Motivations of Content Development in Online Research Database: Towards Sustainable Platform for Knowledge Exchange and Sharing

○Takero Inoue, Shinobu Yamaguchi and Jun-ichi Takada
(Tokyo Institute of Technology)
E-mail: inoue.t.ap@m.titech.ac.jp

Keyword: participatory educational research database, sustainable online platform, knowledge exchange and sharing, volunteers' motivation

1. Introduction

The United Nations Educational, Scientific and Cultural Organization (UNESCO) declares that promoting universal access to information and knowledge is its mandate (UNESCO, 2005). In 2013, it adopted an open access policy which aims to support development of ICT infrastructure for open access using free and open source software (FOSS) as one of six objectives (UNESCO, 2013a). In Asia, UNESCO Asia-Pacific Regional Bureau for Education (UNESCO Bangkok) is in charge of facilitating knowledge exchange and sharing through a number of education research networks (UNESCO, 2014).

With this background, UNESCO Bangkok develops and maintains an online database for education research that is implemented on FOSS. The database, National Education Systems and Policies in Asia-Pacific (NESPAP), is a web-based knowledge portal to provide education experts with three functions; 1) networking opportunities; 2) thematic discussion; and 3) access to education policies and resources (UNESCO, 2013b, p.4).

Tokyo Institute of Technology (Tokyo Tech) has been collaborating with UNESCO Bangkok by providing technical assistance for NESPAP since 2013. Although the educational database had existed since 2011, it did not have an active user community and regular maintenance. The objective of this research is to analyze the problem, discuss and implement solutions, and identify requirements for sustainable system to contribute to the management of the educational database, NESPAP.

2. Analysis of the problem

2.1. Problem identification

The initial version of NESPAP was developed jointly by UNESCO and National Science and Technology Development Agency (NSTDA), the Ministry of Science and Technology of Thailand in 2011[1]. It was comprised of three components developed as standalone websites: 1) “eMap”, database of profiles of education experts and institutions; 2) “eForum”, discussion forum; and 3) “eResources”, repository of education policies and resources. The system was implemented on a web content management system called Drupal due to its flexibility in designing the software system. Although Drupal occasionally provides updates for adding new functions and combatting security threats, the NESPAP system was not updated since its development and therefore, came to have security concerns after two years of implementation.

[1] http://www.unescobkk.org/education/ict/online-resources/databases/ict-in-education-database/item/article/launch-of-the-nespap-open-platform-elibrary-1/

In 2013, Tokyo Tech-UNESCO Bangkok joint team was formed to improve NESPAP. The team integrated three components of NESPAP, eMap, eForum and eResources, on a single website using the latest version of Drupal, while adding another component, "Education System Profiles (ESP)". The ESP is a database of country profiles and analysis on education[2]. The development process, however, faced technical challenges, such as low compatibility between "plug-ins", software components that add specific features to existing software. During its effort to improve the system, feedback from the users were collected through a questionnaire survey. The results implied that there were some gaps between what users expected from the educational database and what NESPAP could actually offer.

In 2014, the team further worked on two important aspects: software design and usability. First, the software design was reviewed again to cope with the technical problems. The difficulty of integrating the four components on a single website was due to low compatibility among Drupal plug-ins. As a result, a large number of plug-ins were used. This also required an extensive amount of custom coding, leading to a complex software implementation. Second, the usability was discussed based on users' feedback. Users could not use NESPAP's multiple components with a single account. Also, there were gaps between desired and current functions.

2.2. Potential solutions and prototype development

Reflecting the problems identified above, two potential solutions, namely, WordPress and mash-up, were analyzed from the viewpoint of technical difficulty. First, WordPress is a popular web content management system which has the largest user communities among others[3]. Although Drupal provides a powerful toolset, it requires technical capabilities to customize the existing programs through development and maintenance. Since those online content management systems are free and open source, software updates are provided by user community. This is why WordPress could provide a more sustainable development platform for NESPAP. One concern was that updates are not automatic, and technical staff members who are familiar with the WordPress system would be necessary in UNESCO Bangkok. Second, a mash-up is a web development where multiple external web services are integrated in one site[4]. Such external services are provided via Application Programming Interface (API). For example, user profile information on LinkedIn can be utilized in other websites through LinkedIn's API[5]. However, developing such system would require hand coding to connect the site with external services through multiple APIs instead of utilizing existing plug-ins, and thus, a high level of technical skills would be necessary. Moreover, sharing users' data with external services was not in line with UNESCO's policy which promotes storing its resources within their organization.

2.3. Solution

Following the initial analysis, prototypes were developed using both approaches. Eventually, WordPress was adopted due to the following advantages in software design and usability. As for software design, WordPress's abundant collection of plug-ins requires little amount of custom coding. Plug-ins can

[2] http://www.unescobkk.org/education/resources/resources/education-system-profiles/
[3] http://w3techs.com/technologies/overview/content_management/all
[4] http://books.infotoday.com/books/Engard/Engard-Sample-Chapter.pdf
[5] https://developer.linkedin.com/docs/rest-api

collaboratively function and provide customized services that cannot be implemented by a single plug-in. Further, updates and back-ups could automatically be conducted by plug-ins. As for usability, the highly integrated plug-ins could manage user data in a way that can provide more convenience for users, such as logging-in to multiple components of NESPAP with a single user account. Also, the broad range of plug-ins allows easily adding new features such as conference management system.

2.4. Implementation

Implementation of NESPAP took three steps between April 2014 and February 2015. In the first step, functions of three components (eMap, eForum and eResources) were improved using WordPress. Functions of eMap and eForum were developed by combining plug-ins supporting social networking activities and discussion forum. Functions of eResources was developed by utilizing the original posting and reviewing functions of WordPress with aid of a plug-in of powerful search functions. In the second step, two features were introduced, namely, "eConf" and "eJob". "eConf" is a conference management system that allows users to schedule events and organize registrations. "eJob" is a job board that allows education experts to find job opportunities for their career, as well as to search candidates for their job openings. This component was implemented by a plug-in for job listing services. Finally, ESP was created by utilizing the original posting functions of WordPress and a plug-in for geographic mapping.

As a result of the implementation, the current system of NESPAP has a total of six interrelated components (Fig. 1)[6]. User's information, which is organized in eMap, is utilized in other components as well. Especially, users can manage their activities in eForum and eConf on the eMap's profile page. The user interface has also been updated using WordPress's template features called "themes", which provides a variety of ways to represent the site contents. There are currently more than 200 education experts registered on NESPAP.

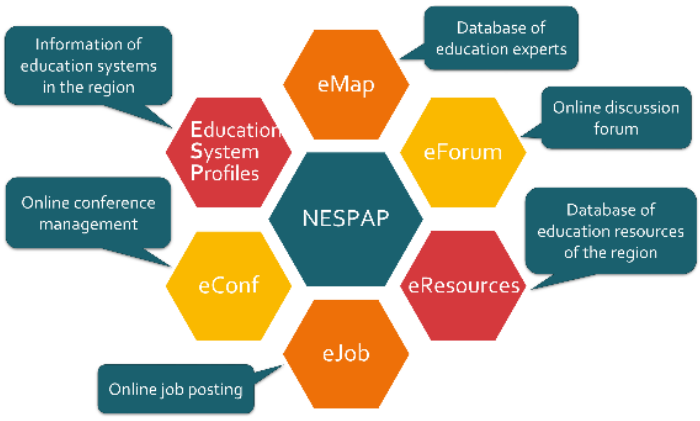

Figure 1 Six components of NESPAP. (Source: UNESCO)

[6] http://www.unescobkk.org/education/news/article/nespap-knowledge-portal-expands-functions/

3. Sustainable use of NESPAP

For the sustainable use of the educational database, NESPAP, two factors were identified important, namely, use of the software system and participants' motivation. First, sustainable use of the software system was a major focus since the outdated systems of previous implementations were prone to security threats and thus, caused concerns in UNESCO to continue the service. Second, participants' motivation was considered highly important from users' feedback received since the educational database NESPAP functions with the participation of users.

3.1. Sustainable software system

Sustainable software system was studied to answer the first research question "what is needed to manage online education research database in a sustainable way?" The following three processes took place: 1) review on the literature and discussion notes; 2) discussion within the database team; and 3) analysis of available resources of UNESCO.

First, the analysis utilized literature and discussion notes on previous versions of NESPAP. As NESPAP is developed on the web content management system, WordPress, it is important to refer to the characteristics of web content management system. McKeever (2003) describes web content management systems as "sophisticated, distributed author, multi-tiered architecture sites" (p. 691), and argues that repeated and effective content collection and delivery are necessary in the workflow to retain such advantages of web content management system. NESPAP is expected to contribute to its educational content development and delivery, and thus, it is important to focus on the workflow of the operation of NESPAP. Further, discussion notes on previous systems argues that a well-defined workflow is necessary for regular maintenance and updates of NESPAP, as well as manuals so that the maintenance team can easily understand "when", "what" and "how" to maintain and update the system. In specifying a workflow, the structure of workflow needs to be carefully considered in order to ensure consistency between individual activities (Sadiq & Orlowska, 2000). In addition, time can be a major constraint (Eder et al., 1999). Further, other various resources such as budget and human resources should be taken into account (Li et al., 2004). Reflecting those literature and discussion notes, further management of NESPAP needs to be carefully planned from workflow structure and resources point of view.

Second, the Tokyo Tech-UNESCO joint team organized discussions on investigate current concerns on NESPAP after its launch. During the discussions, structural workflow was identified focusing on three points: 1) updates of contents and functions according to users' needs; 2) management and maintenance of the database; and 3) relationship between specific roles in those activities. Further, discussion focused on the process of on-site trainings with staff members for maintaining and updating the system.

Based on above two steps, the resources for maintaining and updating NESPAP were analyzed on three factors, namely financial, human and temporal resources. Financially, no special fund is allocated for maintaining and updating NESPAP, except for budget for the network infrastructure of UNESCO Bangkok Office. Therefore, the maintenance and updates should be done at no financial cost. Further, the office does not allocate a professional particularly responsible for maintaining and updating the software system. Thus, the task should be divided and assigned to multiple staff members. When allocating time, time constraints of staff members needs to be taken into consideration.

As a result, following four improvements took place. First, users' impression and concerns about NESPAP were explored through surveys to continuously improve the system reflecting the voice of users. Second, specific roles for the management and maintenance of NESPAP were identified to create a systematic workflow with a clear definition on its management and maintenance. Third, manuals were created for different roles, providing a guide to participate in NESPAP. Fourth, trainings were conducted with the initial members of the management and maintenance team to ensure that the quality of both system and contents of NESPAP are maintained.

3.2. Participants motivation

While sustainable software system is crucial on the developer side, sustained users' participation is another factor for the sustainable use of NESPAP. Thus, the second research question was formulated as "what motivations drive people to participate in online education research databases?"

Analysis was done through literature review and on-site discussion with UNESCO Bangkok professionals. As the users' voluntary motivation was identified as a key issue, the Volunteer Functions Inventory (VFI) was found an established framework to capture volunteer motivations (Clary et al., 1998). In their study, Clary identified six major motivations for individuals to participate in volunteerism, and developed an instrument to examine which motivations is important to an individual. The six motivation includes "Values", "Understanding", "Social", "Career", "Protective" and "Enhancement" (Table. 1). This method to measure motivation has also been used in the context of participatory web content development (Nov, 2007). Nov adopted the VFI in exploring motivations of "Wikipedians", active content contributor in the online encyclopedia, Wikipedia, and identified "Values" and "Understanding" as the most popular VFI motivations among others. VFI was appropriate in investigating on NESPAP since it was a participatory database, which requires users' voluntary contribution.

In addition, on-site discussion with UNESCO experts revealed that it was important to clarify the advantages of NESPAP for educational experts, and to identify the needs of different user groups such as researchers and conference organizers.

Table 1 Six motivations.

Motivation	**Description**
Values	Expressing or acting on important values
Understanding	Learning more about the world and/or exercise skills that are often unused
Social	Strengthening one's social relationship
Career	Gaining career-related experience
Protective	Reducing negative feelings, such as guilt, or for addressing personal problems
Enhancement	Growing and developing psychologically

(Source: Clary et al., 1998)

3.2.1. Survey instrument and data collection

To measure the motivation of NESPAP users, the survey instrument was developed based on the VFI's motivation structure. The questionnaire adopted an extended structure, integrating questions that relates motivations and specific tasks to identify the respondent's task preferences in relation with motivations

(Houle et al., 2005). After adding demographic questions, the draft questionnaire was reviewed by educational experts who actually utilize functions of NESPAP. The survey consisted of three sections: 1) demographic information; 2) questions on likeliness of using seven functions of NESPAP; and 3) rating of six motivations as a driving factor to use each function of NESPAP.

Data collection was conducted to explore motivations of NESPAP's target users to participate in online education research database. A questionnaire survey was conducted in November 2014 and February 2015. Respondents include education experts from 13 countries and areas of Asia and the Pacific, as well as education officers and project staff members of UNESCO Bangkok[7]. In the next section, demographic data of the respondents and the likeliness of using functions of NESPAP are analyzed.

3.2.2 Data analysis and preliminary findings

3.2.2.1 Analysis of demographic data

Out of 78 questionnaires distributed, 50 were returned, yielding a response rate of 64.1%. Demographic information is summarized as follows. First, 66% of the respondents are female. Second, major age ranges are 25-34 (33%), 35-44 (21%) and 45-54 (28%), comprising 81.4% of the total respondents. Third, 32% of the respondents have less than five years of experience in the education field, followed by 5-14 years (21%), 25-34 years (19%) and 15-24 years (18%). Fourth, 79% spend five or more hours on computer and other devices per day. Fifth, 78% spend two hours or less on computer and other devices for knowledge sharing and exchange per day. Sixth, 38% of the respondents are researcher and 26% professor, among others (i.e. administrator, education officer and policy-maker).

3.2.2.2 Analysis on the likeliness of using seven functions of NESPAP

In the second section of questionnaire, users' likeliness to use seven functions of NESPAP was explored. The questions asked the extent to which the respondent is likely to use each function, using a 5-point Likert scale (5 ("Very much"), 4 ("To some extent), 3 ("Neutral"), 2 ("Not much") and 1 ("Not at all")). For each function, mean score was calculated (Table 2). Among the seven functions, four functions showed a mean score above four. Function of "share documents on education systems and policies published by you/your organization" has the highest score of 4.36, indicating that users are interested in utilizing NESPAP with function to share their documents and information. Function to promote online groups for educational events, function to share institutional news, and function to promote online discussions on specific topics recorded an average mean value of more than four. This result may be interpreted that users are interested in event-specific or topic-specific activities. These results only suggest users' likeliness to use NESPAP, however, are important basis to investigate motivation of participants to contribute and utilize online educational database. Utilizing those results, this research plans to analyze participants' motivation.

[7] At UNESCO-organized educational meeting in November 2014, 36 questionnaires were distributed. In February 2015, 42 questionnaires were distributed in UNESCO Bangkok Office.

Table 2 Seven functions of NESPAP.

Number	Description	Mean
1	Discuss education systems and policies at large with experts in a site-wide online forum	3.8542
2	Discuss specific topics in education systems and policies with a group of interested experts in an online forum	4.0408
3	Create an online group for your events/projects on education, and provide members with a space for discussion and file sharing	4.0816
4	Share documents on education systems and policies published by you/your organization	4.3600
5	Self-archive your documents on education systems and policies	3.7551
6	Share your/your organization's news on education systems and policies	4.0600
7	Post recruitment information of you/your organization	3.5800

(Source: created by the authors with survey results, 2015)

4. Conclusion

It is essential to promote use of online research database to make research information universally accessible. In order to provide a web-based portal for knowledge exchange and sharing among educational experts, Tokyo Tech and UNESCO Bangkok collaborate to provide an educational database, NESPAP. In this study, previous systems were analyzed and re-implemented on a sustainable software development platform, WordPress. Further, sustainable use of the online educational database was explored through an analysis from two perspectives; sustainable system design and participants' motivation. For sustainable system design, a specific workflow was developed based on the analysis of available resources, focusing on time, cost and human resources. It was shared with the management and maintenance team through trainings. For the second perspective, users motivation was explored further to promote their voluntary participation in NESPAP. Volunteer Functions Inventory was adopted in investigating motivation of participants to contribute and utilize online educational database. Analysis on users' likeliness to use different functions of NESPAP indicated that users are interested in sharing documents and information, and taking part in event-specific and topic-specific activities. In the future investigation, these findings plan to be analyzed in relation to the participants' motivation to contribute to online educational database.

References

Clary, E. G., Snyder, M., Ridge, R. D., Copeland, J., Stukas, A. A., Haugen, J., & Miene, P. (1998). Understanding and assessing the motivations of volunteers: a functional approach. *Journal of personality and social psychology*, *74*(6), 1516.

Eder, J., Panagos, E., & Rabinovich, M. (1999, January). Time constraints in workflow systems. In *Advanced information systems engineering* (pp. 286-300). Springer Berlin Heidelberg.

Houle, B. J., Sagarin, B. J., & Kaplan, M. F. (2005). A functional approach to volunteerism: Do volunteer motives predict task preference?. *Basic and applied social psychology*, *27*(4), 337-344.

Li, H., Yang, Y., & Chen, T. Y. (2004). Resource constraints analysis of workflow specifications. *Journal of Systems and Software*, *73*(2), 271-285.

McKeever, S. (2003). Understanding web content management systems: evolution, lifecycle and market. *Industrial Management & Data Systems*, *103*(9), 686-692.

Nov, O. (2007). What motivates wikipedians?. *Communications of the ACM*,*50*(11), 60-64.

Sadiq, W., & Orlowska, M. E. (2000). Analyzing process models using graph reduction techniques. *Information systems*, *25*(2), 117-134.

UNESCO. (2005). *UNESCO World Report: Towards Knowledge Societies*. Retrieved from http://www.itu.int/wsis/docs/geneva/official/poa.html#c3

UNESCO. (2013a). *Open Access Policy concerning UNESCO publications*. Retrieved from http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/ERI/pdf/oa_policy_rev2.pdf

UNESCO. (2013b). *Education Policy and Reform (EPR) Unit, UNESCO Bangkok*. Retrieved from http://unesdoc.unesco.org/images/0022/002239/223939e.pdf

UNESCO. (2014). *UNESCO Bangkok Office*. Retrieved from http://unesdoc.unesco.org/images/0022/002284/228479E.pdf