

# XBRL Financial Database for Higher Education Institutions

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**Abstract**—This paper describes new technique of XML database, eXtensible Business Reporting Language, for advanced communication, and its improvement and actual development for higher education institutions, which is aimed to be an infrastructure for data analysis and knowledge discovery in education financial field. Especially this paper focuses on “Financial Statements” of national universities in Japan.

**Keywords**—XML Database, XBRL, Financial reporting, Integrated reporting, Knowledge discovery, Educational data mining.

## I. INTRODUCTION

Worldwide higher education reform is in progress. University evaluation plays more important role in the education reform [1-2]. In Japan, implementation of university evaluation for the national university is remarkable within these ten years [3]. As a part of management of higher education institutions, universities, colleges, and polytechnics, institution comparative analysis has played important role for university evaluation.

Especially, comparative analysis and evaluation on financial situation of higher education institutions is essentially important, which have been conducted mainly based on the financial statements, which are composed of Balance Sheet, Income Statement, Cash Flow Statement, and so on. Fig. 1 shows an example of Balance Sheet of national university in Japan.

It is expected that the electrical submission and dissemination, information disclosure, of university financial statements will be developed rapidly in near future based on various advanced communication technologies. Therefore, intercollegiate comparative analysis and data mining on common format of university financial statements will be more important in education data mining [4].

Data standardization in education-related database is substantially necessary for data dissemination and data mining in education field. One of the promising technology is a XML based XBRL, eXtensible Business Reporting Language [5-7], that can progress not only electrical submission and dissemination of institutional information but also intercollegiate comparative analysis and data mining on the information

| 資産の部       |           |           |
|------------|-----------|-----------|
| 1 固定資産     |           |           |
| 1 有形固定資産   |           |           |
| 土地         | 890,618   |           |
| 減価償却累計額    | △ 3,065   | 887,552   |
| 建物         | 292,100   |           |
| 減価償却累計額    | △ 86,664  |           |
| 減価償却累計額    | △ 636     | 204,799   |
| 構築物        | 22,833    |           |
| 減価償却累計額    | △ 8,487   |           |
| 減価償却累計額    | △ 12      | 14,333    |
| 機械装置       | 1,331     |           |
| 減価償却累計額    | △ 941     | 390       |
| 工具器具備品     | 154,145   |           |
| 減価償却累計額    | △ 102,307 | 51,838    |
| 図書         |           | 42,307    |
| 美術品・收藏品    |           | 3,088     |
| 船舶         | 125       |           |
| 減価償却累計額    | △ 112     |           |
| 減価償却累計額    | △ 6       | 6         |
| 車両運搬具      | 498       |           |
| 減価償却累計額    | △ 364     | 134       |
| 建設仮勘定      |           | 8,846     |
| 生物         | 5         |           |
| 減価償却累計額    | △ 3       | 1         |
| 有形固定資産合計   |           | 1,213,298 |
| 2 無形固定資産   |           |           |
| 特許権        |           | 715       |
| 借地権        |           | 42        |
| 商標権        |           | 4         |
| 電話加入権      |           | 21        |
| ソフトウェア     |           | 484       |
| 無形固定資産合計   |           | 1,269     |
| 3 投資その他の資産 |           |           |
| 投資有価証券     |           | 18,028    |
| 関係会社株式     |           | 156       |
| 長期前払費用     |           | 25        |
| 投資その他の資産合計 |           | 18,209    |

Figure 1. Example of Balance Sheet of a university.

In this paper firstly we explain XBRL technologies, instance file, taxonomies and hierarchy, and an extension of standard XBRL taxonomy for the financial statements of higher education institutions in Japan, where XBRL has not yet been introduced so far in any other countries, which is aimed for developing an infrastructure of data dissemination and data mining in education finance field. We explain the “NUV taxonomy” proposed for Balance Sheet and Income Statement, and refer its latest update for improvement.

Secondly, We explain our XBRL based integrated analysis and reporting that can produce some major financial report tables, and also analyze various kinds of financial indicators based on our second extension of XBRL for university information system. We show our developing financial database system for Japanese higher education institutions with actual data which consists of large Japanese national university data.

## II. EXTENSIBLE BUSINESS REPORTING LANGUAGE

*XBRL, eXtensible Business Reporting Language*, is one of the computer languages based on *XML*, which is a standard for the electronic exchange of data between businesses on the internet [5-7].

XBRL utilize various kinds of XML technologies such as XML Schema, XLink, and XPointer standards, and so on. Based on XML, tags are applied to items of financial business data so that financial data can be processed efficiently by computer software. XBRL is implemented in wide range of scenes such as tax payment system and financial data transfer system in stock exchange. XBRL is utilized in the following financial information systems:

- **EDGAR** (Electronic Data-Gathering, Analysis, and Retrieval system: <http://xbrl.sec.gov/>), is a system to perform automated collection, validation, indexing, acceptance, and forwarding of submissions to file forms of the U.S. Securities and Exchange Commission.
- **EDINET** (Electronic Disclosure for Investors' NETwork: <http://info.edinet-fsa.go.jp/>) is a Japanese electric XBRL based financial information disclosure system for documents of securities report subject to Financial Instruments and Exchange Act.
- **TDnet** (Timely Disclosure network: <http://www.tse.or.jp/listing/disclosure/index.html>) is an XBRL based information disclosure system operated by Tokyo Stock Exchange.

XBRL consists of an *XBRL instance*, containing primarily the business facts being reported, and a collection of *taxonomies*, defining metadata about these facts, such as what the facts mean and how they relate to one another:

$$\text{XBRL} = \text{Instance} + \text{Taxonomy}.$$

- **Instance:**  
Instance holds the following information: *Business Facts, Contexts*(Date and time information, Scenario), *Units, Footnote, and References*.
- **Taxonomy:**  
*Taxonomies* are the reporting-area specific hierarchical dictionaries. The XBRL specification defines five different kinds of linkbases:

- **Label Linkbase:** human readable strings for concepts
- **Reference Linkbase:** concepts associated with citations
- **Calculation Linkbase:** concepts associated with other concepts for consistency.
- **Definition Linkbase:** concepts associated with other concepts ("is-a", etc.).

- **Presentation Linkbase:** concepts associated with other concepts for the creation of a user interface, rendering, or visualization.

Taxonomies consist three hierarchical structure, taxonomy level 1, 2 and 3, as shown in Fig. 2.

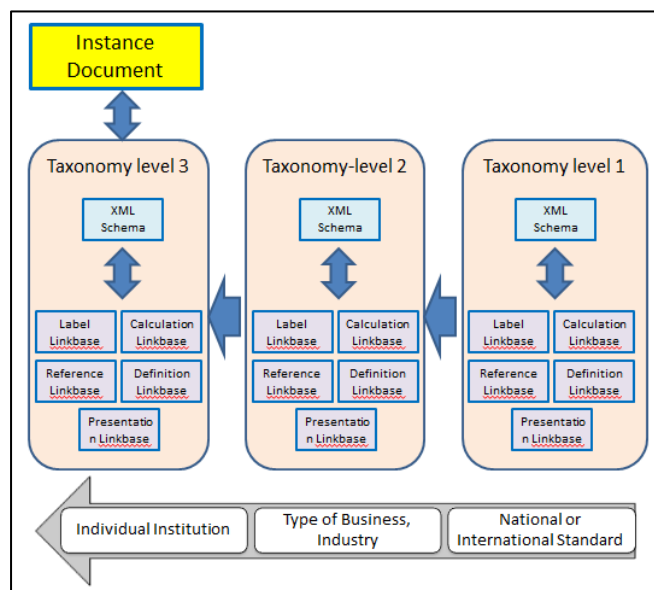


Figure 2. Taxonomy hierarchical Structure.

Different taxonomies are required for different reporting purposes in various application fields, therefore, we extend or modify taxonomies for higher education institution.

## III. EXTENSION OF XBRL FINANCIAL REPORTING

### A. Taxonomy Structure

This section describes an extension of XBRL for higher education institutional data analysis and knowledge discovery, especially on financial statements of national university of Japan [8].

Fig. 3 shows the structure of proposed NUV Taxonomy at taxonomy level 2 for national university financial statement. The proposed file set for Taxonomy has hierarchy structure starts from "jp" folder.

- In t-folder in the figure, the definitions of the vocabulary (Japanese and English) are assembled in cte-folder (general company) and extended nuv-folder (national university corporation).
- The presentation order of the vocabulary on financial statement is defined in the "r"- "nuv"- "an"- folder. Fig. 4 shows an example of "presentation file (-presentation.xml)" based on XBRL.

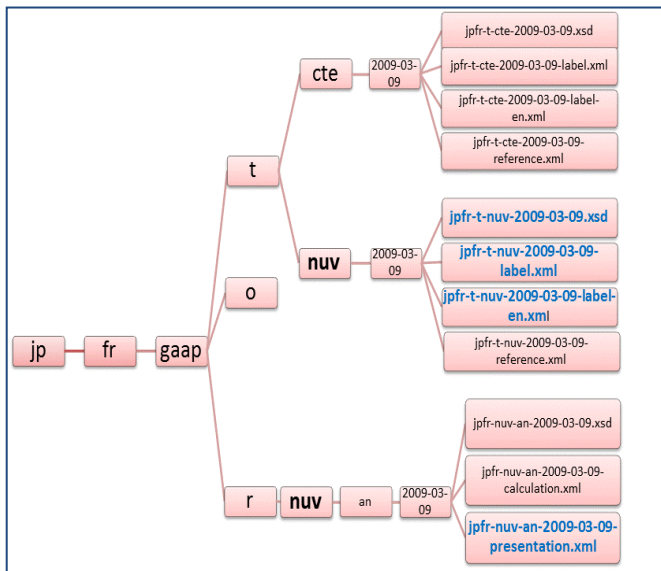


Figure 3. Hierarchical structure of Taxonomy (jpfr-t-nuv).

```

<linkbase>
  <documentation xml:lang="ja">国立大学法人個別財務諸表</documentation>
  <roleRef roleURI="http://info.edinet-fsa.go.jp/jp/fr/gaap/role/NonConsolidatedBalanceSheets" xlink:type="simple"
    xlink:href="http://info.edinet-fsa.go.jp/jp/fr/gaap/role/NonConsolidatedBalanceSheets" />
  <roleRef roleURI="http://info.edinet-fsa.go.jp/jp/fr/gaap/role/NonConsolidatedStatementsOfIncome" xlink:type="simple"
    xlink:href="http://info.edinet-fsa.go.jp/jp/fr/gaap/role/NonConsolidatedStatementsOfIncome" />
  <roleRef roleURI="http://info.edinet-fsa.go.jp/jp/fr/gaap/role/NonConsolidatedStatementsOfCashFlowsDirect" xlink:type="simple"
    xlink:href="http://info.edinet-fsa.go.jp/jp/fr/gaap/role/NonConsolidatedStatementsOfCashFlowsDirect" />
  <!-- 貸借対照表 -->
  <presentationLink xlink:type="extended" xlink:role="http://info.edinet-fsa.go.jp/jp/fr/gaap/role/NonConsolidatedBalanceSheets" />
  <!-- 貸借対照表 -->
  <loc xlink:type="locator" xlink:href="http://info.edinet-fsa.go.jp/jp/fr/gaap/role/NonConsolidatedBalanceSheets"
    xlink:label="BalanceSheetsAbstract" />
  <loc xlink:type="locator" xlink:href="http://info.edinet-fsa.go.jp/jp/fr/gaap/role/NonConsolidatedBalanceSheets"
    xlink:label="AssetsAbstract" />
  <presentationArc xlink:type="arc" xlink:arcrole="http://www.xbrl.org/2003/arcrole/parent-child"
    xlink:from="BalanceSheetsAbstract" xlink:to="AssetsAbstract" order="1.0" />
  <!-- 固定資産 -->
  <loc xlink:type="locator" xlink:href="http://info.edinet-fsa.go.jp/jp/fr/gaap/role/NonConsolidatedBalanceSheets"
    xlink:label="NoncurrentAssetsAbstract" />
  <presentationArc xlink:type="arc" xlink:arcrole="http://www.xbrl.org/2003/arcrole/parent-child"
    xlink:from="AssetsAbstract" xlink:to="NoncurrentAssetsAbstract" order="1.0" />
  <!-- 固定資産 有形固定資産 -->
  <loc xlink:type="locator" xlink:href="http://info.edinet-fsa.go.jp/jp/fr/gaap/role/NonConsolidatedBalanceSheets"
    xlink:label="PropertyPlantAndEquipmentAbstract" />
  <presentationArc xlink:type="arc" xlink:arcrole="http://www.xbrl.org/2003/arcrole/parent-child"
    xlink:from="NoncurrentAssetsAbstract" xlink:to="PropertyPlantAndEquipmentAbstract" order="1.0" />
  <!-- 有形固定資産 土地 -->
  <loc xlink:type="locator" xlink:href="http://info.edinet-fsa.go.jp/jp/fr/gaap/role/NonConsolidatedBalanceSheets"
    xlink:label="Land" />

```

Figure 4. Presentation.xml file

## B. XBRL Instance File

Fig. 5 shows a part of specific “\*.xbrl” instance file for a certain university, and Fig. 6 shows an instance files which is composed of various XML files (\*-label.xml, \*-presentation.xml, \*-calculation.xml, and so on). Those files are gathered in zip file. The data file (\*.xbrl) is included in this zip file as shown in Fig. 6.

```

<!-- 土地 -->
<jpfr-t-cte:Land id="209-100" decimals="-3"
contextRef="Prior1YearNonConsolidatedInstant"
unitRef="JPY">16618000000</jpfr-t-cte:Land>
<!-- 建物 -->
<jpfr-t-cte:Buildings id="209-101" decimals="-3"
contextRef="Prior1YearNonConsolidatedInstant"
unitRef="JPY">196869424000</jpfr-t-cte:Buildings>
<!-- 建物 減価償却 -->
<jpfr-t-cte:AccumulatedDepreciationBuildings id="209-102"
decimals="-3"
contextRef="Prior1YearNonConsolidatedInstant"
unitRef="JPY">-55715026000</jpfr-t-cte:AccumulatedDepreciationBuildings>

```

```

<!-- 建物 減損損失 -->
<jpfr-t-cte:AccumulatedImpairmentLossBuildings id="209-103"
contextRef="Prior1YearNonConsolidatedInstant"
unitRef="JPY"
xsi:nil="true"/>
<!-- 建物 (net) -->
<jpfr-t-cte:BuildingsNet id="209-104" decimals="-3"
contextRef="Prior1YearNonConsolidatedInstant"
unitRef="JPY">141154398000</jpfr-t-cte:BuildingsNet>
-----
<!-- 図書 -->
<jpfr-t-nuv:BooksPPENUV id="209-201" decimals="-3"
contextRef="Prior1YearNonConsolidatedInstant"
unitRef="JPY">32632936000</jpfr-t-nuv:BooksPPENUV>
<!-- 美術品・收藏品 -->
<jpfr-t-nuv:CollectionsPPENUV id="209-202" decimals="-3"
contextRef="Prior1YearNonConsolidatedInstant"
unitRef="JPY">731977000</jpfr-t-nuv:CollectionsPPENUV>
-----

```

Figure 5. Part of specific instance file for a certain university

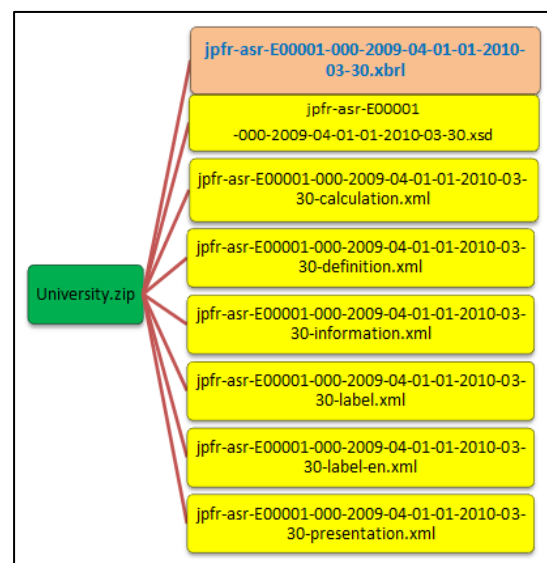


Figure 6. Example of instance zip file

## IV. UNIVERSITY INFORMATION SYSTEM AND XBRL EXTENSION

### A. University Information System

Fig. 7 shows our university information system based on XBRL [9-10]. As explained previous section, we conducted new taxonomy design of XBRL for financial statements of national university in Japan, i.e., we proposed *NUV Taxonomy* for Balance Sheet and Income Statement. Based on the taxonomies, we are now developing XBRL transformation system, XBRL information server, that produces financial report tables, financial indicators/financial indexes.

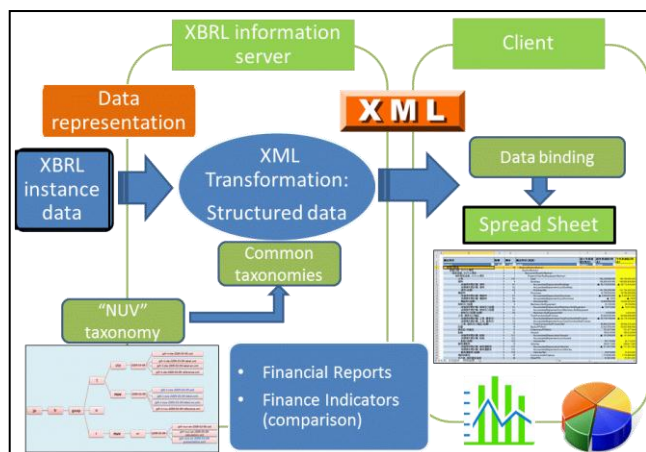


Figure 7. XBRL integrated reporting system

### B. Extension NUV to Integrated Reporting

In order to treat various indexes related to higher education institutions such as

*Ratio of education expenses to student*

$$= (\text{Education expenses}) / (\text{Number of student}),$$

in this section we propose further extension of XBRL for university basic information besides financial information.

Fig. 8 shows a general hierarchy of terminologies, part of taxonomies, of higher education institution. In the bottom of the figure, “Standard Terminology of Japan Financial Reporting for general company (*jpfr-t-cte*)” is utilized, and the proposed Terminology of “Japan Financial Reporting for National University (*jpfr-t-nuv*)” is specified for expressing *Financial Report* of higher education institutions.

The proposed terminology of “Japan Institutional Reporting for national university of Japan (*jpir-t-nuv*)” is utilized for expressing *Institutional Report* of Japanese Universities. Conventionally, *Integrated Report* of Higher Education Institution is constructed by these XBRL-based terminologies.



Figure 8. Hierarchy of terminology.

For example, Table 1 shows part of “Japan Institutional Reporting for national university of Japan (*jpir-t-nuv*)”, which shows data of university information except financial information such as “number of students”, “number of faculty members” and so on. Fig. 9 shows the structure of taxonomies extended from Fig.3.

TABLE 3 “jpur-t-nuv” terminology

|                                                                                                                 |
|-----------------------------------------------------------------------------------------------------------------|
| <jpur-t-nuv:NnumberOfStudent<br>contextRef="CurrentYearInstant" decimals="">18150</jpur-t-nuv:NnumberOfStudent> |
| <jpur-t-nuv:NnumberOfFaculty<br>contextRef="CurrentYearInstant" decimals="">2328</jpur-t-nuv:NnumberOfFaculty>  |
| <jpur-t-nuv:NnumberOfStaff<br>contextRef="CurrentYearInstant" decimals="">2090</jpur-t-nuv:NnumberOfStaff>      |

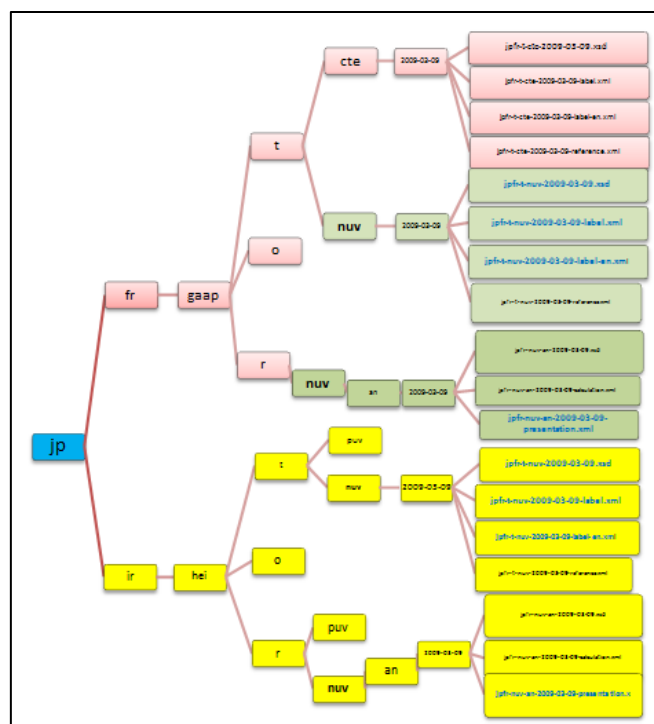


Figure 9. Hierarchical structure of extended taxonomy (jpir-t-nuv).

In this extension of taxonomies for higher education institutions, institutional structure and education program (curriculum) can be expressed as hierarchical structure shown in Fig. 10.

- 1: institution (college, university, polytechnic)
- 2: faculty
- 3: department
- 4: year
- 5: education program (curriculum)
- 6: course

Figure 10. Hierarchical structure of education program.

More detailed structure of “courses” in Fig. 10 also consists hierarchical structure recursively as

course title, course objectives, abstract, term, day, time, room, lecturer, plan, topics, assignment, prerequisite courses, evaluation, credit, textbook, and so on [11].

### C. Indicators for Higher education institution

Based on the proposed taxonomies, we can obtain various indicators of higher education institutions. Fig. 11 shows many kinds of financial indexes and other indicators for university and comparative analysis of seven large national universities in Japan. Fig. 12 shows the changes of financial indexes for B university in three successive years.

|                                                                                                                                      | A Univ.   | B Univ.   | C Univ.   | D Univ.   | E Univ.   | F Univ.   | G Univ.   |  |
|--------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--|
| Current ratio = (Current Assets)/(Current Liabilities)                                                                               | 100.4%    | 90.6%     | 82.2%     | 98.4%     | 78.5%     | 86.5%     | 87.2%     |  |
| Accounts payable ratio = (Accounts payable)/(Operating expenses)                                                                     | 16.2%     | 12.3%     | 17.5%     | 16.5%     | 17.5%     | 19.7%     | 11.7%     |  |
| Personnel expenses ratio = (Personnel expenses)/(Operating expenses)                                                                 | 56.0%     | 48.1%     | 44.0%     | 47.9%     | 46.3%     | 47.1%     | 49.3%     |  |
| General and administrative expenses ratio = (General and administrative expenses)/(Operating expenses)                               | 4.0%      | 2.8%      | 2.1%      | 2.9%      | 3.2%      | 3.1%      | 3.5%      |  |
| External revenue ratio = ((Delegated research revenue)+(Delegated project revenue)+(Donations revenue))/(Ordinary operating revenue) | 7.96%     | 11.60%    | 17.05%    | 8.32%     | 14.75%    | 11.09%    | 7.90%     |  |
| Research expenses ratio = (Research expenses)/(Operating expenses)                                                                   | 11.4%     | 17.4%     | 15.3%     | 11.5%     | 16.7%     | 16.0%     | 11.8%     |  |
| Education expenses ratio = (Education expenses)/(Operating expenses)                                                                 | 4.8%      | 3.8%      | 3.8%      | 3.6%      | 3.9%      | 4.1%      | 3.9%      |  |
| Ratio of Education expenses to student = (Education expenses)/(Number of student)                                                    | 214,215   | 228,975   | 267,041   | 186,176   | 229,595   | 201,497   | 206,649   |  |
| Ratio of research expenses to faculty = (Research expenses)/(Number of faculty)                                                      | 3,946,306 | 6,589,126 | 7,790,230 | 4,787,628 | 6,736,254 | 6,297,631 | 5,356,569 |  |

Figure 11. Financial Indexes and comparative analysis of universities (seven large universities).

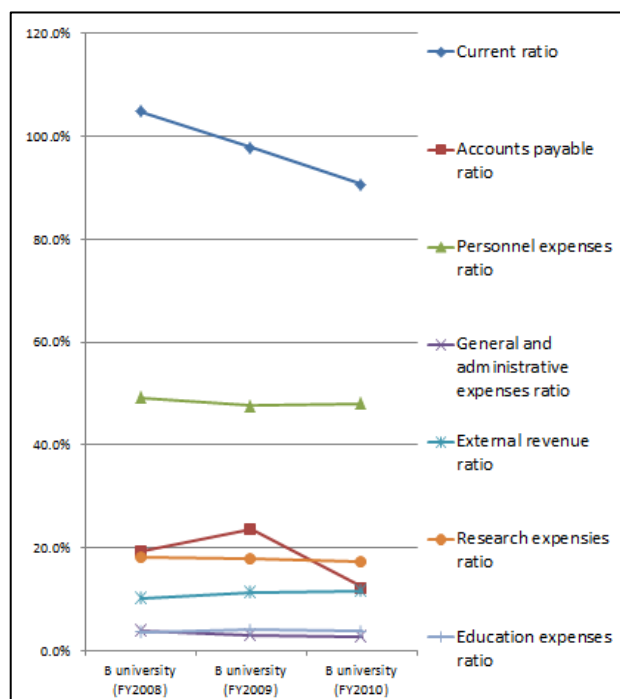


Figure 12. Changes of financial indexes in three successive years.

## V. CONCLUSIONS

In this paper we examined our extension of taxonomy design on the data for financial statements of national university of Japan, i.e., *nuv* taxonomy for balance sheet and income statement. Moreover, we extended XBRL taxonomies for higher education institutions that can produce financial indexes and more general institutional indicators for higher education institutions.

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