



Consideration factors and adoption of type, tabulation and framework for creating e-portfolios

Chi-Cheng Chang^{a,*}, Kuo-Hung Tseng^b, Hsiu-Ping Yueh^{c,**}, Wei-Chien Lin^c

^a Department of Technology Application and Human Resource Development, National Taiwan Normal University, No. 162, He-Ping E. Road, Section 1, Taipei 106, Taiwan

^b Graduate Institute of Business and Management, Meiho University, No.23, Pingguang Rd., Neipu, Pingtung, Taiwan

^c Department of Bio-Industry Communication and Development, National Taiwan University, No. 1, Sec. 4, Roosevelt Road, Taipei, 106 Taiwan

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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 analytic result shows that the number of outcome portfolios created by students is more than that of process portfolios. 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.

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1. 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 & Garrett, 2009; Lorenzo & 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 & Garrett, 2009). Portfolios are categorized based on intended purposes, include outcome, process, assessment, and reflective portfolios, presentation, showcase, and assessment, etc (Abrami & Barrett, 2005; Greenberg, 2004; McPherson, 2007; Tillema & Smith, 2000). Of course, portfolios differ not just in terms of student's learning process but also their particular personal styles as well. Also, the way in which content is collected, organized, and displayed is very important in creating an e-portfolio. However, portfolio content differs according to the proficiency of the student who created it, resulting in different types of portfolios. Therefore, the purpose of this study is to explore whether student e-portfolios can be categorized, and if so, what these categories are. This is one of the motivations for this study.

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, 2010; Barrett & Garrett, 2009; Ntuli, Keengwe, & Kyei-Blankson, 2009; Oskay, Schallies, & Morgil, 2008; Tubaishat, Lansari, & Al-Rawi, 2009).

Tabulation, which refers to a set of buttons arranged according to a specific method and order, has both the 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

* Corresponding author. Tel.: +886 2 77343439; fax: +886 2 23921015.

** Corresponding author. Tel.: +886 2 33664427; fax: +886 2 23634827.

E-mail addresses: samchang@ntnu.edu.tw, samchichengchang@gmail.com (C.-C. Chang), gohome8515@gmail.com (K.-H. Tseng), yueh@ntu.edu.tw (H.-P. Yueh), weichien.lin@gmail.com (W.-C. Lin).

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 design, 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?

2. Literature reviews

2.1. Types of e-portfolio and considerations of creation

Several universities have already included the creation of e-portfolios to their graduation requirements (Greene & Ferrell, 2006; 2007), and many teacher education institutions have also listed e-portfolios as a requirement for teacher certification and the institution itself, showing that the creation of portfolios is a necessary skill for both university students and pre-service teachers. Therefore, a firm grasp of the principles and correct process for creating e-portfolios is a skill every university student must have. Also, in order to ensure that the creation process goes smoothly, it is important to understand beforehand the portfolio types or features that one wishes to make use of.

Types of portfolios include the presentation portfolio, documental portfolio, assessment portfolio, process portfolio, outcome portfolio, comprehensive portfolio, record portfolio, work portfolio, course portfolio, reflective portfolio, structured portfolio, and learning portfolio (Carlson, 1999; Cole, Ryan, & Kick, 1995; Danielson & Abrutyn, 1997; Greenberg, 2004; Tillema & Smith, 2000), with the main difference being portfolios oriented toward assessment as opposed to those focused simply on presenting one's learning process or outcome. In regards to the features of digitalized portfolios, Abrami and Barrett (2005) argued that e-portfolios may be designed as three types: process, showcase, and assessment portfolio. McPherson (2007) divides e-portfolios into presentation portfolios, learning portfolios, work portfolios, and resource portfolios. Presentation portfolios are focused on presenting professional achievements; learning and work portfolios present one's learning process and reflections on the process; resource portfolios use a variety of portfolio formats and hyperlinks and multimedia to present digital resources.

2.2. Framework and tabulation of e-portfolios and considerations of creation

The purpose of e-portfolios is to systematically gather data in order to present the student's learning process. However, portfolios with an abundance of data that are not properly organized run the risk of being cluttered and unfocused. In a sense, the importance of portfolio tabulation may be shown. However, there are so few previous studies discussing the tabulation of e-portfolios. Generally, tabulation or table of contents (TOC) is a basic element in a portfolio (Oskay, Schallies, & Morgil, 2009). According to Wang (2009), Chalk & Wire's e-Portfolio system has table of contents linking to assessment. In bibliography or the study of tabulation, it is held that the tabulation is a series of buttons arranged in a specific order, which functions as a tool for assessing the portfolio's contents. These buttons are composed based on the content and form of the portfolio; in other words, they are a condensed version of the portfolio's contents. Library collections, for example, are organized according to bibliographical principles into collection catalogues, categorized catalogues, and subject catalogues, etc. Regardless of how it is presented, a portfolio's tabulation reflects not just its form and content but how it will be understood by creators or viewers.

An e-portfolio's tabulation helps viewers navigate content, and includes menus and hyperlinks. It can also lead users to establish relationship structures between information nodes, helping them switch back and forth between the nodes, and help them choose the content they wish to read without getting lost among the complex information presented (Wang, 2004). Therefore, a good tabulation makes organization of data more logical, helps viewers establish connections between the portfolio's structure and its content, and enables more systematic browsing. Therefore, the generic relationships of information may be sorted in order to create buttons which reflect content, following which tabulation types may be differentiated. According to Kuo (2004), organizing information in a proper way can effectively display a student's development, progress, or achievements, which is a necessary part of creating an e-portfolio. He offers several methods for portfolio organization, including those organized by fields of study, topics within a field of study, types of content item, student works, chronological order, or one of two distinct models: "student works first, followed by self-assessment and reflection," or "self-assessment and reflection included as an attachment following the works." In some e-portfolio samples (Burnett & Williams, 2009; Sweat-Guy & Burnett, 2007; Tubaishat et al., 2009), tabulations were created in terms of fields of study as learning content was the main focus. Otherwise, tabulations could be based on e-portfolio content items, e.g. goal setting, reflection, work, evaluation etc.

According to Lee (2006), students should design the tabulation for navigation after gathering data and organizing it into a portfolio. Wang's research (2004) establishes three categories of navigation interfaces: folder-style menus, double level style menus, and guide map

2-1

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2-3

Table 2

Checklist of tabulation types and lining data on each level in e-portfolios.

Portfolio	First level	Second level	Third Level	Type of tabulation
A	Work	Content items		Work
B	Content item	Time	Work	Content item
C	Work	Content item		Work
⋮				
⋮				

3.4. Validity

This study uses Barrett's (2000) e-portfolio evaluation criteria to assess whether student portfolios may be considered e-portfolios. Evaluation criteria include: 1. Whether the portfolio shows a sufficient degree of meta-cognition or reflection, 2. An easily-used navigation mechanism, 3. A user-oriented interface, 4. Whether the portfolio incorporates criteria, student works, and reflection; 5. Appropriate use of multimedia. Each criterion is described according to five different levels as shown in Table 4. For the purposes of this study, the evaluation criteria were used to assess whether portfolios could be considered e-portfolios rather than evaluating detailed quality. Therefore, all student portfolios with level 1 or higher in each of the evaluation criteria were considered e-portfolios whose content could be further analyzed and which could improve the validity of content analysis.

4. Results and discussion

4.1. Portfolio samples

Analysis showed that 4 of the 21 student portfolios were incomplete and had insufficient content to analyze portfolio types and structures. These 4 portfolios fell short of the lowest level (level 1) for at least one of Barrett's (2000) e-portfolio evaluation criteria, and thus could not be considered e-portfolios. As Table 5 shows, the other 17 student portfolios reached at least level 1 for each of the five evaluation criteria, and may thus be considered e-portfolios, suitable as samples to analyze portfolio types and structures.

All 17 portfolios reached a level 5 in the aspect of meta-cognition and reflection. In the “easily-used navigation mechanism” aspect, the majority of students (65%) received a level 4. In the “user-oriented interface” aspect, the majority of students (65%) received a level 3. In the “Integration of portfolio criteria, works, and reflection” aspect, the majority of students (71%) received a level 3. In the “appropriate use of multimedia aspect,” the majority of students (35%) received either a level 1 or 5 (35% in each level). When the levels were converted to scores, meta-cognition and reflection held the highest. However, the score of the user-oriented interface was the lowest, implying that it was the most difficult aspect to reach.

4.2. Types of e-portfolio and considerations of creation

Based on objective and content, portfolios may be divided into two types, outcome and process (Cole et al., 1995). Moreover, Abrami and Barrett (2005) argued that research on the outcomes and processes supported by e-portfolios may be considered as the most important research. Outcome portfolios emphasize a student's outstanding works or achievements, such as finished creations, but they fail to show student development and effort over the course of his or her learning process. Process portfolios emphasize a student's learning process, providing a record of his or her efforts and achievements, and may include papers written over the course of education, such as outlines,

Table 3

Reliability between analyzers in the e-portfolio type and tabulation.

Portfolio	Portfolio type			Portfolio tabulation		
	Researcher	Teacher	Disagree	Author	Teacher	Disagree
A	2	1	D	6	6	
B	2	2		5	5	
C	1	2	D	6	6	
D	2	2		6	6	
E	1	1		6	6	
F	2	2		5	5	
G	1	1		3	4	D
H	1	1		4	5	D
I	2	2		5	5	
J	1	2	D	7	7	
K	2	2		7	7	
L	1	2	D	7	7	
M	2	2		7	7	
N	2	2		3	4	D
O	2	2		7	7	
P	1	1		5	5	
Q	1	1		4	4	

Note: 1 Outcome portfolio, 2 Process portfolio, 3 Time-based tabulation, 4 Course unit-based (or study topic-based) tabulation, 5 Content item-based tabulation, 6 Works-based tabulation, 7 Combination-based tabulation.

Table 4
Evaluation criteria of e-portfolios.

Criteria	Levels	Descriptions of level
Meta-cognition or reflection	1	Comprehensive reflection on the entire portfolio
	2	Inclusive of level 1 in addition to self-set learning goals
	3	Inclusive of level 2 in addition to reflection on learning goals as well as setting future learning goals
	4	Inclusive of level 3 in addition to reflection on student works
	5	Inclusive of level 4 in addition to feedback from others and self-evaluation.
Easily-used navigation mechanism	1	Linear documents. No navigation links, or links with errors.
	2	Hyperlink functionality, connecting from tabulation to student works. (one-way links)
	3	Hyperlink functionality connecting tabulation, student works, reflection, etc. (two-way links)
	4	Fully hyperlinked documents, connecting tabulation, student works, reflection, etc.
	5	Full interactivity presented in an engaging, intuitive manner.
User-oriented interface	1	Lacking a user-oriented interface
	2	Relatively non user-oriented interface
	3	Clear and moderately user-oriented interface
	4	Clear and highly user-oriented interface
	5	Very clear and perfectly user-oriented interface
Integration of portfolio criteria, works, and reflection	1	Stand-alone original document portfolio
	2	Stand-alone or merged document portfolio
	3	All documents combined in a single portfolio
	4	All documents combined in a website-based portfolio
	5	Documents combined into an automatically playing multimedia presentation portfolio
Appropriate use of multimedia	1	No audio or video, or inappropriate use
	2	Audio only
	3	Selective, appropriate use of audio and video
	4	Appropriate use of audio and video
	5	Appropriate use of audio and video that is well integrated with the portfolio presentation

rough drafts, first drafts, and final drafts, as well as records of discussions. According to MacDonald, Liu, Lowell, Tsai and Lohr (2004), process portfolios should include specific student works or examples that show a student's achievements and development process, and this is the biggest difference between outcome and process portfolios. Therefore, for the purposes of this study, outcome and process portfolios are distinguished based on the content's "formative or summative samples, works, or achievements," and "whether or not they shows examples or evidence of development and progress."

Table 6 shows the findings of analysis. Students A, E, G, H, P, and Q only presented a final achievement for each study topic. Although Student A explained the process of creating his (her) work, the portfolio lacked examples or evidence of this, such as documents created during the process. Students C and L presented a portion of their final outcomes for the study topics, but failed to include examples or evidence of the effort exerted or progress experienced during the process. Therefore, the e-portfolios created by students A, C, E, G, H, L, P, and Q fit better under the category of outcome portfolios. Students B, D, F, I, K, M, N, and O presented the development of their works and included drafts and unfinished versions of the product that were created in the process. Although Student J did not present the development of his (her) works, he (she) demonstrated development and progress with examples and evidence of extracurricular study. Therefore, the e-portfolios created by students B, D, F, I, J, K, M, N, and O focused on presentation of the learning process and evidence of effort, and thus better fit the category of process portfolios.

As shown above, even if they are being taught by the same teacher, there are slight differences in the way students interpret and present e-portfolio content, resulting in different types of e-portfolios. Student considerations in choosing a type of portfolio can be gathered from the reflections in their portfolios.

Student A: "Everyone knows that an e-portfolio should present concrete information and examples about one's learning process, but this is easier said than done. It was simple enough to save copies of different versions of my works into the computer, but I was a bit embarrassed to share some of these unfinished works with my classmates. I didn't always have the time to collect evidence and examples of progress, and sometimes had to settle for just presenting final works."

Table 5
Analytic results of e-portfolio samples.

Criteria	Percentages of students					Average
	Level 1	Level 2	Level 3	Level 4	Level 5	
Meta-cognition and reflection	0	0	0	0	100%	5
Easily-used navigation mechanism	0	6%	29%	65%	0	3.5
User-oriented interface	0	29%	65%	4%	2%	2.8
Integration of portfolio criteria, works, and reflection	0	0	71%	29%	0	3.3
Appropriate use of multimedia	35%	6%	0	24%	35%	3.2

Table 6
Student percentages of different types of e-portfolio.

Types of portfolio	Students	Percentages
Outcome portfolio	A, C, E, G, H, L, P, Q	47%
Process portfolio	B, D, F, I, J, K, M, N, O	53%

Student B: “During class, the teacher repeatedly emphasized that the content of a portfolio should focus on presenting one’s learning process rather than simply displaying finished works. This was rather tough, and forced one to always stay in the habit of collecting material on their learning process. I got in the habit of organizing my materials whenever possible. Working week by week, I would gather materials and then on the weekends spend some time to organize them and plan an order and method for presenting them. I saved copies of different versions of my works, and did my best to keep a record of evidence of efforts or examples of progress. The only time I fell behind in this habit was the week of midterms, and I made up for this the next week.”

4.3. Types of e-Portfolio tabulation and considerations of creation

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 7 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.



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4.3.1. Time-based type

Fig. 1 shows a time-based tabulation. 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.

The advantage of this type of tabulation is that it is arranged according to time, which is useful for presenting a complete record of course progress. Students must collect materials each week, and thus it is easier to observe their development and changes on learning. The disadvantage of this tabulation type is that having to record learning goals and reflections each week is a lot of work for students. If students feel their work load is too heavy, they may leave out content items (such as learning goals or reflection) for certain weeks, resulting in a lack of hyperlinks for that week. The considerations of students who used time-based tabulation are apparent from their reflections.

Student G: “The teacher stated at the beginning of the course that it’s important to choose a type of tabulation before making a portfolio. I considered for several weeks before deciding on weekly-based tabulation buttons, which I chose because it was the best way to present a complete record of my learning process. But I also worried that setting learning goals and recording reflections each week might be a lot of work, something the teacher had mentioned at the beginning of the course. Later I thought that if I left out links on some weeks, such as midterm week, during which no classes are held, that would make things easier, so I stopped worrying about this. In the end I decided on weekly-based tabulation buttons, taking the first step toward creating my portfolio.”

4.3.2. Course unit-based type

Fig. 2 shows a tabulation type based on course units. 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.

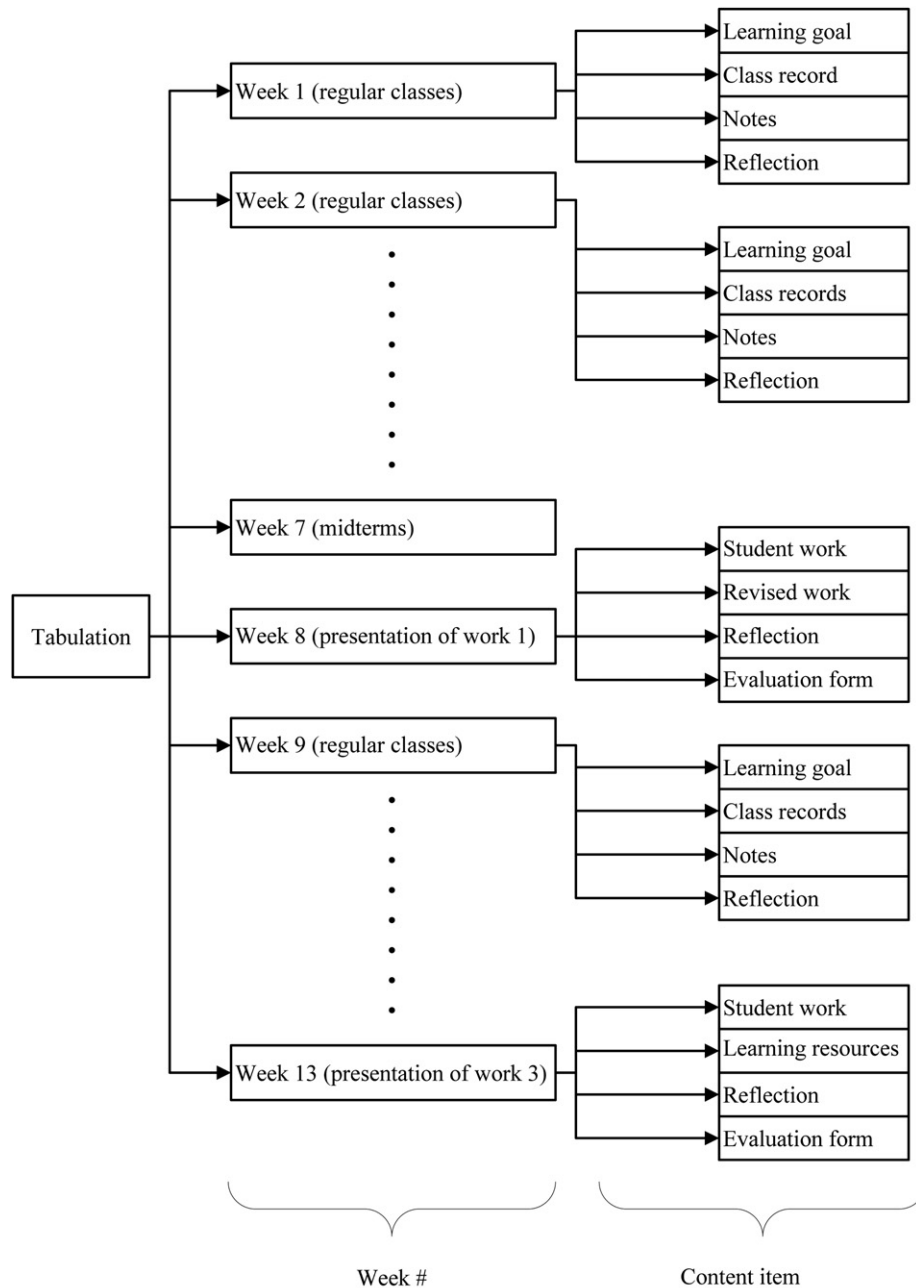
1. Student H adopts button names based on course unit numbers, such as course unit 1, course unit 2, course unit 3, etc, as well as content items, such as learning goals, learning resources, and reflection.
2. Student N adopts button names based on course unit numbers, such as course unit 1, course unit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

The advantage of this tabulation type is that it corresponds with the progress of material being taught in class. In addition to having phases which are more clearly defined than those in the time-based tabulation type, course unit-based tabulation offers features more

Table 7
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.



Note: Links between the buttons themselves are not displayed

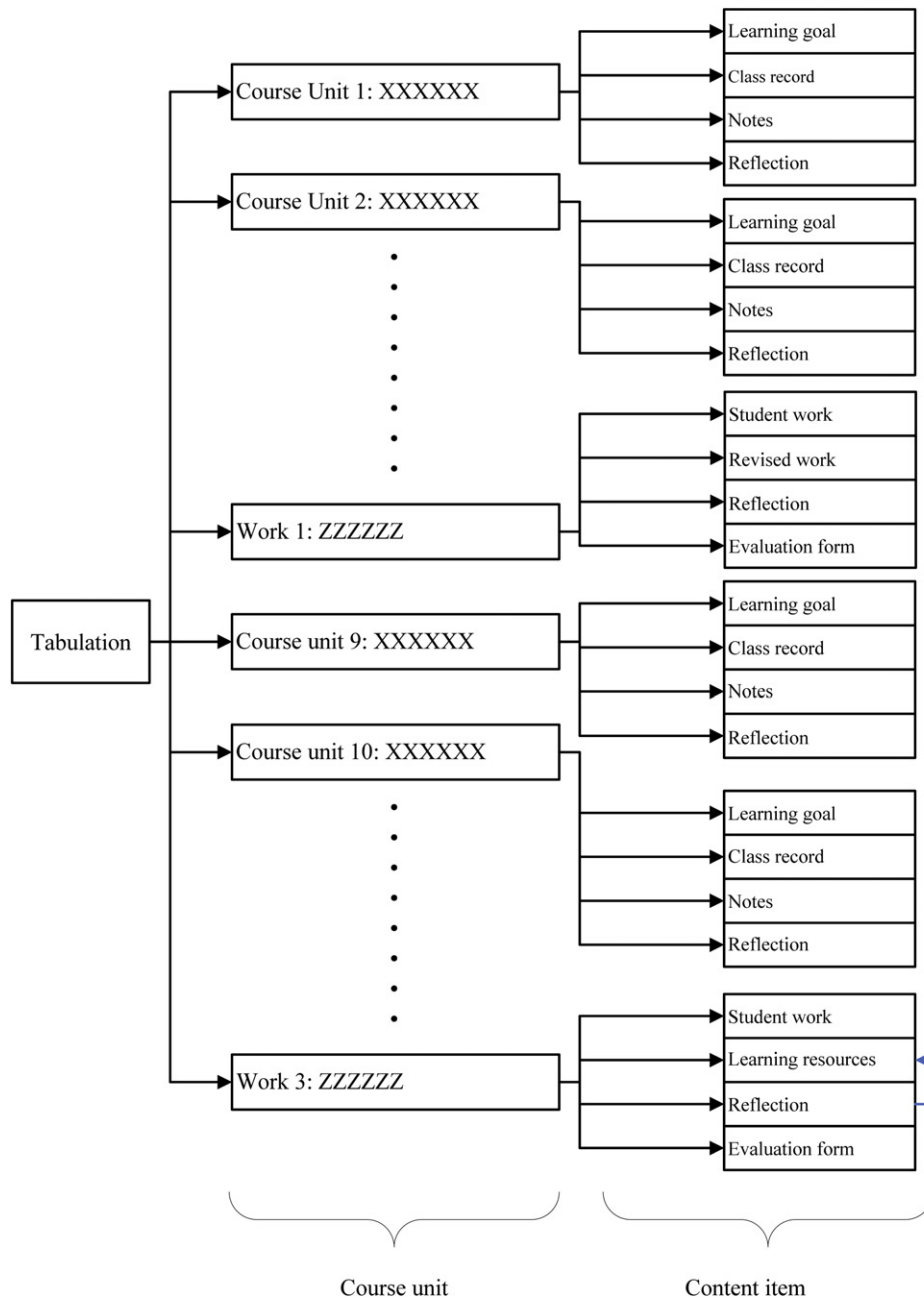
Fig. 1. Structure of portfolios featuring time-based (or weekly) tabulation, Note: Links between the buttons themselves are not displayed.

specific presentation of student achievement and reflections, which helps teachers and peers conduct evaluations. This **type of tabulation is also less work for students**, not having to reflect and set objectives each week. The drawback is that students have no way of presenting their weekly learning goals, reflections, and achievements, and teachers do not get a detailed picture of weekly student progress. The considerations of students who used course unit-based tabulation are apparent from their reflections.

Student H: “The teacher introduced several types of portfolios, but I couldn’t make up my mind on one. But a few days ago I had a sudden idea. If I created a portfolio that corresponded to our class topic of progress of materials being covered, it would help me learn the class topic better, and divide my achievements in different course units into different buttons. It would also be easier not having to write learning goals and reflections each week. OK! I’m going to use course unit type tabulation for my portfolio.

4.3.3. Content item-based type

Fig. 3 shows a tabulation type based on content items.” For this type, button names are based on the portfolio’s content items (Fig. 4). The second level buttons are based on time, student works, or course units, with the student work button being most common (Fig. 5). This tabulation type is relatively easier to create. Students B, F, H, I, and P adopt this type, as described below.



Note: Links between the buttons themselves are not displayed

Fig. 2. Structure of portfolios featuring tabulation based on course units, Note: Links between the buttons themselves are not displayed.

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.

The advantage of this tabulation type is that students define and categorize the contents of their portfolio; there is no need for evaluators to explain the meaning of the contents, but to review whether data provided by the student sufficiently reflect the meaning of the content

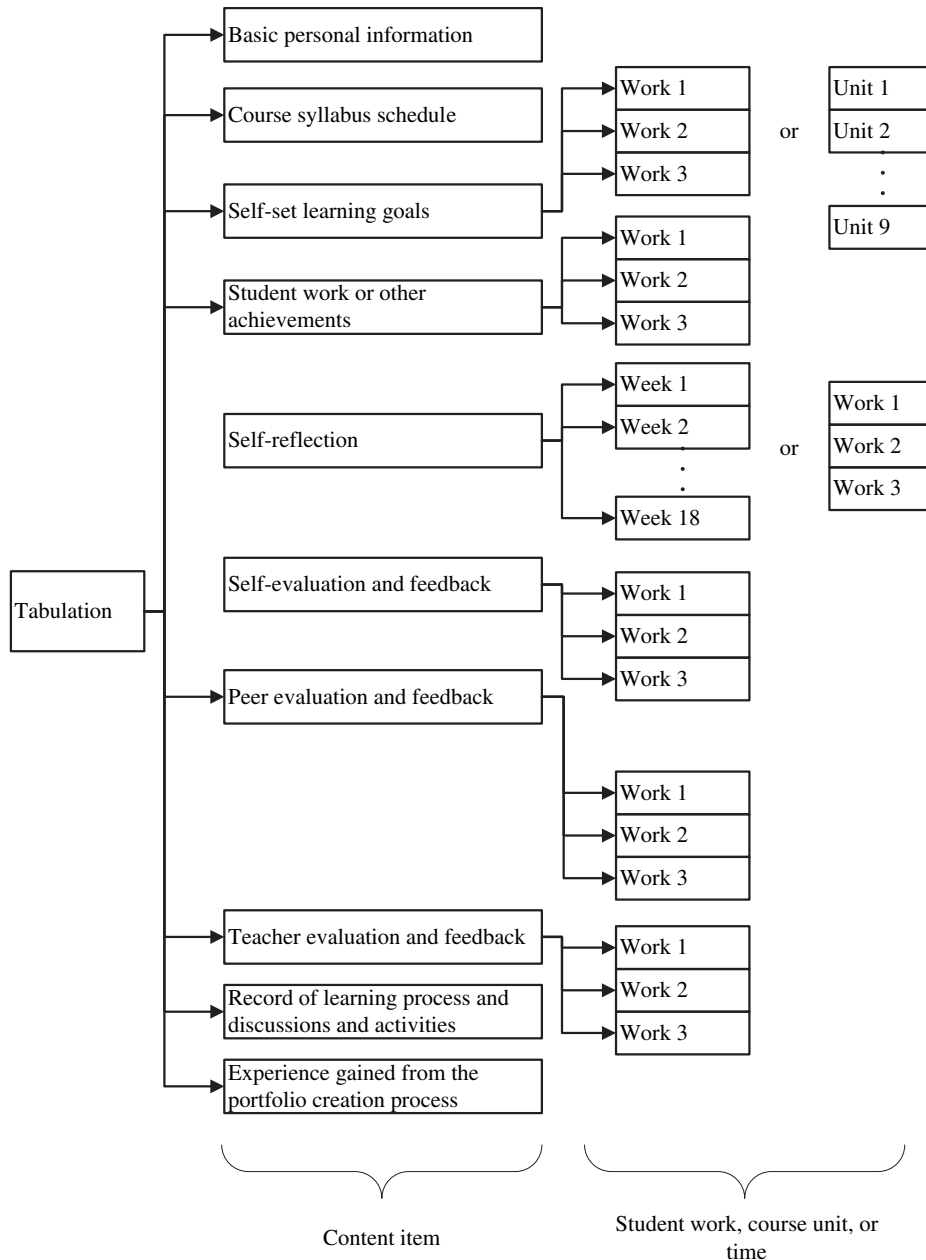


Fig. 3. Structure of portfolios featuring tabulation based on content items, Note: Links between the buttons themselves are not displayed.

items, simplifying the task of teacher and peer evaluation. The disadvantage of this type is that the categorization method for the second level (student works, time, or course unit) is not entirely consistent for each student, **which can complicate the task of evaluation**. Also, it is more difficult for a student to present his or her learning process at different points in time (i.e. weekly learning goals, reflections, etc.). When teachers do not understand how the learning process of students is progressing, this makes review and evaluation difficult. The considerations of students who used the tabulation based on content items are apparent from their reflections.

Student B: "When first introducing the e-portfolio, the teacher explained content items which are commonly used. This gave me some ideas for my own portfolio tabulation. Forming tabulation buttons from the portfolio contents was the most intuitive method, in the same way that a book's table of contents is composed of the titles of its individual chapters! Looking up a chapter is as easy as locating and turning to the right page number. So it seems that a good way to organize e-portfolios is to use hyperlink buttons named after items of content, which when clicked lead to details on those buttons."

Student F: "The drawback to basing a portfolio's tabulation on its items of content is that it may not be well time-based, making it difficult to present the progression of a student's learning process or achievements. A possible solution would be to adjust the second or third level of buttons, perhaps by placing the time button in one of these levels to show the progression of learning achievements."

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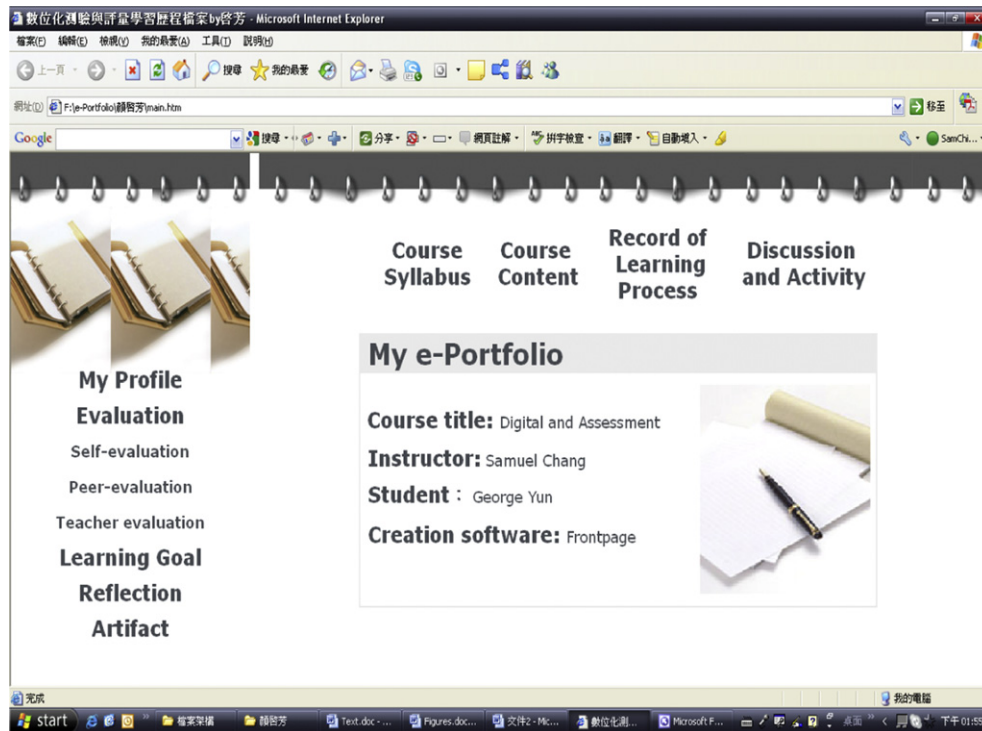


Fig. 4. Home page of an e-portfolio based on tabulation of content items, Note: Links between the buttons themselves are not displayed.

4.3.4. Work-based type

Fig. 6 shows a tabulation type based on student works. 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.

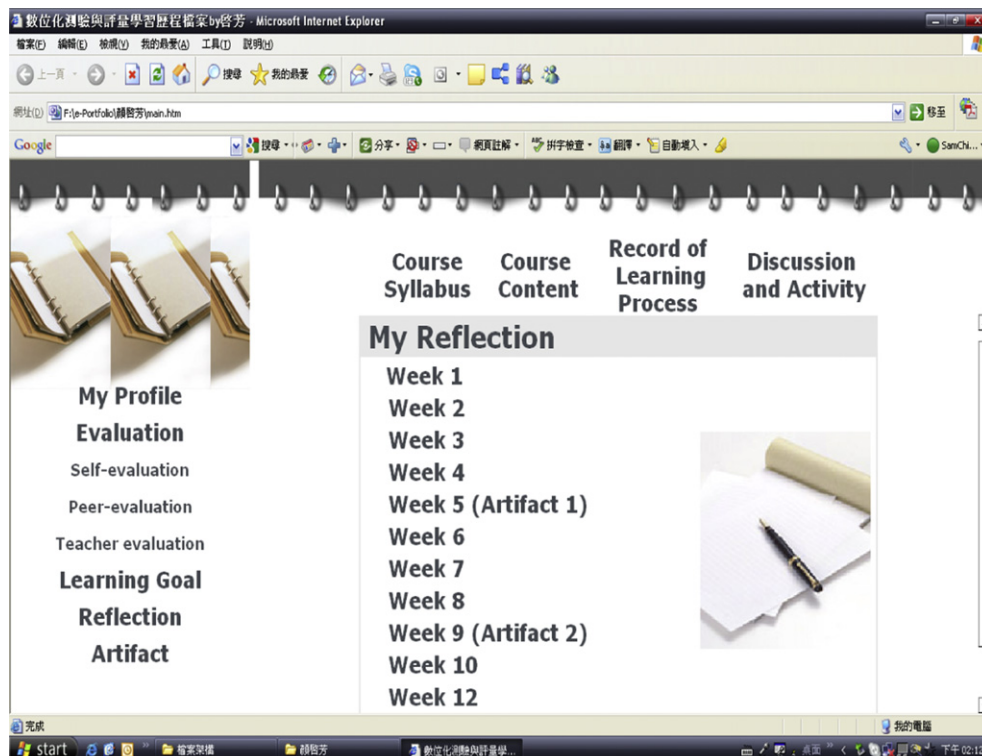
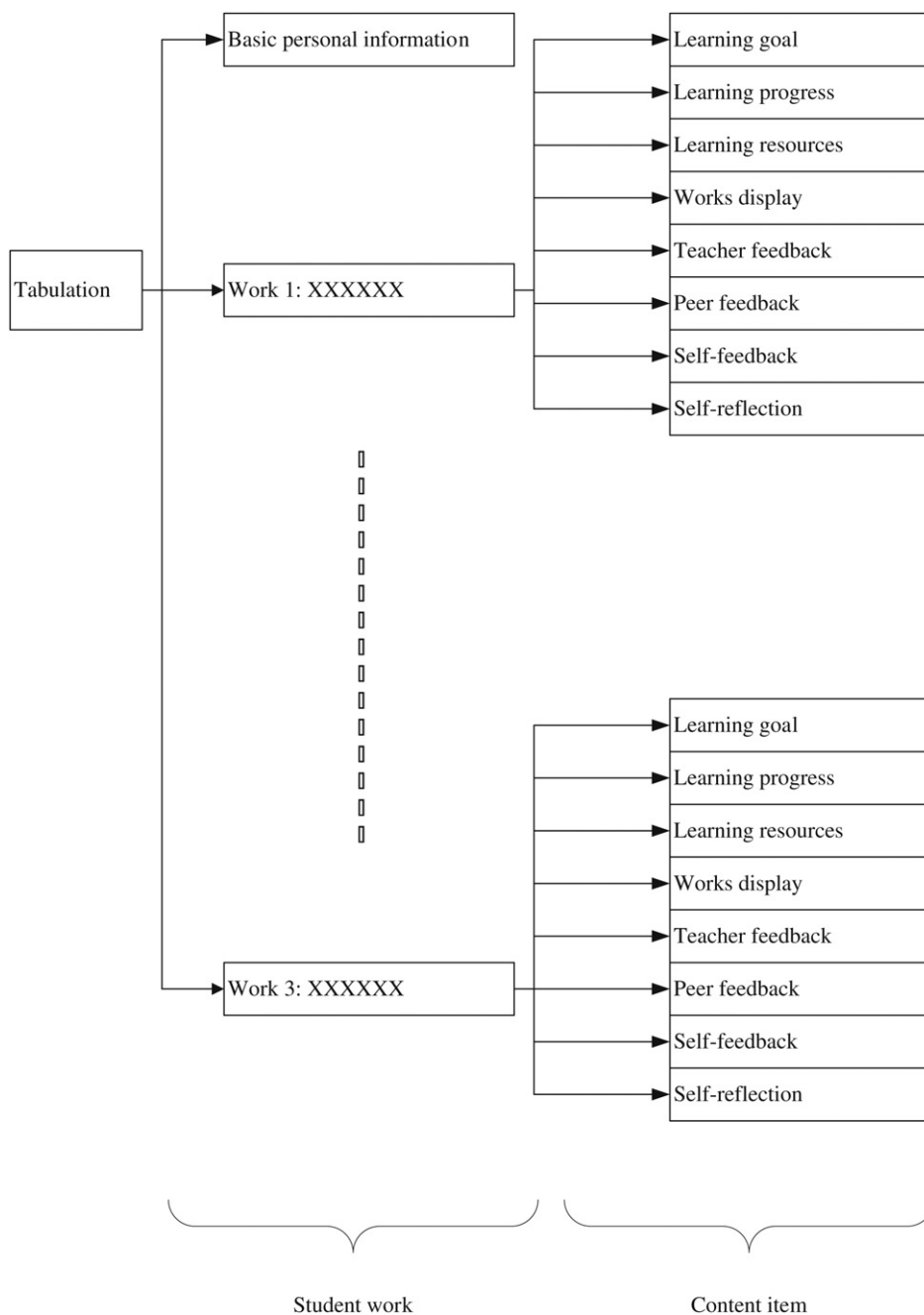


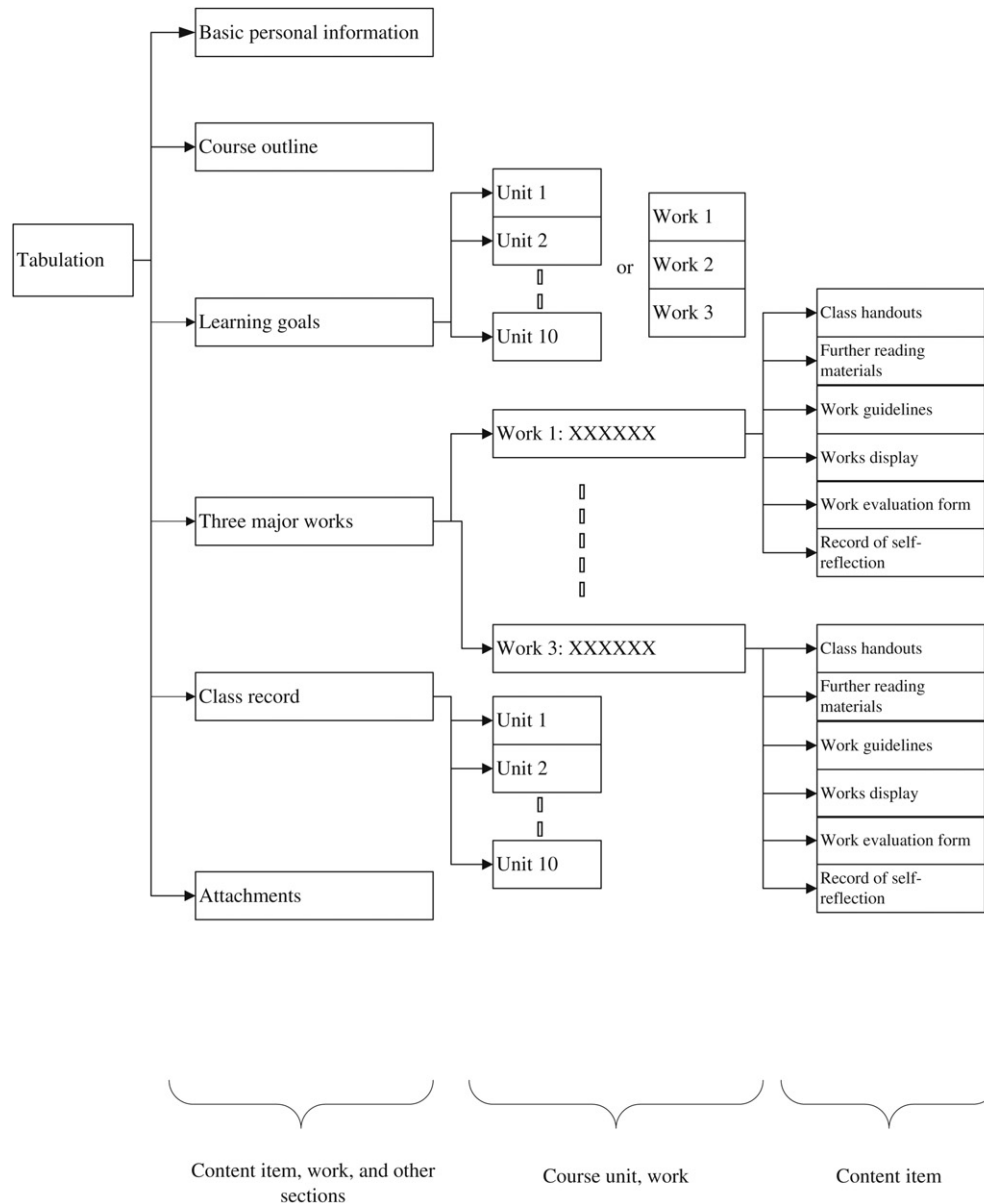
Fig. 5. Reflection on the second level page of an e-portfolio based on tabulation of content items.

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.



Note: Links between the buttons themselves are not displayed

Fig. 6. Structure of portfolios featuring tabulation based on student works, Note: Links between the buttons themselves are not displayed.



Note: Links between the buttons themselves are not displayed

Fig. 7. Structure of portfolios featuring a combination tabulation style, Note: Links between the buttons themselves are not displayed.

The advantage of this tabulation type is that data is ordered and linked in a clearer, more distinct, and more specific way (focused on student works). These tabulations take less time and effort to make. The drawback is that students tend to focus only on displaying finished works, ignoring the presentation of other learning outcomes and processes, and especially the presentation of the learning process at different time slots. Also, there are usually not enough student works to properly fill the first level of buttons. The considerations of students who used works-based tabulation are apparent from their reflections.

Student D: "I had a tough time deciding on a type of portfolio tabulation. I finally chose the type that would be the simplest and most concrete, saving time and effort and giving me the least amount of trouble. A tabulation using student works for buttons allowed me to focus on these works, and this allowed me to write works-focused learning goals and reflections without worrying about completing new ones each week. But how would information unrelated to works be presented? Could I leave it out? My solution was to link the second level buttons to different items of portfolio content. I think other students would've done the same."

Student E: "A tabulation that is developed based on student works allows one to focus on these works, which are one of the most important parts of a learning portfolio. However, students using this type may ignore the presentation of the learning process or other information, a problem which can be solved by linking from the second or third levels. But learning goals and reflections have to be written for every week if there is really to be a link for each in the portfolio, which is going to be a lot of work. Well! Perhaps I may have to sacrifice presentation of learning progress. But on second thought, isn't doing a good job of presenting the process of creating works equivalent to displaying my learning process? It's just not as detailed."

4.3.5. Combination-based type

As shown in Fig. 7, 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.

13-1 **Combination type tabulations integrate the advantages of other tabulation types in order to create a more varied form of organization.** However, the feedback is that buttons on the same level are not consistent, which can be confusing. Also, the achievements of one's learning process are less apparent due to the difficulty of presenting information on the progress of this process (if this information is present, its more likely to be found on in the second level.) The considerations of students who used combination-based tabulation are apparent from their reflections.

Student J: "The teacher introduced several types of portfolio tabulation, but which should I choose? It's a tough decision. Since I can't really decide, why not try the combination type, putting the more important items of portfolio content along with works? This is similar to mixing the two types. However, this type might be relatively lacking in the concept of chronological or course schedule, and information on student progress may be found in the second or third instead of first level."

5. Conclusion and implication

13-2 This study analyzed and verified the types of e-portfolios created by students according to the classification methods of Cole et al. (1995). It found that even when they were taught by the same teachers in the same classes, students created different types of e-portfolios – outcome portfolios and process portfolios. This result can answer the research question proposed in this study. It is that e-portfolios can be categorized into at least two types in terms of content. Abrami and Barrett (2005) argued that research on the outcomes and processes supported by e-portfolios may be considered as the most important research. An e-portfolio is not a specific software package, but more a combination of process (a series of activities) and product (the end result of the e-portfolio process) (Barrett, 2010). In this study, outcome portfolios focused on displaying final achievements are a little bit more than process portfolios focused on the development of the learning process and formative achievements. This result conformed to Barrett's argument "Most e-portfolios tend to emphasize the showcase (portfolio as product) rather than the workspace (portfolio as process)."

Outcome portfolios were the preferred choice for several reasons: time was limited, records were missing, missing formative data could not be filled in at a later time, and presentation of the learning process was affected by whether or not students immediately manually recorded or digitized the production process. The research of Lopez-Fernandez and Rodriguez-Illera (2009) argues that e-portfolios can improve a student's self-management and self-responsibility in the process of learning and evaluation. Students with good self-management and self-responsibility naturally get in the habit of collecting data for their portfolios, leading to the creation of process portfolios. It is recommended that instructors should provide guidance and keep track of students' e-portfolios construction. Moreover, they should encourage process portfolios in students' data collection and presentation. As for learners, they have to constantly gather and document learning data, and pay more attentions on process-oriented data than on outcome-oriented data.

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.

This study found that even when taught by the same teachers and given the same class assignments, students created different portfolios. For this reason, the semi-structured portfolio is recommended in order to minimize differences in content and give students the autonomy to plan part of the items of content of their portfolios. As concluded by Lopez-Fernandez and Rodriguez-Illera (2009), the creation of an e-portfolio should improve a student's self-management and self-responsibility in the learning process, making him or her a life-long learner. This shows that it is important to provide students a certain degree of autonomy in creating their portfolios. Of course, teachers still need to clearly define and explain to students the items of content in a portfolio, in order to minimize differences between student portfolios and facilitate the process of evaluation. Moreover, the students who participated in this study were equipped with basic knowledge and skills in creating e-portfolios. If students are not familiar with e-portfolios, they should be offered additional guidance and explanations, especially regarding e-portfolio and tabulation types.

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. Finally, this study only analyzed a small number of samples, and in the future a larger number may be analyzed.

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1-1

2012-01-21 5:54 PM

Authors categorize 5 types of portfolios

1-2

2012-01-21 5:54 PM

Purpose and type

2-1

2012-01-21 5:54 PM

Tabulation is used to organize and interact with content; if used properly portfolio will be uncluttered

2-2

2012-01-21 5:54 PM

Methods / ideas for organizing the portfolio

2-3

2012-01-21 5:54 PM

I wonder what the cognitive load is on this task alone?

3-1

2012-01-21 5:54 PM

We're reflections done online?

4-1

2012-01-21 5:54 PM

I don't find a clear description of these aspects

5-1

2012-01-21 5:54 PM

Needs examples as evidence of accomplishments

5-2

2012-01-21 5:54 PM

Maybe this is most inline with syllabus

6-1

2012-01-21 5:54 PM

Maybe this is most inline with syllabus

9-1

2012-01-21 5:54 PM

Must be challenging to evaluate different types and tabulations

9-2

2012-01-21 5:54 PM

Bingo! Thought so

13-1

2012-01-21 5:54 PM

More demanding in terms of time? Students need to be allocated more time in labs or in lieu of assigned work to benefit from the learning objectives here

13-2

2012-01-21 5:54 PM

Would teachers not specify the type though?

13-3

2012-01-21 5:54 PM

Similar to Clark's argument. Not the technology, but what the student does with it...

14-1

2012-01-21 5:54 PM

These were higher level students. Motivation less of an issue and students more likely to conform...