Types of Tabulation for Creating e-Portfolios

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Abstract—**The purpose of this research is to analyze the content of e-portfolios created by students in order to understand their tabulation and ways of displaying content. The five types of e-portfolio tabulation, in order of those most commonly created by students, are combination-based, content item-based, work-based, course unit-based, and time-based. The combination-based type incorporates the advantages of other tabulation types, while the content item-based and work-based types are better for clearly classifying data and step-by-step organization of it. Future research may further explore factors related to students' decision of tabulation type, the difficulties they face in the process, and their mentality as they adopt a portfolio type.**

Index Terms—**Portfolio, e-Portfolio, Tabulation, Type, Framework**

I. INTRODUCTION

As internet usage becomes more widespread, e-portfolios represent an advantage over traditional portfolios in terms of storage, access, management, interactivity, real-time functionality, and presentation method. E-portfolios have the capability to digitize information and organize content through hyperlinks. (Barrett and Garrett, 2009; Lorenzo and Littelson, 2005). Compared with paper-based portfolios, they also have the added value in terms of keeping records, connecting ideas, relating information, and publication (Barrett, 2006; Barrett and Garrett, 2009).

In terms of structure, e-portfolios favor systematic organization rather than random displays of data (Lee, 2006), and this organization is essential for helping viewers quickly get a grasp of the student's learning process. The tabulation of the portfolio provides a communication interface as well as a way to exchange information for its viewers, which is the only way for them to interact with the portfolio. In e-portfolios, tabulation is similar to the concept of website navigation, the primary function of which is to help viewers browse information. Navigation aids are often a part of web design, such as hyperlinks, search indexes, and tabulation. At the same time, good web navigation enables users to efficiently execute tasks and locate information quickly, which not only influences data retrieval, storage, and management, but also affects how information is obtained, produced, and organized (Barrett, 2006; Barrett and Garrett, 2009; Barrett, 2010; Oskay et al., 2008; Ntuli et al., 2009; Tubaishat, 2009).

Tabulation, which refers to a set of buttons arranged according to a specific method and order, has both a navigational mechanism and hyperlink functionality. Its primary function is to help viewers interact with portfolio content. It is similar to a navigation tool which includes category indexing and searching functionality, serving to organize the overall structure of the portfolio and facilitate interaction with users. It is therefore apparent that design of a portfolio's tabulation has a significant influence on how content is organized and presented. Tsai, Lowell, McDonald, and Lohr (2003) found that much of the time students spent creating e-portfolios went toward designing an interface and arranging the order in which content was presented, showing that organizing a good portfolio can present quite a challenge. Therefore, deciding on a suitable tabulation type or method of organizing content for students to follow can make it easier to create a good e-portfolio.

Wang's research (2004) establishes three categories of e-portfolio navigation interfaces: folder style menus, double level style menus, and guide map style menus. Different types affect the performance and attitude of learners as they navigate the portfolio, and portfolios are divided into these three categories based on navigation interface and button types. The three types of tabulation are irrelevant to the content items of an e-portfolio or the learning process of a student. Are they exactly the types of tabulation used in all e-portfolios? That remains to be researched. Kuo (2004) proposes several types of portfolio organization based on fields of study, content item, student works, chronological order, etc. These organization methods are relevant to the portfolio content items and the student's learning process, and may be used as a reference in designing the tabulation of the portfolio. However, they are designed for paper-based portfolios. Should e-portfolios have similar tabulations with those of paper-based portfolios? Or should they employ a different form of organization? And can these forms be categorized? These unanswered questions interested the researcher, and prompted exploration and induction of the types of portfolio tabulation used by students, forming the second motivation for the research.

In summary, the purpose of this research is to analyze the content of e-portfolios created by students in order to understand their tabulation and ways of displaying content. Portfolio structure refers to the way in which students use hyperlinks to organize and link portfolio content according to a specific method. Portfolio structure includes tabulation, navigation des ign, and links between different items in the portfolio. Questions to be explored include: (1) Can e-portfolios be categorized in terms of content, and if so, what are these categories? (2) Can portfolio structure be categorized according to tabulation, and if so, what are these categories?

II. METHOD

A. Subjects

Research was conducted among graduate students in a course on "Digital Test and Assessment". E-portfolios were collected from 21 students, 4 of which were incomplete, leaving 17 valid for analysis. They included 7 men and 10 women; 12 masters and 5 PhD students. The course was conducted 2 hours a week for 18 weeks, and involved exploring the principles, methods, and systems of digital tests and assessment. The three class assignments were design of online test system, design of online assessment system, and digital concept map creation and assessment. Students were allowed to include the three works in their e-portfolios to present their achievements and learning process. Students created their e-portfolios by using Webpage production software (e.g. Frontpage, Dreamweaver) or presentation software (e.g. Powerpoint). Conducting research among these students in the "Digital Test and Assessment" course was advantageous because: 1) They were already familiar with the concept of e-portfolios, since the course included a unit on e-portfolios. 2) The course was related to computers, so students had basic computer literacy and skills which reduced the difficulty of creating e-portfolios. 3) Required course assignments were all electronic and thus suitable for assessing or presenting in an e-portfolio.

B. Data Gathering and Analysis

For this research, content analysis was used to examine data. This method was used non-obtrusively to portray a representative impression of the values and beliefs of participants in a specific location (Marshall and Rossman, 2006). Content analysis may also be used to analyze the features of student works (Lin, 2003). Therefore, this research gathered student-created e-portfolios, analyzed their content, and singled out common features and context of development in order to study the research questions. The reflection contents of student portfolios were also studied in order to understand concerns of students as they created the portfolios.

III. RESULTS AND DISCUSSION

The tabulation of a portfolio is also a condensation of its contents, drawn from the portfolio itself. It shows the portfolio's contents, reflects the features of its form, and is highly flexible. The tabulation of an e-portfolio is similar to the hyperlink buttons of a navigation interface in that it plays an important role for linking and navigating content. Before creating a portfolio, it is essential to decide on a type of tabulation, otherwise the contents will not be efficiently organized and integrated. The student's type of tabulation may be determined by the button names, content, structure, and features listed for each tabulation type by this study. Each of the students who submitted an e-portfolio to this study had chosen a type of tabulation, and Student H chose to incorporate two types in his (her) portfolio. Findings revealed five types of tabulation: time-based, course unit-based (or study topic-based), content item-based, work-based, and combination-based tabulations.

As Table I shows, the study also revealed that "content item-based" and "combination-based" were the most common type of tabulation chosen, with "work-based" and "course unit-based" types being next, and "time-based" being the least chosen type.

TABLE I: STUDENT PERCENTAGES OF DIFFERENT TYPES OF E-PORTFOLIO TABULATION.

Types of portfolio tabulation	Students	Percentages
Time-based	G	6%
Course unit-based (or study topic-based)	H, N, Q	18%
Content-item based	B, F, H, I, P	29%
Work-based	A, C, D, E	24%
Combination-based	J, K, L, M, O	29%

Note: Student H has two types of portfolio tabulation.

A. Time-Based Type

This type of tabulation features button names divided by weeks and arrangement based on the order of course units. Course content is included as annotation next to the name of the week. The names of buttons on the second level are based on the important content items of the portfolio, such as learning goals, reflection, etc. Student G used a time-based tabulation whose button names were based on a list of the number of weeks, that is, week 1, week 2, week 3, etc. These buttons were also hyperlinked to the portfolio content items (the second level of buttons), such as learning goals, reflections, class notes, or peer evaluations. The content items on the second level varied depending on the material covered in class for each week, for example, content differed for weeks spent in regular class as opposed to presentation of works. Some weeks, such as midterm week, did not have any hyperlinks, perhaps because no teaching was conducted that week.

B. Course Unit-Based Type

In this type of tabulation, buttons are named after the course unit (or study topic.) The second level of buttons is based on the important content items of the portfolio, such as learning goals, reflections, learning resources, teacher feedback, peer evaluations, self-feedback and other relevant organized data. This form shares some similarities with the time-based tabulation type, however, the difference lies in that tabulation buttons are based on the names of similar course units over a period of several weeks, instead of listing individual weekly progress. Students H, N, and Q adopt this type of tabulation, as described below.

1) Student H adopts button names based on course unit numbers, such as course unit 1, course unit 2, course unit 3, etc, as well as content items, such as learning goals, learning resources, and reflection.

2) Student N adopts button names based on course unit numbers, such as course unit 1, course unit 2, course unit 3, etc, as well as content items, such as learning goals, learning resources, reflection, and works for the current unit.

3) Student Q adopts button names based on course unit numbers, such as course unit 1, course unit 2, course unit 3, etc, as well as content items, such as learning goals, learning resources, reflection, and feedback.

C. Content Item-Based Type

For this type, button names are based on the portfolio's content items (Fig. 1). The second level buttons are based on time, student works, or course units, with the student work button being most common (Fig. 2). This tabulation type is relatively easier to create. Students B, F, H, I, and P adopt this type, as described below.

1) Student B's tabulation included 12 buttons, such as basic personal information, self-reflection, self-set learning goals, etc.

2) Student F's tabulation included 13 buttons, such as basic personal information, self-reflection, self-set learning goals, etc.

3) Student I's tabulation included 6 buttons: basic personal information, course syllabus and schedule, learning outcomes, assignments, reflection, and evaluation.

4) Student P's tabulation included 6 buttons: basic personal information, course syllabus and schedule, self-reflection, assignments and evaluation, record of discussions, and personal learning record.

5) Student H's tabulation included 6 buttons: learning goals, learning experience gained in the portfolio creation process, record of the learning process, assignments, record of discussions, and evaluation. In the second level of buttons, information was sub-divided, for example, the learning goal button was broken down into categories based on different weeks, and the "learning experience from the portfolio creation process" button was divided by experiences gained in different course units

D. Work-Based Type

In this type, tabulation buttons are named after works which were assigned in class. The second level of buttons is named after important items of content, such as learning goals, reflection, learning resources, teacher feedback, peer evaluation, and self-feedback. Students A, C, D, and E adopted this tabulation type, as described below.

1) Student A's tabulation buttons included two levels. The first included 4 items: basic personal information, and works 1, 2, and 3. The second level presented information related to each work.

2) Student C's tabulation buttons included three levels. The first included 4 items: basic personal information, course introduction, works display, and specific recollections. The "works display" was linked to buttons for each of the individual works (the second level of tabulation). Selecting any of these buttons would take the viewer directly to the student works (the third level).

3) Student D's tabulation buttons included two levels. The first level included 6 items: about me, course syllabus and schedule, about our class, and works 1, 2, and 3. The second level presented information related to the works, such as learning goals, reflection, works display, and teacher, peer, and self feedback for each work.

4) Student E's tabulation buttons also included two level. The first level included 5 items: about me, course syllabus and schedule, and works 1, 2, and 3. The second level presented information related to the works, such as learning goals, reflection, works display, and teacher feedback.
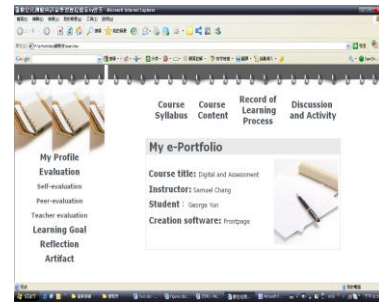

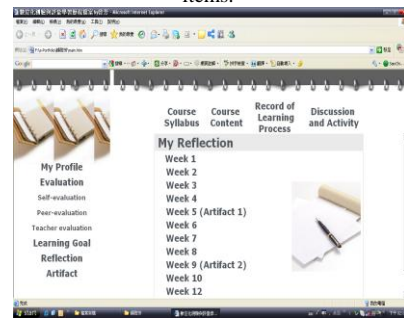Fig. 1. Screenshot of an e-portfolio Webpage based on tabulation of content items.

Fig. 2. Reflection on the second-level page of an e-portfolio based on tabulation of content items.

E. Combination-Based Type

This tabulation type is a combination of the features of any two of the aforementioned types. For example, tabulation buttons might include some of the items of content, all the student works, and some other items (such as basic personal information, course schedule, or learning resources). Second level buttons could include course units or student works, such as works 1, 2, or 3. This level is similar to course unit-based or works-based type of tabulation. The third level of buttons is composed of some of the items of portfolio content, such as course handouts, further reading materials, works display, evaluation, and reflection. In fact, Fig. 5 shows that the combination tabulation type is virtually a combination of the content item-based and work-based types, the only difference being that the work buttons are moved to the second level, and some of the items of content are moved to the third level. Students, J, K, L, M, and O adopted this tabulation type, as described below.

1) Student J's tabulation buttons were divided into three levels. The first level included 7 items: basic personal

information, course outlines, learning goals, portfolio download, a record of activities, a website map, and three major works. Works 1, 2, and 3 on the second level were linked to such items of content as works display, examples of development and progress, learning resources, and evaluation (the third level).

2) Student K's tabulation buttons were divided into three levels. The first level included 5 items: basic personal information, course syllabus and schedule, learning goals, three major student works, and class notes. Works 1, 2, and 3 on the second level were linked to items of portfolio content such as course handouts, further reading materials, reflection, works display, and works evaluations (the third level).

3) Student L's tabulation buttons were divided into three levels. The first level included 6 items: basic personal information, course syllabus and schedule, learning goals, evaluation forms, learning experiences from the portfolio creation process, and student works. Works 1, 2, and 3 on the second level were linked to items of portfolio content such as works display, self-reflection, and peer feedback (the third level).

4) Student M's tabulation buttons were divided into three levels. The first included 5 items: basic personal information, course syllabus and schedule, learning goals, a record of activities and discussions, and three major works. Works 1, 2, and 3 on the second level were linked to items of portfolio content such as class handouts, works display, reflection, learning resources, and evaluation (the third level.)

5) Student O's tabulation buttons were divided into two levels. The first included 6 items: basic personal information, course introduction, student works, records of reflection and development, and learning goals. Works 1, 2, and 3 on the second level were linked to items of portfolio content such as works requirements, displays, and evaluations.

IV. CONCLUSION AND IMPLICATION

The five types of e-portfolio tabulation, in order of those most commonly created by students, are combination-based, content item-based, work-based, course unit-based, and time-based. The combination-based type incorporates the advantages of other tabulation types, while the content item-based and work-based types are better for clearly classifying data and step-by-step organization of it. The main features of each tabulation type are listed below:

1) Time-based: Arranged by week, with content also organized according to this method.

2) Course unit-based: Arranged by the main unit of courses, with content also organized according to this method.

3) Content item-based: Arranged by items of portfolio content, with content also organized according to this method.

4) Work-based: Arranged by class work or assignment type, with content also organized according to this method.

5) Combination-based: Refers to tabulation which combines any of the two types listed above. Most are a combination of the content item-based and work-based types.

The findings of this study are not altogether the same as the six types mentioned by Kuo (2004). Those parts sharing similarities include the time-based, content item-based, and work-based types. His organization methods of "field of study" or "topic within field of study," however, are more similar to the course unit-based type featured in this study. Finally, the combination-based type featured in this study was not among those mentioned by Kuo. This result can answer the research question proposed in this study. It is that e-portfolio structures can be categorized into at least five types according to tabulation. According to the research findings, instructors should introduce various types of tabulation as well as the pros and cons of each of them; meanwhile, they should present useful examples so that learners are able to view and learn from it. On the other hand, in tabulation selection, a learner must take into consideration his/her learning styles in order to have the choice effective and appropriate. Content item-based or combination-based types, considering its accessibility, are well-suited for those who are not inclined toward any type; students may find the work-based type fairly convenient and handy; time-based or course unit-based will satisfy the students who value richness and completeness, even though they are likely to be time- and labor-consuming.

Future research may further explore factors related to students' decision of tabulation type, the difficulties they face in the process, and their mentality as they adopt a portfolio type. The development of an e-portfolio platform may take into consideration the types of tabulation established by this study. The findings of this study may also provide a reference for students or teachers designing the tabulation of their portfolios.

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