

A CASE STUDY OF USING AHP GROUP DECISION MAKING FOR EPORTFOLIO SELECTION

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ABSTRACT

Using the Saaty and Peniwati (2007) group decision making structured approach as the discussion framework, this study reports on a year-long ePortfolio study undertaken by an ePortfolio task force at a regional liberal arts university. Emphasis will be given to the group decision-making process that led to the development of an ePortfolio selection model and how AHP methodology and the group features of the Decision LensTM software supported the model development process. Future steps in the ePortfolio selection process and lessons learned in using the Analytic Hierarchy Process at a group level will be also discussed.

Keywords: AHP, ePortfolio, Decision LensTM, group decision-making

1. Introduction

The target of this study is a small liberal arts university that has had a long history of teaching innovations aimed at improving the educational experience and career prospects of their students. Consistent with this, an ePortfolio system was developed in-house and deployed in 2003. The original purpose of this system was to create an easy way for students to post their class projects either for student learning outcomes assessment or for potential employer's perusal. Faculty would employ the ePortfolio system to assess individual students' progress while faculty and administrators would use it to evaluate broader curricular goals. The results of this in-house initiative were mixed. Although both faculty and students agreed that the tool was useful, its inflexible design, awkward and limited interfaces, and unappealing presentation caused this ePortfolio system to be used only by a few members of the academic community. In addition, available ePortfolio technologies have become profuse since this system was first implemented. In fact, "ePortfolio has almost become a code word for a variety of important concepts: a digital archive for a purpose-driven portfolio, a digital identity linking us to others," or even a tool for "social capital development" among others (Jafari and Kaufman, 2006).

For this reason, the university formed a work group to analyze the current ePortfolio situation with two main goals: to determine the specific needs of the academic community and, longer term, to determine

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whether to upgrade or replace the existing ePortfolio system. This task force worked for about a year and was able to fulfill these basic goals. However, the most important outcome of the task force work was the development of a set of criteria for the selection of an ePortfolio system. For this purpose, the introduction of the Analytic Hierarchy Process (AHP), a well-known selection and prioritization methodology (Vaidya and Kumar, 2006), and an AHP group-oriented decision support software package, Decision LensTM, allowed the task force to quickly develop a decision model for the ePortfolio evaluation. The advantage of this methodology is that even if the institution's priorities change over time, the basic criteria selection model can still be used for the evaluation of ePortfolio systems. This is important since the work done so far constitutes only the first step in what is still a work in progress.

The rest of the paper will describe the process followed to develop the model and perform a preliminary evaluation of five ePortfolio systems; illustrate how the AHP/ Decision LensTM decision approach was used; and finally, will present a discussion of lessons learned and recommendations, in terms of improving the AHP-based group decision making process, for further work in ePortfolio evaluation.

2. The ePortfolio Work Group

Hunt proposed that key characteristics in three areas (member, group and task) must be present for group work to be successful (Hunt, 1992). In this section, the ePortfolio task force will be analyzed in terms of these characteristics following Hunt's discussion of group effectiveness.

2.1 Members

Group effectiveness demands members who work together cooperatively rather than competitively, who are committed to the project, and who trust each other (Cohen and Bailey, 1997). The ePortfolio task force members fulfilled these requirements. They were faculty and staff members with different perspectives (e.g. assessment, computing, education, instructional technology) and from different disciplines. Furthermore, there was not a competitive work environment, and members felt comfortable offering opinions, asking questions, and working toward a mutual understanding.

2.2 Group Composition

Initially, the group had six members and increased to seven with the addition of new participants in the second half of the project¹. This is still consistent with the five to six member size recommendation for small groups (Levine and Moreland, 1998). In addition, the group was adequately resourced and had an effective leader with broad knowledge of the task matter and the academic institution as a whole. Faculty members outside the work group were willing to provide their opinions and fill in questionnaires when requested to do so.

2.3 The Task

Although the task of studying the ePortfolio needs and performing a preliminary evaluation of current systems in the market was clear to all the group members, there were varying levels of ePortfolio knowledge among the participants. It also became clear that the task would require skills and input from each of the members and, what is more important, the task was concrete and had precise objectives. Clarity of objectives, concreteness, and clear beginning and end points have been identified as critical task features for decision-making success in small groups (Hunt, 1992).

¹ One member left the group due to other demanding responsibilities while two members, an instructional technologist and an information system specialist, were added in the second half of the project.

2.4 Other Group Decision-Making Considerations

The decision-making process followed by the group is also critical for the success of the group (Elwyn, Greenhalgh et al. 2001, p. 224). In effect, it is unrealistic that a group will operate based on consensus during the whole process. Bruce Tuckman (1965) identified four developmental stages in a group: forming, storming, norming, and performing. During the *forming stage* the group is just being formed, the members are getting to know each other, and their power and responsibilities are being tested. At this stage it is more likely that members would tend to keep the cohesiveness of the group rather than offer strong divergent opinions. The ePortfolio group went through this process while collecting information about ePortfolio needs in the university. Having a clearly and officially defined leader in the group helped to navigate this stage smoothly. Also, the fact that all participants knew each other as colleagues facilitated this stage.

The second stage, *storming or conflict stage*, is where relationships and power play key roles. During this stage, participants tend to define their positions and try to exercise power and influence to defend their opinions. The ePortfolio group entered this stage when it was necessary to prioritize the needs and objectives for a new system. From the ePortfolio needs analysis, two clearly defined objectives emerged: an assessment tool (faculty and administrators' perspective) and an employment-seeking tool (students' perspective). According to the first objective, the key features of an ePortfolio should be those associated with evaluating student progress toward student learning outcomes, while, according to the second perspective, the key usefulness of an ePortfolio is its ability to easily showcase a student's work to a potential employer. Although neither denies the importance of the other, the truth was that these two objectives (assessment and showcasing) are in conflict in terms of application design. A showcase portfolio typically has lots of rich authoring tools for the user, allowing a high degree of customization in both look and structure. Assessment tools, on the other hand, rely on a consistent pre-established structure with flexibility reserved for reporting and data analysis.

The third stage in a group development is called the *norming or conflict resolution stage*. Although the term conflict has a negative connotation, the truth is that constructive conflict is a great way to ensure good decisions. For example, a recent study found that groups in which contrarian opinion was explicitly allowed led to better decisions (Dye, Sibony, and Truong, 2009). The task force members, largely academics and faithful to their roots, did not refrain from amicably disagreeing with each other about their preferences (assessment versus showcasing) for the purpose of an ePortfolio; however, as the group work progressed, the need for a more structured approach toward decision-making that would allow resolving these conflicts, and somehow accommodate all the opinions, became evident. This need was fulfilled by the introduction of the AHP and a group decision making structured approach (Saaty and Peniwati, 2008). Once this method was introduced and a group decision-making software package, Decision LensTM, was adopted, the group could move into the last stage of group development, the *performance stage*.

In this stage the group has moved through a learning process, has found a way to norm their differences, and has learned to trust each other. It is in this stage that the group reaches its peak of productivity and effectiveness in problem-solving. For the ePortfolio group, the advantage of a group structured decision approach, such as the one recommended by Saaty and Peniwati (2008), is that every participant becomes aware that his/her opinions as well as their intensities will be reflected in the final decision, proportionally to the degree in which the rest of participants share the same opinions and intensities. This structured approach defuses any potential for conflict because every judgment and every intensity of opinion will be reflected in the final outcome.

3. The AHP Group Decision Making Approach

The approach proposed by Saaty and Peniwati (2008) for group decision making is based on the seminal work of Saaty (1982). In terms of the ePortfolio evaluation, it may be described as involving the following steps: 1) structure the decision as a hierarchy of goal, criteria, and alternatives; 2) elicit judgments to prioritize evaluation criteria; 3) evaluate alternatives with respect to criteria; 4) synthesize the model to obtain the best alternative and; 5) perform a sensitivity analysis. Next, a brief description of each step will be given².

3.1. Structuring the Problem

The first step in the AHP approach consists of *structuring the decision-making problem* as a hierarchy. The hierarchy starts at the top with a goal (first level) and is followed by decision criteria (and if needed, sub-criteria) in the subsequent lower level. The bottom level is constituted by the alternatives to be evaluated. One important consideration for developing the model is to first make explicit all the assumptions that are being made for the decision. The work group initially determined that the ePortfolio selection model could be represented as a hierarchy of three levels: goal (selecting an ePortfolio); six criteria (tiered access, matrices for student learning outcome, evaluation, areas for student reflection, aggregate reporting/access, aesthetics and usability or “stickiness”); and other considerations³.

3.2. Weighting the Criteria

In the second step, *prioritizing or weighting the criteria*, all the criteria are compared pairwise (e.g. what is more important: evaluation or areas of student reflection?) with respect to the goal at hand (i.e. selecting the most suitable ePortfolio). The intensity of these judgments are represented with a value in a numerical scale (e.g. 1-equally important, 5- more strongly important, 9-extremely important) in a criteria comparison matrix. Next, the weights of the criteria are derived by calculating the eigenvalues of the comparison matrix.

3.3. Evaluating Alternatives and Synthesis

The third step consists of *evaluating the alternatives*. In this step, the decision maker has two possible lines of action. Similar to in the previous step, he/she can compare the alternatives in a pairwise fashion with respect to each of the criterion, build an alternative comparison matrix with respect to each criterion, and obtain the final priorities for each of the alternatives. This last process of calculating the final priorities constitutes the fourth step in the AHP approach and is called *synthesis of the model*. This approach, however, is not possible when the alternatives are not fully defined, the number of alternatives is large, or if the possibility of adding or deleting alternatives exists. Given that some alternatives were going to be added later on and that some alternatives were discarded, a different method, called the ratings approach, was used. Using this method, a rating scale consisting of the anchors *excellent*, *good*, *fair*, and *poor* was developed and each ePortfolio system was rated against each of the selection criterion using this rating scale. The ePortfolio systems were then prioritized in terms of preference according to their score in the rating process.

3.4. Sensitivity Analysis

The final step, *sensitivity analysis*, consists of varying the weights of each of the criteria to determine how the preferences might change if the importance of selected criteria were to change. The task force determined that a sensitivity analysis should be made at a later stage when other faculty members and the administration could have a chance to analyze and discuss the results. Performing a sensitivity analysis

² For an in-depth mathematical discussion of the AHP method, read Saaty’s (1982) original work.

³ As will be seen later, the final model added sub-criteria to three of the criteria so the final hierarchy ended up having four levels.

involves varying the importance of the selection criteria, but the work group determined this must be done taking into account the possible differences in the preferences of the decision makers at large.

3.5 AHP Software Implementation

The *Analytic Hierarchy Process (AHP)* approach and its generalization, the *Analytic Network Approach (ANP)*, have been widely used in a wide variety of areas such as operations management, strategy, policy making and engineering (Vaidya and Kumar, 2006). A popular application, similar to the one in this study, has been selection and prioritization of different alternatives (Udo, 2000; Mu, 2006). Also, AHP is easy to use in combination with other statistical and mathematical programming methods. AHP has been also used in situations of conflict resolution (Saaty and Mu, 1997; Saaty and Alexander, 1999). AHP ratings models are particularly useful for personnel evaluation (Taylor III and Ketcham, 1998) and as an organizational assessment tool (Mu, 2009).

The AHP method is particularly easy to use when it is implemented as a decision support software such as Expert Choice™ (2008), SuperDecisions™ (2008), or Decision Lens™ (2008). In the opinion of one of the authors⁴, Decision Lens™ is more of a group decision-making support system than the previous ones. The advantage of Decision Lens™ is that it supports not only the AHP methodology but also the group decision making process. This software allows the incorporation of assumptions, process rules, as well as the ability to activate or deactivate participants to analyze the different result in each case. In other words, Decision Lens™ has been explicitly designed for use by groups. It allows group participation with local and remote participants through its web implementation, in addition to providing several other decision support features, such as the dashboard sensitivity view. All these features make Decision Lens™ the most suitable software for this study (Decision Lens, 2008).

4. AHP Approach in Action: Developing the ePortfolio Selection Model

This section outlines the process the group followed: determining basic assumptions, defining needs and criteria, prioritizing the criteria, and reviewing and evaluating several options.

4.1 Assumptions

The following assumptions were considered for our task:

- 4.1.1. ePortfolio will be used for both student learning outcomes assessment and student showcase. These dual purposes were clearly articulated by faculty in a preliminary ePortfolio survey. It is for this reason that members of both the Assessment and the Academic Computing committees were recruited to be members of the ePortfolio work group.
- 4.1.2. Only functionality is being considered at this stage. Neither price nor technical infrastructure are being considered. This assumption was based on the fact that both financial and IT leadership were in transition at the beginning of this task, and it was not clear what the financial and technical context for ePortfolio deployment would be. It was also considered important to define the ideal functionality (and the ideal ePortfolio system meeting that functionality) before considering any related costs or technical requirements.
- 4.1.3. Integration with Blackboard™ (BB) is not considered of high importance at this time because first, none of the vendors (including BB) has this functionality demonstrably available and second, it is also not clear at this time if the university will continue with Blackboard™ as its course management system.

⁴ The first author has had the opportunity to use other AHP software implementations in the past.

4.2 Criteria Development

The ePortfolio work group began by surveying faculty about their perceptions and uses of the ePortfolio in order to inform a needs analysis. The survey, conducted in the spring semester of 2008, revealed two main priorities: student showcase and assessment. The result summary of this survey indicated that while the majority of full-time faculty knew at least something about ePortfolios in general and the University's ePortfolio specifically, only a small percentage of faculty (3%) interacted with it on a regular basis. A startling percentage (over two-thirds) had never used it at all (Carlow, 2008).

In the survey, faculty also noted some of the barriers to usage of the current university's ePortfolio, which include an unfriendly and unattractive interface for both faculty and students. There were also, however, clear possibilities articulated for ePortfolio and an obvious desire to have a system in place that would support these benefits. Using both barriers and positive feedback from the survey and subsequent discussions of the ePortfolio work group, the following criteria were developed:

4.2.1. Tiered Access

The ePortfolio should be accessed and assessed on multiple levels. Some owner-defined artifacts are accessible only to owner. This criterion has two sub-criteria:

External

External access facilitates the viewing of showcase work by potential employers, family, and friends and provides different levels of sharing based on artifacts. Access is controlled by the owner of the portfolio, including time of life for guest accounts. Some owner-defined artifacts are accessible only to owners.

Internal

Internal access provides for portfolio evaluation and administrative maintenance on multiple levels. For example, access for evaluation might include faculty self-appraisals, course appraisals, advising work (possible), or program or university appraisals. System administration access would include: individual portfolio auditing, program level administration, and assignable role-based access. Some owner-defined artifacts are accessible only to owners (i.e. course-based appraisals).

4.2.2. Matrices of Student Learning Outcomes

Matrices provide a clear visual reference to expected student learning outcomes and levels of growth by course, program, and institution as well as map to external standards (i.e. Nursing, Psychology, Accounting accreditation/ certification).

4.2.3. Evaluation

These criteria provide multiple interactive methods for reviewing, assessing and encouraging growth.

Rubrics for Evaluating Student Learning Outcomes

Rubrics should be interactive and feed assessment data, as well as be descriptive for students, faculty and administration alike. As artifacts may be reviewed at multiple levels (course, program, university), multiple rubrics should be able to be attached to single artifacts.

Areas for Feedback

Feedback at multiple levels is important for both student learning and ‘stickiness.’⁵ There should be multiple levels and types of feedback by peers, faculty (course), advisor (post letters of recommendation), and possibly assessors.

4.2.4. Areas for Student Reflection

Reflective learning is a core student learning outcome. The system should provide ample opportunity for students to reflect on artifacts, growth, etc. for self-review as well as reflection, comparison, connection, and goal setting, among others.

4.2.5. Aggregate Reporting

The ability to collate and view data at multiple levels in aggregate form might include: instructor evaluations (self-review), progress toward program student learning outcomes, combined with other aggregate program data available to School/Division, i.e. external standards, program demographics, aggregate comparison; same at institutional level, plus comparison with retention data and completion/activity statistics.

4.2.6. Aesthetics and Usability (“Stickiness”)

It is important that the ePortfolio be perceived as easy to use and that it is aesthetically pleasant so users feel inclined to use it. Unless it is visually appealing, it will not be a suitable showcase for potential employers.

Easy to Use

Particularly for faculty and students, but also for the outside world, it should be easy to: view, understand and navigate; add, create, and change different types of content (Office files, video, graphics, etc); sort, search and organize (sitemap or file tree); access by potential employers/external reviewers – Direct URL / link.

Aesthetics

Particularly for the outside world, but also for students, it should be visually appealing, provide customizable views, and customizable looks. This criterion is particularly important to showcase ePortfolio artifacts to potential employers.

4.2.6 Other Considerations

Particularly integration with student information system and possibly Blackboard™, the system provides an extended length of access for student, as well as meet other technical criteria (i.e. infrastructure, staff, bandwidth).

5. Weighting Criteria

After determining and defining the criteria, the next step was to weight (or prioritize) them. For this purpose, a prioritization method based on pairwise comparison of criteria, called the Analytic Hierarchy Process (AHP), was used.⁶ To simplify the process, a group decision-making software called Decision Lens™ was used. The importance of each criterion relative to the others was discussed as a group and these judgments were aggregated into the decision support system. Each participant would vote using a

⁵ In web-related terminology, “stickiness” refers to the ability of the website or e-system, the ePortfolio in this case, to retain the interest of the users, to the point that they return to using the site or system over and over.

⁶ The choice of AHP as the prioritization method was made because one of the task group members, Enrique Mu, had expertise on the method and access to a demonstration software version of Decision Lens©.

numeric pad and Decision Lens© would aggregate the individual judgments into the comparison matrix. At any given time, the participants would be able to see their own judgments and the others'; however, all judgments remained anonymous. At the end of this process, the derived weights for the criteria were as shown below in Figure 1. A graphical display of the criterion weights is shown in Figure 2.

Decision Goal: Selecting an e-portfolio	
0.173	TIERED ACCESS
0.057	External
0.116	Internal
0.1	MATRICES OF STUDENT LEARNING OUTCOMES
0.191	EVALUATION
0.128	Rubrics
0.063	Feedback
0.128	AREAS FOR STUDENT REFLECTION
0.116	AGGREGATE REPORTING/ACCESS
0.234	AESTHETICS AND USABILITY (STICKINIESS)
0.165	Easy to use
0.07	Aesthetically Pleasing
0.058	OTHER CONSIDERATIONS (e.g. BB integration, length of access)

Figure 1 – Evaluation Criteria and Sub-criteria Hierarchy and their Weights⁷

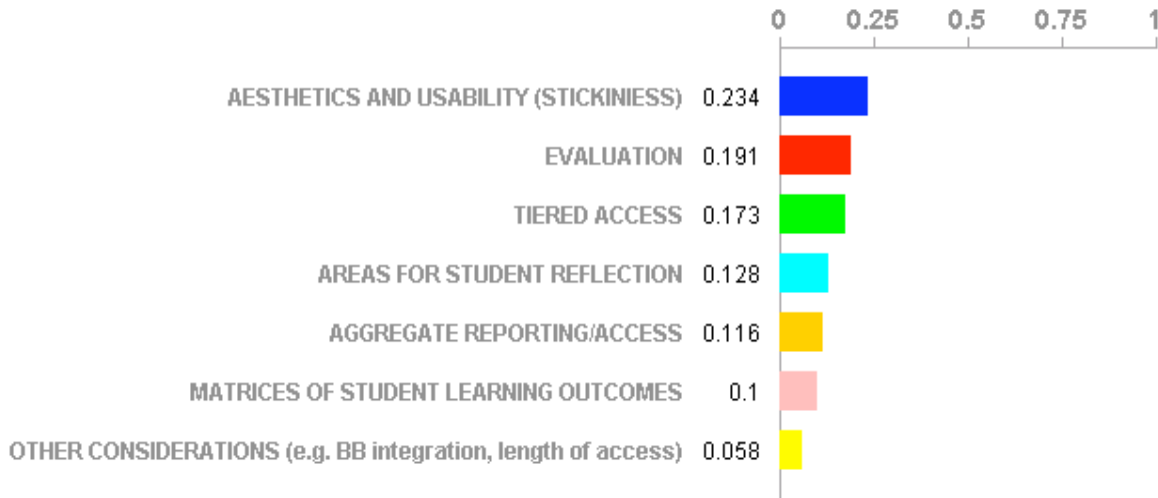


Figure 2 – Criteria and Weights for the ePortfolio Evaluation⁸

As can be seen in Figure 2, *Aesthetics/Usability*, *Evaluation*, and *Tiered Access* are the most important ePortfolio selection criteria with 23.4%, 19.1%, and 17.3% of the overall importance (100%). They are followed by *Areas for Student Reflection*, *Aggregate Reporting*, and *Matrices for Learning Outcomes* with 12.8%, 11.6%, and 10% importance weights. *Other Considerations* has the least importance (5.8%)

⁷ The priorities shown for the sub-criteria are global priorities. For example, the sub-criterion *Tiered Access Internal* has 11.6% (0.116) of the overall importance (100%) of criteria.

⁸ The way to read these values is to state that out of the total importance of the criteria (100%), *Aesthetics and Usability* has 23.4% of the overall criteria, *Evaluation* has 19.1% and so on.

as a selection criterion. These weights were calculated as a result of the pairwise comparison of the criteria by the group.⁹

6. Defining Alternatives

The goal of the work group was to be as inclusive as possible. So, all vendors that responded were invited to participate¹⁰. The following products were evaluated:

6.1 LiveText©

LiveText© is a web based “Accreditation Management System” which includes both an assessment engine and student tools for customizing and presenting their work. LiveText© provided several online opportunities for the work group to evaluate its product: a general web demo that introduced the application to a limited number of the group in the summer, demo accounts for both student and faculty/assessor views, and two more ‘customized’ web demos in the fall based on our needs, sample rubrics, and existing core curriculum template.

Strong areas of this product include assessment tools, such as interactive rubrics, while weaker areas include its not-so-intuitive nature. The demonstrations seemed to indicate that its focus was course-based assessment, although it appeared institutional student learning outcomes could be supported by adapting them to a course-based structure. While the product seems to meet most of our articulated criteria, the disorganized nature of the presentations did not help the group to clearly understand exactly how this could work in our environment.

6.2 WayPoint Outcomes™

WayPoint Outcomes™ was brought to the group’s attention by another faculty member who was impressed by its integration with Blackboard™ and other learning management systems. While it is tightly integrated and provides many outcomes assessment tools, it does not address student showcase needs at all. A separate method or system would need to be used to address this and, as a result, the group opted not to review it formally.

6.3 Epsilen©

Epsilen©, originally developed at Indiana University-Purdue University Indianapolis (IUPUI) to support its distributed ePortfolio and assessment efforts, is now commercially available to other institutions. Epsilen© ePortfolios are designed to be lifelong tools for the user, specifically users in the higher education world, and the Epsilen© environment “places social networking and ePortfolios at the center of global eLearning.” The New York Times is currently a strategic and equity partner in the company.

Group members that reviewed Epsilen© during a web demo in the summer, and subsequently through demo accounts (basic Epsilen© accounts are free to all students, faculty and staff of higher education institutions) were impressed by its user-friendly features and stickiness, mostly due to the built-in social networking tools. However, while Epsilen© provides some basic student learning outcomes features, its

⁹ The weights were calculated using the Decision Lens™ software and a method called *Analytic Hierarchy Process*. The decision makers compare the criteria pairwise and express their relative preferences in terms of numerical values using a 1-to-9 scale (e.g. decision makers could state that *Usability* is strongly more important than *Areas for Student Reflection* with an intensity of 5). The final priorities (importance weights) are calculated based on these numerical preferences.

¹⁰ Given that based on information currently available Blackboard™ does not appear to have an operational ePortfolio (despite marketing one), it was not included in this evaluation.

developers are only just starting the process of building essential reporting features. It was necessary to rewrite the backend structure (scheduled for completion in December 2008) in order to accommodate this functionality.

6.4 Nuventive (iWebFolio™ and TracDat™)

Nuventive©, based in Pittsburgh, was invited to give a demonstration on campus to members of the summer ePortfolio work group. Nuventive© demonstrated both the iWebFolio™ and TracDat™ products. In this report, both products are reviewed and referred to as one – iWebFolio™.

While rich and impressive in reporting features, the group felt that the product had a fatal flaw in that only one rubric could be attached to an artifact. Students would need to upload multiple versions of assignments in order to be assessed on combinations of skills or learning outcomes or even accreditation requirements. This would not only be cumbersome for the user, but problematic for the assessor as well. The group opted out of further discussions with Nuventive©, although it should be noted that this product may be worth another look in a year or two.

6.5 Foliotek©

Foliotek© is another application that was developed for the diverse needs of a large university environment – the University of Missouri-Columbia. Based on an “adaptive infrastructure” and built by an outsourcer that has developed solutions for major companies such as Boeing© and State Farm Insurance®, the application is rich in both assessment tools and showcase features. Foliotek© provided two web demonstrations. The second demo was tailored to our evaluation criteria, our own rubrics, and the institutional template. Based on this presentation, it was very clear to the group how Foliotek© could support our assessment and showcase needs. The group was particularly impressed with the file management feature, one that is unique to this product.

Other strengths included the intuitive nature of the interfaces, the manageability of data (from both student and assessor perspectives), and the ability to customize multiple portfolios. A potential weakness might be manifested in the reporting structure; while it can be tailored to our needs, the reporting fields need to be built-in by their programmers, at least initially.

7. Rating the Alternatives

In order to rate the different products, a rating scale with the following categories was developed:

Table 1 – Rating Scale for Evaluation of ePortfolio Alternatives

<u>Category</u>	<u>Rating</u>	<u>Definition</u>
Excellent	1.0	Exceeds needs, as defined
Good	0.75	Meets needs, as defined
Fair	0.50	Meets some but not all needs, as defined
Poor	0.25	Meets few, if any, of needs, as defined

Using this rating scale, each product alternative was evaluated with respect to each of the criteria or sub-criteria. As an example, the product iWebfolio™ was rated by the summer work group reviewers with respect to the sub-criterion *Tiered Access Internal* as shown in Table 2.

Table 2 – Ratings for iWebfolio™ with respect to *Tiered Access Internal* sub-criterion

iWebFolio™				
Participants	Excellent	Good	Fair	Poor
Summer Participant 1		X		
Summer Participant 2		X		
Summer Participant 3			X	
Summer Participant 4		X		

When summer participant 1 rated the iWebFolio™ alternative as *Good* with respect to the *Tiered Access Internal* sub-criterion (Table 2), a score of 0.75 was computed (Table 1). The same score was recorded for summer participants 2 and 4 while the score according to participant 3 was only 0.50. The ratings of the different participants were then aggregated¹¹ to obtain a single rating for each product with respect to each of the criterion.

The final score (preference priority) for each alternative was calculated from the partial scores or ratings shown in Figures 3a and 3b. For example, the score of LiveText© was calculated as the weighted sum of its scores with respect to each criterion as follows:

$$\begin{aligned}
 \text{LiveText©_Total_Score} &= 0.60 \text{ (external score)} * 0.06 \text{ (weight of external criterion)} \\
 &+ 0.58 \text{ (internal score)} * 0.12 \text{ (weight of internal criterion)} \\
 &+ 0.62*0.10 + 0.75 * 0.13 + 0.75 * 0.06 + 0.55*0.13 \\
 &+ 0.62*0.12 + 0.60 * 0.16 + 0.70*0.07 + 0.75*0.06 \\
 &= \mathbf{0.64}
 \end{aligned}$$

Ratings Scoresheet						
Alternatives	Value	External 0.06	Internal 0.12	MATRICES OF STUDENT LE... 0.10	Rubrics 0.13	Feedback 0.06
IDEAL PORTFOLIO	1.00	1.00	1.00	1.00	1.00	1.00
FolioTek	0.80	0.83	0.79	0.81	0.87	0.83
Live Text	0.64	0.60	0.58	0.62	0.75	0.75
Epsilen	0.61	0.81	0.62	0.42	0.44	0.50
eWebFolio	0.58	0.69	0.56	0.69	0.50	0.58
WayPoint	0.00	0.00	0.00	0.00	0.00	0.00

Figure 3a – ePortfolio Partial Scores for the first five criteria

Ratings Scoresheet						
Alternatives	Value	AREAS FOR STUDENT REFL... 0.13	AGGREGATE REPORTING/A... 0.12	Easy to use 0.16	Aesthetically Pleasing 0.07	OTHER CONSIDERATION... 0.06
IDEAL PORTFOLIO	1.00	1.00	1.00	1.00	1.00	1.00
FolioTek	0.80	0.67	0.79	0.83	0.79	0.87
Live Text	0.64	0.55	0.62	0.60	0.70	0.75
Epsilen	0.61	0.69	0.33	0.92	0.87	0.42
eWebFolio	0.58	0.50	0.62	0.58	0.56	0.62
WayPoint	0.00	0.00	0.00	0.00	0.00	0.00

Figure 3b – ePortfolio Partial Scores for the remaining criteria

To provide a reference framework to assess how high or low the final score of 0.64 for LiveText© is, a fictitious IDEAL PORTFOLIO alternative was included (alternative 6 in Figures 3a and 3b). This ideal alternative has the ideal (partial) score of 1.0 (*Excellent* according to Table 1) for each criterion. The final

¹¹ For accuracy and mathematical consistency, Decision Lens™ aggregates all the ratings (numerical scores) using the geometric mean. However, aggregation using a simple arithmetic mean should not be much different.

score or rating was the sum of all the partial scores multiplied by their respective criterion weight (e.g. 0.06 for *External*, 0.12 for *Internal*). The weighted sum for the IDEAL PORTFOLIO is 1.0. So LiveText© with a final score of 0.64 is 64% of what the ideal score 1.0 (100%) for the ideal Carlow portfolio would be.

8. Sensitivity Analysis and Results¹²

The final results are shown in Figure 4. The criteria and their priorities (Figure 2) are shown again for convenience of the reader.

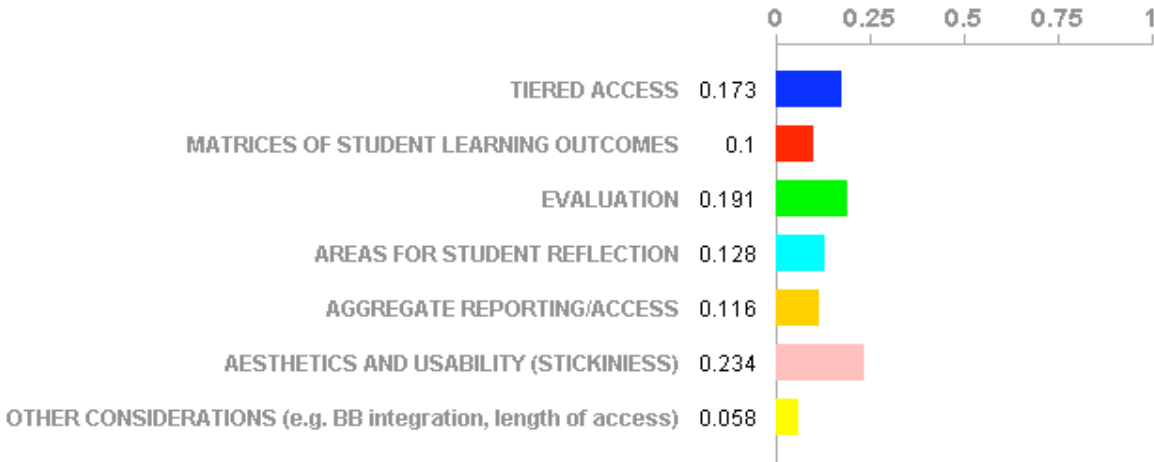


Figure 2 – Criteria and Global Criteria Weights for the Portfolio Evaluation

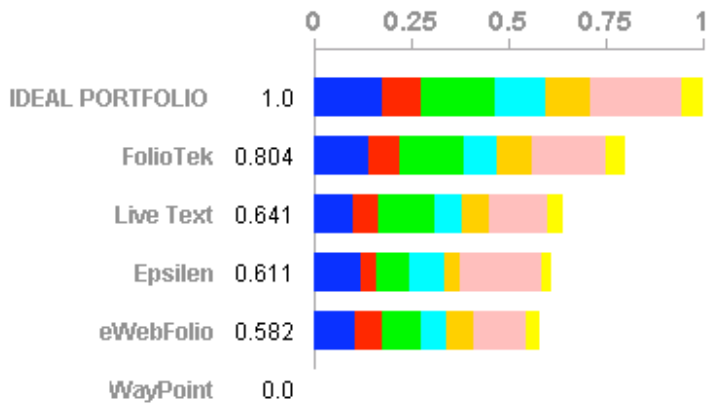


Figure 4 – ePortfolio Final Scores (Preference Priorities) and Sensitivity to Criteria

From Figure 4, we can see that Foliotek© is the product with the highest score (0.804). One way to read the results shown in Figure 4 is that Foliotek© has 80.4% of the score that the ideal Carlow ePortfolio system would have. The second best product, in this preliminary analysis, is LiveText© with 64.1% of the ideal score. However, the other two alternatives: Epsilen© (61.1%) and iWebFolio™ (58.2%) are not far from Live Text.

Also, Figure 4 shows that Foliotek© is particularly strong in terms of Aesthetics/Usability (pink areas in Figures 2 and 4, and 23.4% weight according to Figure 2) and this is the main reason why it stands out so

¹² Sensitivity analysis needs to be re-visited once the complete evaluation is done and the decision is imminent.

far from the other products. As can be seen in Figure 4, there is a 16.3% difference between the score of Foliotek© and Live Text©. See Appendix A for the summary of Foliotek© ratings. For the results of the other products, please refer to the work group report (Carlow, 2008).

9. Future Direction and Conclusions

9.1 Should the group have used the AHP/Decision Lens™ approach from the beginning?

In the case reported here, the introduction of the AHP approach allowed overcoming the *storm* stage and the group moved confidently into the *norming* stage (Tuckman, 1965). AHP was inserted into the group process to sort the emerging judgment conflicts. However, had the AHP been introduced at the beginning, the whole group decision making process would have occurred within the AHP decision making framework rather than being only a part of the process. This may have made the navigation across Tuckman's group development stages much smoother from the beginning. In effect, the group reported that using AHP/ Decision Lens™ greatly facilitated the final recommendations process for ePortfolio selection. The criteria developed and used highlighted the relative importance of each in a clear manner that allowed each committee member's opinion to be heard and clearly articulated.

9.2 Should an AHP Sensitivity Analysis have been incorporated during this evaluation of an ePortfolio alternative?

In spite of the assumption that the sensitivity analysis would be left to the faculty body at large, a preliminary sensitivity analysis would have helped to understand the drivers behind each ePortfolio rating. In this case, a sensitivity analysis was not performed because the group operated under the assumption that the most important task was to create a set of criteria that could serve as a template for evaluating ePortfolio systems in the future. The specific ePortfolio system identified in this study, therefore, may not necessarily be the best choice in the future, but the criteria identified here may help to evaluate other products.

9.3 Conclusions

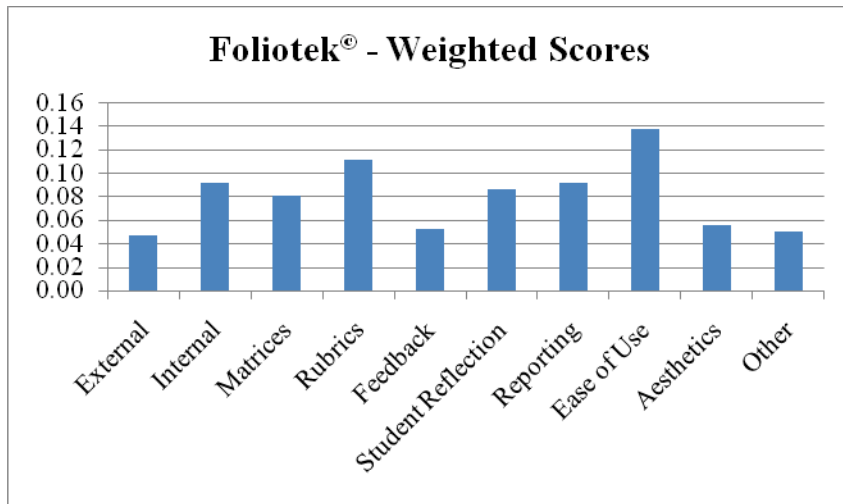
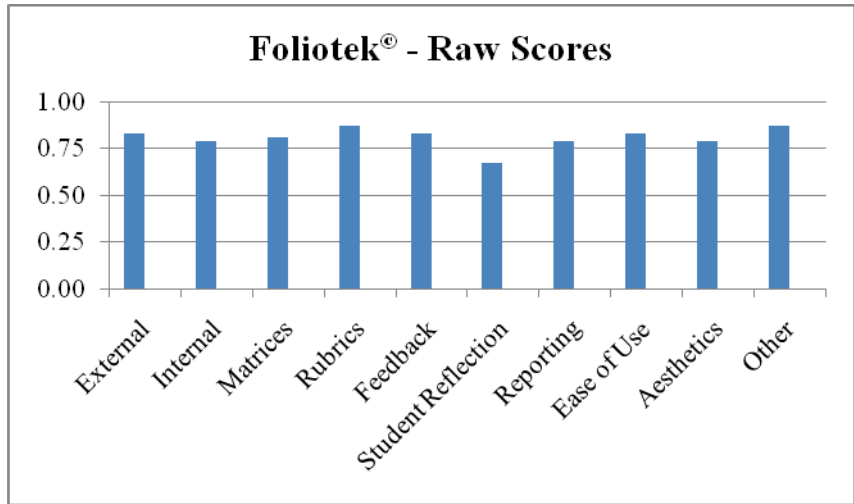
In truth, any of the ePortfolio products the group reviewed would benefit the university far more than the current ePortfolio system. Based on the summation of our rankings, however, Foliotek© appears to be the top choice of the group, standing out quite ahead of the other products mainly because of its *Aesthetics and Usability* ("stickiness"). Aesthetics and Usability has been considered, by this group, as the most important characteristic for success in an ePortfolio system. These results are supported by discussion and anecdotal impressions from group members. If the university were to support moving to a new ePortfolio system for fall of 2009, the ePortfolio work group would strongly recommend Foliotek©, contingent upon its integration with existing student information systems and financial feasibility.

What is important to note here, however, is that if the implementation of a new ePortfolio system is delayed beyond fall of 2009, the prioritization of the criteria should be reviewed to verify that the university's assessment processes have not changed greatly. This is one of the advantages of having used the AHP group decision making structured approach; that is, the ability to communicate the decision making process and outcomes across different group participants in space and time. This is not a minor issue since communication has been identified as critical in group processes (Barker, Wahlers et al. 2001).

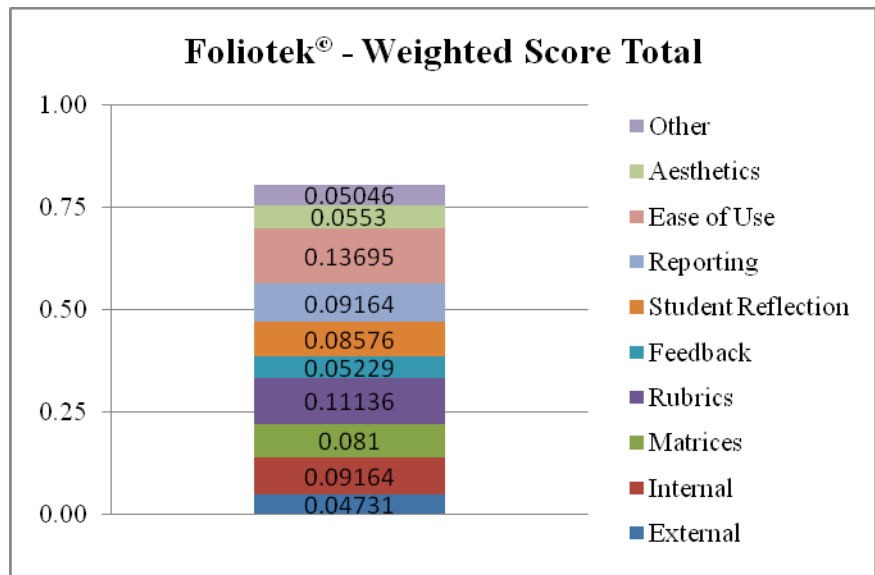
This case report constitutes a first exploratory step toward the evaluation and selection of a more appropriate ePortfolio system for the university and a reflection on the use of AHP/Decision Lens™ group decision making approach to aid small groups in the decision making process.

APPENDIX A - FOLIOTEK® RESULTS

Rating	Weight
Excellent	100.0% (1.00)
Good	75.0% (0.75)
Fair	50.0% (0.50)
Poor	25.0% (0.25)



Rating	Weight
Excellent	100.0% (1.00)
Good	75.0% (0.75)
Fair	50.0% (0.50)
Poor	25.0% (0.25)



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