (樟寮; the place where camphor is produced).

(5) Ethnic groups: The peoples of different ethnic groups created geographical names based on their own cultural backgrounds. A common example is that the Hakka people would use the word *Wu* (屋) in the name of a small village , while the Hoklo people would use the name *Cuo* (厝) for the same entity. Such geographic names reveal the cultural and ethnic backgrounds of the early settlers (Wei *et al.*2013; Wei, 2004).

(6) Indigenous people: Before the arrival of Han immigrants, the indigenous

people created geographic names for their own use. Many of these names have been lost, while some have remained preserved in the oral languages of the surviving tribes. In addition, some geographic names related to indigenous people were associated with Taiwan's colonial history. For example, names with *Fan* (蕃; native people) and *She* (社; native tribes) were given by the Japanese during the colonial period, which indicated settlements of indigenous people (Lu, 2014; Lu, 2015).

The categories listed above are commonly used in the study of geographic names in Taiwan. As the environment in Taiwan has been changed dramatically by urban and industrial developments over the last century, early geographic names may help us to comprehend the history and environmental change of an area. This is a unique value of geographic names in Taiwan.

## 3.   CONTENT AND FUNCTIONS OF THE GNIS

To better manage these geographic names, the MOI has created a comprehensive geographic names database and established the "Geographic Names Information Service (GNIS)" website. This openly accessible website provides a wide range of data and services. In terms of the database, GNIS contains more than 110,000 records of geographic names. Each record is composed of several fields, including the name, coordinates, type, description, and data sources. Users can query and plot the results on a map. With such a comprehensive database as the core, this website provides several useful functions as introduced below.

(1)   Keyword Query: This function allows users to input keywords of geographic names and search the geographic names database. The query results can be listed as a table and shown on an interactive map. Users can select certain query results and read their backgrounds. In addition, users can export the query results into a .KML file that can be used in Google Earth or other GIS software such as ArcMap or Q-GIS. These functions allow users to further explore the locations or analyze spatial patterns of certain geographic names in combination with other GIS tools.

(2)   Map Query: The main interface of this website is a map query system composed of two sets of maps, a base map and feature map. The default base map is a 'General' Map of Taiwan, the official digital map maintained by the Bureau of Surveying and Mapping. Users can switch the base map into aerial ortho-photos provided by the same agency as well. On top of the base map, users can choose to overlay a series of scanned historical maps dating back to 1904. As maps are a major source of geographic names, these comprehensive maps provide good sources for potential users who are searching for geographic names and studying environmental change of Taiwan.

(3) Administrative boundary query: The website provides options to query administrative boundaries at city/county, district/township, and village levels. The results are shown on the base map and/or feature maps, allowing users to explore the area of interest using maps from various times.

(4) Spatial Positioning: This website allows the user to import the coordinates of a specific location to show the existing maps. In addition, it also allows users to explore the geographic names and their surrounding areas of certain location.

(5) Digitizing: This function allows users to digitize a specific feature of interest derived from the map layers provided and to store the digital result as a .KML file. This feature of interest can be a point, line, or polygon. This function also allows users to digitize features from one map and save them as a main layer for another use, such as overlaying it on another map or for GIS analysis .

(6) Name Translation: This function provides the official English translations of geographic names in Taiwan. In addition, users can choose to translate the names by single input (for one-by-one search) or by batch input (for multiple searches, by uploading a list of place-names).

**Figure 1: The home page of the GNIS provides six main functions, including keyword query, map query, administrative boundary query, spatial positioning, digitizing, and name translation.**
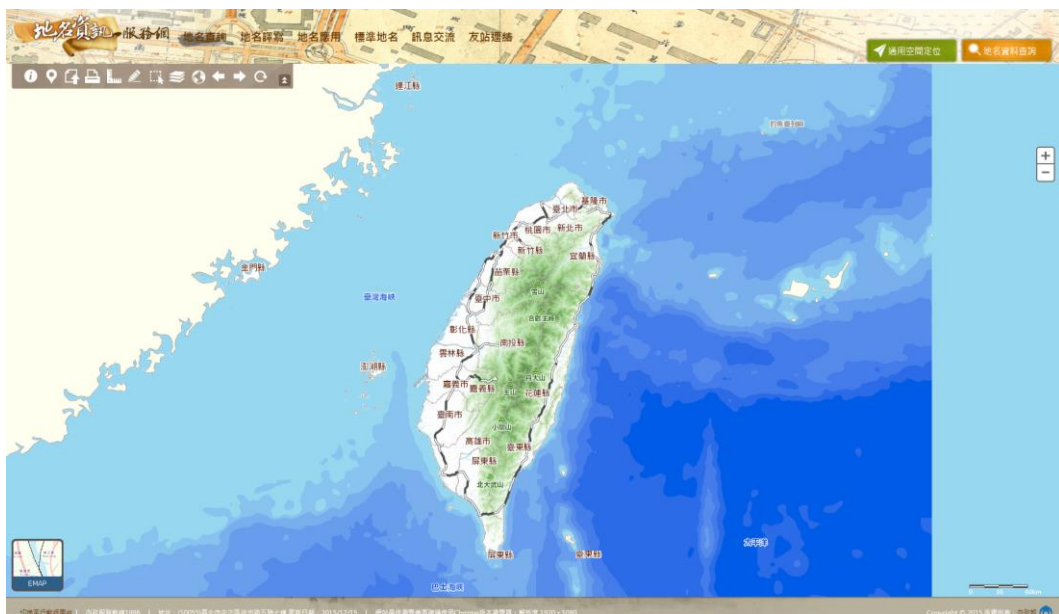


As introduced above, this website was created with GIS facility in mind. The database of geographic names is composed of coordinates that can be an input to different GIS tools. However, compared to other open GIS tools like Google Earth,

the GNIS has three major advantages. First, it provides information about the meanings of geographic names rather than merely showing their locations. Second, the website provides a series of geo-referenced historical maps that allow users to compare the names of a place at different times and observe their transformations in relation to land-use changes. Third, the query functions make it possible to study the spatial pattern underlying a group of geographic names. For example, one can search for place names with the same keyword and explore their distributions. In this way, the relation between geographic names and other environmental characteristics, such as topographical features and distributions of ethnic groups, can be visualized better.

## 4. DISSEMINATION AND PROMOTION

### 4.1. Development of teaching modules

We developed ten teaching modules involving the application of the geographic names database. All 10 of the teaching modules are aimed at high school education in Taiwan. These modules were designed to cover different topics of the six categories of geographic names as mentioned in Section2. The specific topics are shown in Table1.

**Table1 Topics of teaching modules**

| TOPICS | OUTLINE |
| --- | --- |
| Terrain | Names associated with terrain features |
| Plants / Animals | Names associated with local plants or animals. |
| Hydrology | Names associated with hydrological features |
| Industry | Names associated with industrial developments |
| History | Names associated with history issues |
| Ethnic | Names associated with different ethnic groups |
| Indigenous | Names originating from indigenous people |
| Politics | Names associated with political influences |
| Land development | Names associated with the development of land in early Taiwan |
| Koxinga | Names associated with Koxinga, a historical figure in  Taiwan |

Each teaching module is composed of two parts. The first provides descriptions of the geographic names, and the second focuses on the applicability of the GNIS. With clear aims in mind, these modules provide examples of applying the GNIS in classes. Below, an example module is briefly introduced to demonstrate the relationships between a terrain feature *Wo*, ethnic issues and geographic names.

The terrain feature of *Wo* (窝) was chosen for this module. The name *Wo* is a term originating from the Hakka dialect and refers to a narrow mountain valley. We

queried the geographic names database to identify all names containing *Wo*. The result of this query is shown in Figure 2.

**Figure 2: *Wo* distribution in Taiwan. The right map shows the locations of all geographic names with *Wo*. The left table shows the attributes of each of these locations, including its coordinates, geographic name, and administrative county and district name.**



| | 名稱 | 類別 | 標準地名 | 縣市 | 鄉鎮市區 |
|---|---|---|---|---|---|
| 定位 | 山豬窩 | 聚落 | 否 | 新竹縣 | 芎林鄉 |
| 定位 | 松樹窩 | 聚落 | 否 | 新竹縣 | 芎林鄉 |
| 定位 | 宋屋窩 | 聚落 | 否 | 新竹縣 | 芎林鄉 |
| 定位 | 烏龜窩 | 聚落 | 否 | 新竹縣 | 芎林鄉 |
| 定位 | 芎蕉窩 | 聚落 | 否 | 新竹縣 | 芎林鄉 |
| 定位 | 牛欄窩 | 聚落 | 否 | 新竹縣 | 芎林鄉 |
| 定位 | 牛角窩 | 聚落 | 否 | 新竹縣 | 芎林鄉 |
| 定位 | 燒炭窩 | 聚落 | 否 | 新竹縣 | 芎林鄉 |
| 定位 | 下窩子 | 聚落 | 否 | 新竹縣 | 芎林鄉 |
| 定位 | 桔子窩 | 聚落 | 否 | 新竹縣 | 芎林鄉 |
| 定位 | 茄苳窩 | 聚落 | 否 | 新竹縣 | 芎林鄉 |
| 定位 | 安屋窩 | 聚落 | 否 | 新竹縣 | 芎林鄉 |

As shown on the map, these name features appear mostly in Taoyuan, Hsinchu, and Miaoli Counties, where most of the population is ethnically Hakka. We further exported the results into a .KML file so that it could be displayed in 3D using Google Earth software (Figure 3). This example shows how a place name can be related to an ethnic background and a certain terrain feature.

**Figure 3: The appearance of terrain with *Wo* (窩)**
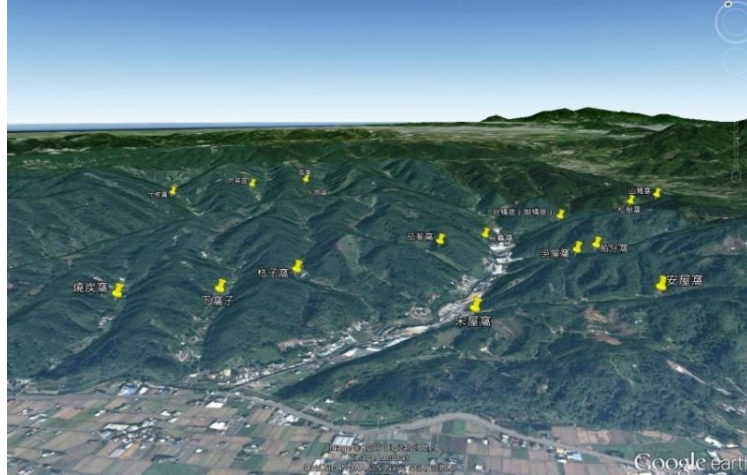


## 4.2. Organizing workshops

To promote the teaching modules, we organized eleven workshops in 2015 mainly targeting high school teachers; however, the workshops were open to anyone with interest. Each workshop lasted about 3 hours, during which each participant used a computer for hands-on experience. The content of the workshops included two parts: 1) background knowledge of geographic names, and 2) application of the GNIS website. At the end of the workshop, each participant was asked to complete a task described in a digital slideshow (in Microsoft PowerPoint) regarding how to use the geographic names in a teaching plan.

### 4.2.1. Teachers' feedback

The eleven workshops had a total of 368 participants. Among these participants, the high school teachers accounted for 75%, whereas the rest 25% included the non-teaching participants (11%), elementary school teachers (9%), and university students (5%). It is worth to note that the participated high school teachers had diverse backgrounds. While most of them were geography teachers, they also included history, math, civic education and English teachers.

The questionnaire results clearly showed that the high school teachers appreciated the way the GNIS website could be used in classes. In general, they agreed that the website could facilitate student learning about issues related to the usage of geographic names and solve geographic problems. More specifically, rich information, interesting topics and visualization functions were considered as the major advantages of using the GNIS in classroom. Most of the teachers expressed their willingness to use the website in their classes, given sufficient time and

facilities. In summary, the teaching modules were viewed favourably by the teachers. They indicated that these modules provided inspiration for both teaching and learning. They also strongly recommended that relevant workshops could be organized regularly in future.

According to the evaluation questionnaires, all the participants gave the workshops an average satisfaction rating of 4.5 out of a maximum score of 5. Overall, the participants were most greatly impressed by the numerous historical maps and the query functions of the geographic names database. In addition, the interactivity of the historical mapping and the option of exporting query results to KML format were considered very useful.

*4.2.2. Suggestions for the GNIS*

Based on the feedback from the workshop participants, we developed suggestions for the future development and application of the GNIS website.

(1) The use of the GNIS website should not be limited to only geography classes, but open to the teaching of various subjects, such as history, biology, and geology. Geographic names can help students to learn about the early environment and development of a place, which is key to a wide range of knowledge, such as the development of hometowns, climate change, and human-environment interactions. Accordingly, the website functions should be extended to allow multi-disciplinary use, and relevant teaching modules and workshops specific to other subjects should be developed.
(2) The geographic names and their positions should be better integrated. The location of a particular geographic name is crucial to its application. However, because many of the place names in the database lack coordinates due to the inherent ambiguities of historical maps, they cannot be located with GIS. The major difficulty is that many place names cannot be pinpointed to an exact position. Still, for most applications and users, an approximate position or additional textual information will be helpful for users to refer the places names and to explore their spatial contexts.
(3) Digital audio files should be linked to the place names of the site so that users can be sure of the pronunciation. The pronunciation of geographic names is important and useful to their application because very often, a name may carry different meanings depending on its linguistic origin. Therefore, the pronunciation of the name may help to eliminate such ambiguity. Compared to the conventional maps or databases on paper, it is easier to combine phonetic information (e.g. by recording the pronunciation in a digital audio format) with digital map databases nowadays.
(4) The GNIS could be combined with mobile devices to provide better accessibility to users. This design might facilitate outdoor teaching or other uses in varoius

activities.

## 5. CONCLUSION

The importance of geographic information skills has been recognized and gradually included in textbooks or the national curriculum in many countries. Since geographic names are important components of geographic information, the promotion of the study of geographic names will enhance students' learning of geographic information. Although the existing high school education in Taiwan has long regarded map reading an essential skill, little attention has been given to the derivations of geographic names. However, through the development of the geographic names database and relevant websites, it is currently feasible for school teachers to highlight the origins of geographic names and to show the meanings of such names in a geographical and historical context.

Through the efforts of developing teaching modules and organizing workshops, we investigated the potential for application of the GNIS website specifically in high school education. According to the questionnaire results, the teachers who participated in workshops on the teaching materials provided positive feedback and felt encouraged to incorporate the website into their classes. Nevertheless, some suggestions for improvements are still provided as guidance for the future development of the website in terms of both information about place-names (i.e. better accuracy of locations, integration with audio information) and service functions (i.e. combination with mobile devices).

Finally, the participants of our workshops demonstrated that geographic names are attractive to not only high school teachers, but people with diverse backgrounds and professions. Therefore, how to create multiple functions of the GNIS and to promote it to the public is an important issue for future research.

## 6. ACKNOWLEDGEMENT

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