Process Model of Educational Information Management in Institutional Research for Education and Students*

Yuji OKADA*1 and Tomoko TORII*2

*1 Institute for Excellence in Higher Education, Tohoku University, Kawauchi41, Aoba-ku, Sendai, Miyagi, 980-8576 Japan

*2 Institute for Teaching and Learning, Ritsumeikan University, Toujinkitamachi56-1, Kita-ku, Kyoto-city, Kyoto 603-8577 Japan

Received for publication, September 30, 2019

This study investigated a process model of educational information management in institutional research for education and students. Educational information management was assumed to contain four aspects: data utilization purpose, data utilization structure, database development, and data analysis and reporting. A total of 248 educational institutions responded to a nationwide questionnaire survey that was administered to four-year universities and two-year junior colleges. Covariance structure analysis revealed a set of processes in which data utilization purpose facilitated the preparation of a data utilization structure which, in turn, prompted the development of a database. Finally, data analysis and reporting were executed. It was also found that the data utilization purpose had a direct effect on data analysis and reporting. Multiple regression analyses regarding the characteristics of the institutions showed that the type and scale of the institution and its institutional mission affected the four aspects of educational information management.

Key words: Educational information management, Institutional research (IR) for education and students, Process model, University education, Data utilization

1. INTRODUCTION

1.1. Institutional Research (IR) for Education and Students and Educational Information Management

In recent years, interest in internal quality assurance and accountability of universities has increased globally. In order to deal with these issues, IR, which is defined as “research conducted within an institution of higher education to provide information which supports institutional planning, policy formation and decision making (SAUPE 1990),” has drawn immense attention. Although IR in Japan only began in earnest from the 2000s (TORII and OKADA 2017, YAMADA 2011), a recent nationwide survey revealed that today approximately half of Japanese educational institutions have introduced IR in some form. This is a clear indicator that IR has been rapidly spreading in Japan for the past 15 years.

Although IR addresses various areas, it is IR for education and students that has attracted Japanese educational institutions’ faculty and administrative staff the most. IR for education and students is defined by MATSUDA and WATANABE (2017) as the “practice or research regarding data collection, analysis, and reporting for the purpose of improvement of education and student learning.” Therefore, it mainly addresses information about education and students, and stresses educational improvement. However, since Japanese educational institutions have only had a short history of IR for education and students, there are some challenges regarding its proper functioning.

On the other hand, due to the founding of the Association for Institutional Research (AIR)—a professional association for institutional researchers—in 1965, research and practice in related fields has been continuing for over half a century in North America (YAMADA 2016). Thus, not surprisingly, in comparison to North America, Japan has experienced some problems regarding educational information management (ASANO 2016). According to institutional researchers of North American institutions, in most cases...
institutional data is already stored in a database by the respective institution’s IT department (FUJIWARA and OHNO 2015) and the main responsibility of institutional researcher is data analysis and reporting (YANAGIURA 2009).

In contrast, most universities in Japan do not possess a well-developed database, thus institutional data tends to be dispersed among various departments of an educational institution (JAPANESE CONSORTIUM OF ACCREDITATION COORDINATORS FOR HIGHER EDUCATION 2013, FUJIWARA and OHNO 2015, TAKATA et al. 2012). Consequently, institutional researchers in Japan need to collect the necessary data from various departments in order to analyze it. Moreover, even to procure the data, they need to explain its necessity to, and secure permission from, the concerned department.

For instance, FUKUSHIMA (2015) had to negotiate for two years with relevant departments to procure the data necessary to develop a data analysis system. This implies the necessity of certain preconditions. First, a thorough discussion regarding the purpose of data utilization, access authority, data security etc., and consensus building with the relevant department and faculty is necessary. Second, an official agreement regarding data utilization among university executives and deans is required. University executives are required to prepare a data utilization policy and demonstrate leadership in order to understand the needs of each department. As ASANO (2016) noted, a positive, cooperative relationship among relevant departments and setting goals for data utilization is important to develop a database. As mentioned above, both effective top-level leadership and department-level understanding are essential to integrate necessary data, which will enable helpful analysis and reporting.

Given that IR does not function without sufficient data, proper educational information management is necessary for IR for education and students, which includes sharing university executives’ policy, cooperation among departments, data collection, and database development. Therefore, educational information management is a sequence of information flow that consists of creating conditions for data collection about education and students, data collection and storage, and data analysis and reporting. This study investigated educational information management based on a nationwide survey.

1.2. IR for Education and Students, and Educational Information Management

With regard to the specific process of educational information management, researchers in North America are developing models of information management in IR.

For example, MCLAUGHLIN et al. (1998) suggested a model of informational support for an institution’s decision-making. This model, which places primacy on the decision maker’s needs, comprises the following steps: (1) identify concepts and measures, (2) collect and store data, (3) restructure and analyze facts, (4) deliver and report information, and (5) use and influence decisions. VOLKWEIN (2010) also advocated a process model of institutional effectiveness in higher education institutions. This model comprises the following steps: (1) establishing two main goals consisting of internal quality assurance and accountability; (2) establishing five questions regarding goal attainment, improvement, meeting standards, benchmarking, and productivity; (3) selection of appropriate assessment measures and methods according to questions; (4) collection, cleaning, and analyses of data; and (5) sharing and utilizing results for improvement. Furthermore, BORDEN et al. (2001) developed a life cycle model of IR based on MCLAUGHLIN et al.’s model. They assumed that on the basis of organizational goals, IR comprises the following steps: (1) designing IR activities, (2) data collection, (3) preparation for analysis, (4) data analysis, and (5) providing findings.

As described above, there are several models of information management in IR, and their commonalities include: identifying goals for data utilization, collecting and adequately analyzing the necessary data, and providing information for decision-making. However, as previously discussed, educational information management in Japan has some issues related to sharing of the purpose of data utilization and relations among relevant departments when data are integrated. Compared with North American institutions that have advanced systems for data integration, it is important to consider the conditions for data integration and utilization to understand educational information management in Japanese institutions.

Based on the above discussion, we assumed a process model of educational information management (Figure 1), which includes the following steps: (1) specifying data utilization purpose in an institution (i.e., sharing the data
utilization purpose), (2) preparing the data utilization structure to share and utilize institutional data (i.e., preparation of a data utilization structure), (3) development of university-wide database that integrates data in each department (i.e., development of a database), and (4) adequate data analysis and reporting for decision-making (i.e., data analysis and reporting).

Although this model assumes the time-series process, we do not necessarily suppose only the sequential process from “(1) sharing the data utilization purpose” to “(4) data analysis and reporting.” The purpose of data utilization is particularly important because it is regarded as the point of origin in process models of educational information management in IR. Therefore, there is a possibility that “(1) sharing the data utilization purpose” will have direct effects on “(3) development of a database” and “(4) data analysis and reporting.” “(1) sharing the data utilization purpose” may also indirectly impact the subsequent process via “(2) preparation of a data utilization structure.” Hence, we examine both the direct and indirect effects of “(1) sharing the data utilization purpose” on “(3) development of a database” and “(4) data analysis and reporting.” Furthermore, the desired analysis and reporting differ according to the manner in which data are utilized in institutional decision-making. Given that “(2) preparation of a data utilization structure,” which is closely related to data utilization, may directly affect “(4) data analysis and reporting,” we assume a direct path between them.

Quantitative analysis is necessary to determine direct and indirect effects of a particular aspect of educational information management on other aspects. However, models in previous studies have been derived from logical reasoning, and there is little empirical research on this issue. The process among various aspects of educational information management has not been revealed yet, although TORII and OKADA (2017) partially investigated the current situation of each aspect by simple tabulation with the same dataset used by this study. For the above reason, this study investigates a process model of educational information management based on a nationwide questionnaire survey.

1.3. Institutional Features and Educational Information Management

Educational information management, whose general process we have already discussed, may differ from institution to institution according to the context. For example, a nationwide survey by THE UNIVERSITY OF TOKYO (2014) revealed that the IR function and survey regarding education and student learning is more advanced in Japan’s national universities than in public and private universities. TAKE (2015) used three case studies to indicate that the background for the introduction of the IR function in national and private universities was different. He pointed out that the IR function in national universities was originally introduced to deal with external university evaluation, whereas it was introduced in private universities to improve the standard of education. Moreover, other factors besides type of institution may affect educational information management. KOMINATO and NAKAI (2007) studied three case studies to indicate the different purposes of IR and information utilization among national universities.

As seen above, the purpose of IR and the background of its introduction differ among institutions, which gives rise to diverse educational information management systems. We can assume different surroundings, missions, and resources of each institution behind diverse management systems. However, quantitative research to examine relations between educational information management and diversity of institutions is limited. Therefore, this study investigates the manner in which institutional characteristics affect the aspects of educational information management.

1.4. Purposes of This Study

This study served the following purposes: First, this study confirms if educational information management consists of four aspects and examines the validity of the assumed process model. Second,
it investigates the manner in which factors regarding institutional characteristics affect each aspect of educational information management.

2. METHOD

2.1. Participants and Procedures

From December 2015 to February 2016, a nationwide questionnaire survey was administered to 1,104 higher education institutions (four-year universities and two-year junior colleges except graduate universities) in Japan. It was conducted online using the Real-time Evaluation Assistance System (REAS) available through the Open University of Japan (housoudaigaku). A survey request form was sent to the provost of each institution requesting that the person responsible for the utilization and disclosure of educational information answer a questionnaire. A total of 248 institutions responded: in the category of four-year universities, 30 national, 25 public, and 136 private universities responded; and from the two-year junior colleges, seven public and 50 private colleges responded.

2.2. Measures

2.2.1. Educational Information Management

Twenty-one items were created on the basis of the following four assumed aspects: (1) data utilization purpose (e.g., attitude toward utilizing data for institutional management has been shared among university executives), (2) data utilization structure (e.g., cooperation among departments, such as the division of registrar/student affairs and faculty has been developed for sharing and utilizing data), (3) development of a database (e.g., a well-developed university-wide database that integrates information about education and students has been prepared), and (4) data analysis and reporting (e.g., the IR function that addresses the information about education and students has been prepared). Four higher education researchers confirmed the expression of 21 items. Participants responded to these items on a 4-point scale (from strongly agree to strongly disagree) according to the following instruction: “In terms of data about education and students, we would like to ask you about the data utilization policy, data utilization structure, development of a database, and data analysis and reporting.”

2.2.2. Institutional Characteristics

With regard to institutional characteristics, the following questions were asked: type of institution (whether four-year university, or two-year college); year of establishment; number of students; students’ academic ability; and orientation to research/education/internationalization. For students’ academic ability, participants responded on a 5-point scale (from significantly higher than average to significantly lower than average) according to the following instruction: “please let us know about the academic ability of the students of your institution.” With regard to orientation to research/education/internationalization, participants responded to “our institution is strongly oriented to research (education/internationalization)” on a 4-point scale (from strongly agree to strongly disagree).

3. RESULTS

3.1. Development of a Scale for Educational Information Management

A scale for educational information management in universities was developed by conducting factor analysis (maximum likelihood method, promax rotation). As a result, 18 out of 21 items were selected (Table 1). In the process, the number of factors was fixed at four according to the eigenvalue and interpretability. Items which indicated less than .35 of factor loading or a certain amount of factor loadings to several factors were excluded.

F1 was named “data analysis and reporting” because it contains items related therein. F2 contains items related to leadership and discussion on university executives for data utilization and policy thereof. These items are closely related to purposes of data utilization because the manner in which data is utilized in an institution concerns the university executives. Therefore, we named F2 “data utilization purpose.” F3 includes items related to the development of a database, the information stored there, and its structure; therefore, it was named “development of a database.” F4, which contains items related to driving data utilization and cooperation among departments for utilization thereof, was named “data utilization structure.” Internal consistency was adequate because Cronbach’s alphas of the four factors were .81-.90.

The mean values of items in each factor were as follows: “data utilization purpose=2.61,” “development of a database=2.51,” “data utilization structure=2.50,” and “data analysis and reporting=2.18.” One sample t-tests were
executed to examine whether the mean of items was higher or lower than the theoretical median—in this study, it was 2.5 because the score range was from 1 to 4. This shows that the mean of “data utilization purpose” was higher than the theoretical median ($t(231)=2.69, p<.01$), whereas the mean of “data analysis and reporting” was lower than ($t(227)=7.93, p<.001$). Significant differences were not found in “development of a database ($t(234)=0.25, n.s.$)” or “data utilization structure ($t(236)=0.06, n.s.$).”

For items in “data utilization purpose,” the mean of which was relatively high, the percentage of “strongly agree” and “somewhat agree” in
“Attitude toward utilizing data for institutional management has been shared among university executives” was 70% or more, whereas the percentage in “University-wide policy for data utilization has been specified” was approximately 40%. Regarding items in “development of a database,” the percentage of “strongly agree” and “somewhat agree” were more than 60% in “Adequate information related to education and students has been stored in a database,” whereas the percentage in “There is a database that enables data extraction and analysis according to the needs of university executives and departments” was around 40%. As for the items in “data utilization structure,” the percentage of “strongly agree” and “somewhat agree” was a little under 60% in “Responsible persons of departments are positive about data utilization in department management,” whereas the percentage in “System for promoting evidence-based decision-making in a department has been prepared” was less than 40%. With regard to items in “data analysis and reporting,” the percentage of “strongly agree” and “somewhat agree” in “There are requests about data utilization or reporting from university executives and departments” was 47.7%, which was relatively higher than other items, whereas the percentage in “Organizational structure and human resources about data analysis and reporting is adequate” was merely 13.4%.

3.2. Verification of the Process Model of Educational Information Management

According to the model in Figure 1, a covariance structure analysis was conducted to examine relations among each aspect of...
educational information management. The revised model—which was revised by removing non-significant passes—is shown in Figure 2 (CFI=.985, NFI=.975, RMSEA=.077). This model revealed a set of processes in which the “data utilization purpose” facilitated the preparation of a “data utilization structure (.70).” “Data utilization structure,” then, in turn, prompted the “development of a database (.55).” Finally, “development of a database” propelled the “data analysis and reporting (.37).” The sum of the direct and indirect effects of “data utilization purpose” on “data analysis and reporting” was .60, which meant that data utilization purpose had a great impact both directly and indirectly on data analysis and reporting. No direct effects of “data utilization purpose” on “development of a database,” and of “data utilization structure” on “data analysis and reporting” were detected, although these relations were assumed in the model in Figure 1.

3.3. Institutional Characteristics and Educational Information Management

Multiple regression analyses were conducted to examine the effects of university characteristics on each aspect of educational information management (Table 2). A series of analyses showed that “orientation to education (.21)” and “orientation to internationalization (.21)” affected “data utilization purpose” positively. Regarding “data utilization structure,” “public university (-.17)” had a negative effect, while “orientation to internationalization (.23)” had a positive effect. As for “development of a database,” only “number of students (.17)” had a positive effect. Regarding “data analysis and reporting,” “number of students (.25)” and “orientation to education (.21)” had positive effects.

4. DISCUSSION

4.1. Process Model of Educational Information Management

The primary purpose of this study was to confirm whether educational information management consists of four aspects and examine the validity of the assumed process model. A series of analyses were conducted according to the assumed model based on a nationwide questionnaire survey to educational institutions in Japan. Factor analysis showed that there were four different aspects in educational information management, namely: “data utilization purpose,” “data utilization structure,” “development of a database,” and “data analysis and reporting.” Although previous studies have suggested several distinct aspects of information management of IR (e.g., MCLAUGHLIN et al. 1998), this study empirically confirmed four distinct aspects based on a nationwide survey of Japanese educational institutions. Understanding educational information management from the perspective of these four aspects will help an institution to better analyze institutional management issues.

The descriptive statistics related to each aspect of educational information management indicated an improvement in the sharing of the data utilization purpose, while effective data analysis and reporting have not yet improved by much. Although educational institutions in Japan have generally not made good use of institutional data, their interest in data is now on the rise because of their recent introduction to the IR function. Currently, with regard to the data utilization purpose, the importance of data utilization has been shared among university executives; data utilization policy, however, is yet to be established in many institutions. As for the data utilization structure, the finalization of the manner in which data is to be utilized in actual decision-making is still at the incipient stage, although momentum for data utilization in departments is gradually building. As FUKUSHIMA (2015) investigated, the steady development of conditions for data utilization—these conditions are based on the perceived importance of data utilization in an institution and within its departments—is considered to be a critical issue. Regarding the development of a database, there are problems related to database structure. Nonetheless, data concerning education and students has been adequately stored. As for data analysis and reporting, it was found that despite a pressing need, an organizational structure for appropriate data analysis and reporting has not been prepared. In light of these findings, and also as indicated by FUJWARA and OHNO (2015), and YANAGIURA (2009), raising a dedicated workforce of data management and analysis/reporting professionals will be an important issue in educational information management.

An examination of the process model of educational information management as shown in Figure 1 revealed a set of processes in which...
"data utilization purpose" facilitated the preparation of a "data utilization structure." "Data utilization structure," in turn, prompted the "development of a database." Finally, "data analysis and reporting" were executed. In addition, it was also shown that "data utilization purpose" had a direct effect on "data analysis and reporting." Although conceptual models of the information management process have been suggested in previous studies (MCLAUGHLIN et al. 1998, VOLKWEIN 2010, BORDEN et al. 2001), the validity of a model had not yet been examined on the basis of a nationwide survey. This study could reveal the processes of educational information management mentioned above, and empirically verify the validity of the assumed model.

The study indicated that clarity of the data utilization purpose facilitated the preparation of a data utilization structure. As ASANO (2016) noted, it is necessary to clarify the institutional policy for data utilization when managing educational information. It was also revealed that data utilization purpose contributed to data analysis and reporting. Considering that IR is an activity to provide information that supports institutional decision-making (SAUPE 1990), it is necessary to select appropriate analysis and reporting methods according to the needs of decision makers. As described above, despite the data utilization purpose being the point of origin in educational information management, in many institutions a data utilization policy has not yet been formulated (OKADA 2018). A policy with a clear data utilization purpose should be established in each institution to elicit better performance from IR in education and students.

At the same time, it was found that data utilization purpose did not have a direct impact on the development of a database, and data utilization structure mediated these two aspects. As discussed above, previous studies have indicated some problems related to data collection in Japanese institutions (JAPANESE CONSORTIUM OF ACCREDITATION COORDINATORS FOR HIGHER EDUCATION 2013, FUJIWARA and OHNO 2015, TAKATA et al. 2012). Therefore, the preparation of a data utilization structure, such as cooperation among departments, is required to collect institutional data and develop a database as well as establish a clear data utilization purpose. Moreover, data utilization structure did not have a direct influence on data analysis and reporting. Even if a data utilization structure is prepared, adequate data analysis and reporting for decision-making would be impossible without a well-developed university-wide database, which is a precondition of data analysis and reporting.

4.2. Relations between University Characteristics and Educational Information Management

The second purpose of this study was to identify influences of institutional characteristics on the four aspects of educational information management.

Regarding the factors related to institutional characteristics, it was shown that public institutions tended to face more issues related to data utilization structure as compared to national institutions. A previous nationwide survey reported that the percentage of public institutions without IR organization was higher than the percentage of national and private institutions (THE UNIVERSITY OF TOKYO 2014). It would appear that the absence of IR is responsible for an inadequate data utilization structure. It was also revealed that a greater number of students positively contributed to the development of a database and data analysis and reporting. Large-scale institutions seem to allocate resources easily and adequately for the development of a database and staffing of institutional researchers. It is also possible that university-wide data is more important to large-scale institutions because, owing to their size, they find it difficult to understand the complete organizational picture. In contrast, a spontaneous need for understanding the current situation based on data may be rare in small-scale institutions; owing to the relative proximity between students and institutional staff, they may have access to a clear overall organizational picture.

Aspects of educational information management were also affected by institutional orientations. Internal quality assurance, which is recently rising in importance, seems to be related to the finding that data utilization purpose has been clearly spelled out and data analysis and reporting has functioned well in education-oriented institutions. In particular, assessment of students’ learning outcomes is emphasized as an important function of internal quality assurance in the third period accreditation (THE CENTRAL COUNCIL FOR EDUCATION SUBDIVISION ON UNIVERSITIES 2016), and education-oriented institutions may be responsive to the policy trends. It was also
indicated that data utilization purpose has been clearly stated and a data utilization structure has been developed in institutions oriented toward their internationalization. In order to internationalize institutions, it is necessary that institutional attractiveness for foreign as well as domestic students is strategically conveyed (TORII and OKADA 2017). It seems that demand for data regarding attractiveness of an institution for students, both domestic and foreign, drives educational information utilization. It is also possible that in order to understand the diverse cultural and learning backgrounds of international students and provide them a good quality education, it may be necessary to collect data related to education and students.

4.3. Conclusion and Further Tasks

This study distinguished four aspects of educational information management and examined its process model. The results showed a set of processes in which “data utilization purpose” facilitated the preparation of a “data utilization structure.” “Data utilization structure,” in turn, prompted the “development of a database.” Finally, “data analysis and reporting” were executed. Similarly, it was indicated that “data utilization purpose” had an important role in educational information management, as it also had a direct effect on “data analysis and reporting.” As mentioned above, this study could explain the educational information management process empirically based on a nationwide survey, the findings of which are significant for the development of IR for education and students. The results also show that each aspect of educational information management differs according to institutional characteristics. These findings have significant implications and necessitate an understanding of the differences of IR organization and function among institutions.

This study also has some limitations. First, this study asked the person responsible for the utilization and disclosure of educational information to respond to a questionnaire. However, an imprecise expression, “data about education and students,” was used to request evaluation of each aspect of educational information management. Therefore, when interpreting findings of this study, it should be noted that each participant might have recalled different data and data utilization. Second, we did not investigate how data analysis and reporting improve education and student learning. Recently, the concept of “institutional effectiveness” has been gathering popularity; it emphasizes how data analysis and reporting effect educational improvement in an institution (ASANO 2017, VOKLEIN 2010). In addition, processes between educational information management and educational improvement should be investigated in the future.

ADDITIONAL STATEMENTS

This paper further developed the research presented by OKADA et al. (2016). This study was supported by JSPS KAKENHI Grant-in-Aid for Scientific Research (B) (Grant number 26282063, Principal investigator: Tomoko Torii, “A study on the system of utilization and disclosure of educational information in management of teaching and learning in Japanese universities and colleges”).

ACKNOWLEDGMENTS

We would like to express our gratitude to the participants of the questionnaire survey. We would also like to thank Professor Tetsuya Takahashi at the Osaka Prefecture University and Professor Shigeru Asano at the Yamagata University who offered us insightful advice on the items of the questionnaire survey.

NOTES

1) Internal quality assurance is explained as follows. "Internal quality assurance (IQA) is a process by which higher education institutions themselves take responsibility for checking and evaluating the quality of their various activities. The results are used to reform and improve the institutions, as well as to ensure quality. IQA of teaching refers to an institution continuously assuring the quality of its teaching and research activities as well as the level of students’ learning outcomes. Organizational units responsible for orchestrating and implementing academic programs analyze and evaluate educational and research initiatives in those programs, as well as the abilities students should acquire and the programs’ learning outcomes. They use the results to make improvements. Institutions are responsible for monitoring such efforts in each academic program and for ensuring that reform and improvement mechanisms are working in the aggregate, thereby resulting in the maintenance of
educational and research quality” (NATIONAL INSTITUTION FOR ACADEMIC DEGREES AND QUALITY ENHANCEMENT OF HIGHER EDUCATION, 2016).

REFERENCES


