Multimedia Development Methodologies Matrix

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ABSTRACT

This study aims to produce a practical and usable guide to choosing methodology that enables novice multimedia developers to design and create effective multimedia systems by following a well-principled design methodology. A matrix of multimedia methodologies was developed. Third year multimedia students were selected and divided into tested and control groups. The tested group used the suggested methodology from the matrix while the control group used the datum as the methodology for their application development. The findings show that tested group has a higher preference towards the methodology and the methodology proved to be helpful as compared to the control group. Thus, it is believed that the multimedia methodology matrix can used as an aided tool towards better application development of novice multimedia developers.

Keywords
Multimedia, Methodology, Novice Developer, Decision Matrix

1.0 INTRODUCTION

A methodology is a codified set of practices that may be repeatedly carried out to produce software. Why do we need a methodology for application development? A study by Avison & Fitzgerald (1990), shows that a methodology improves project planning and control, and provides better quality system resulting in a better end product, a better development process and a standardized process.

Multimedia design methodologies have been around for quite some time, however, many multimedia programs today are designed on an ad hoc basis (Khoo, 1994). Most multimedia methodologies are not being practiced. It is therefore crucial to note that for any interactive multimedia program to be effective, meticulous planning of the design and content is prerequisites.

The first part of this article describes the problems faced by the novice programmers. Next, the research objectives and scope of the project described in this paper are outlined. Later, method to achieve all objectives and the findings are also discussed. Finally, a conclusion part is presented.

1.1 Problem Statements

It is well known that before embarking on any interactive multimedia project, a potential interactive multimedia designer or developer may need to select a suitable methodology appropriate to the context of the application and its industry. The main motivations for adopting a methodology vary between organization and individual but are generally adopted to achieve: better end products (meeting user demands); a better development process (improving developer control and productivity); and a standardized process (enabling better systems integration and the benefits of a common approach in an organization) (Avison & Fitzgerald, 2003).

However, according to the survey results by Barry and Lang (2001), no uniform approach exists to multimedia systems development and that practitioners in the industries are not using the multimedia models cited in their literature. It was seen essential, that multimedia producers are provided with a rigorous and well-defined approach to the development of multimedia products and systems. The methodology needs to be appropriate for the type of product being created and the type of environment in which it is being produced.

Today there are number of multimedia design methodologies that can be adopted when developing multimedia applications. However, these methodologies differ from one field to another and each fits a different purpose with different requirements and

approaches. The existing methodologies as mentioned before are numerous, and can be confusing for developers especially novice ones when it comes to selecting appropriate methodology for a project. Thus, there is a need to produce a matrix of multimedia methodologies in order to assist and guide these novice multimedia developers.

1.2 Research Objectives

The objectives of the study are:

1) To produce a matrix that will guide novice developers to choose suitable multimedia methodology for their application development.

2) To evaluate the effectiveness of the matrix.

1.3 Research Scope

The matrix of multimedia methodologies is meant as a guide for novice multimedia developers. The matrix created, focused on two types of Multimedia applications which are interactive multimedia and hypermedia. The study took place at MIIT-UNIKL. The study uses third-year students of Bachelor in Multimedia Technology majoring Interactive Multimedia Design.

2.0 LITERATURE REVIEW

Multimedia may be defined in multiple ways, depending upon one's perspective. There is numerous definition of multimedia in the literature however, the commonality among these definitions "involves the integration of more than one medium into some form of communication. Most commonly, though, this term now refers to the integration of media such as text, sound, graphics, animation, video, imaging, and spatial modeling into a computer system" (Jonasses, 2000).

In a generic sense, multimedia is simply the use of many digital media. However, when the viewer of a multimedia project is allowed to control what and when the elements are delivered, it is interactive multimedia. When a structure of linked elements is provided through which the user can navigate, interactive multimedia becomes hypermedia (Vaughan, 2004).

Multimedia technology has a wide range of application areas including education: e.g. hypermedia/multimedia aided learning, e-learning, Training: e.g. Web-based training, Point of sales and information: e.g. multimedia kiosks and etc. These multimedia applications differs on many areas that a particular methodology used to develop one application might not be suitable to develop another. Thus, a guideline is needed as to choose the appropriate methodology for a particular multimedia application.

Nowadays, there are a growing numbers of multimedia designs and development methodologies for the use of multimedia developers. For this study, a collection of multimedia methodologies are collected and summarized.

To ease the selection of an appropriate methodology, a decision matrix is proposed. Matrix representation is used in the study since it takes advantage of the human visualization capability to easily check the rule relationships via the pattern-matching recognition process. It automatically protects against duplication and assures completeness within a defined parameter range (Braun, 1989).

There are two types of decision matrix techniques:

- Weighted Rating Method

This typical decision matrix or also known as weighted decision matrix or Pahl and Beitz method, is used to define attributes, weight them and appropriately sum the weighted attributes to give a relative ranking. However, a research has mathematically proved that this typical decision matrix method suffers from two major drawbacks (Mullur et al., 2003); (i) some potentially optimal concepts may appear to be undesirable, because they never receive the highest total score, and (ii) the typical construction requires that the decision maker specify physically meaningless weights and ratings.

Under this concern, Pugh's method is believed to have the advantage on helping decision maker making a more reliable decision.

- Pugh's Method

In the Pugh's method a decision matrix is prepared with columns to identify design concepts (variant) and the rows to represent criteria. A design team chooses both concepts and criteria. One of the column concepts is chosen as a datum against which all others are to be judged. In the matrix cells for each row criteria, a plus (+), zero (0), or minus (-) sign is then used to indicate whether the concept is

better, equivalent, or less than that of the datum. For each concept, the number of plus and minus signs is noted and the best concept is selected.

3.0 METHODOLOGY

This study followed four steps in accomplishing the research objectives. Steps used in the research methodology are depicted in Figure 1.

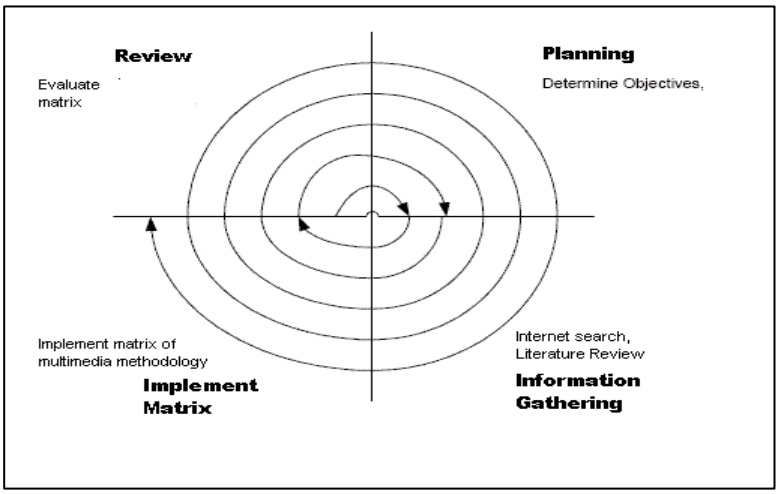

Figure 1: Research Methodology Overview

3.1 Phase 1: Planning

A project always begins with an idea or a need that can be refined by outlining its messages and objectives. In this phase, the study starts by defining the research objectives. All possible alternative to achieve the objectives are map out.

3.2 Phase 2: Information Gathering

In this phase, data and fact-finding for this study is collected through literature and internet search. From these established and reliable sources, researcher gained a better understanding on the subject of study. To achieve the first objective, twenty multimedia methodologies were reviewed in this phase. For each methodology, comparison is made on its components including its lifecycle, applications type, issues discussed, notations used, etc. These are then summarized to be used in the next phase.

3.3 Phase 3: Implement

To achieve the first objective of this study (to produce a matrix that will guide novice developers to choose appropriate multimedia methodology), the matrix is built using Pugh' Selection Matrix which consists of the following steps:

i. Methodology Pre-screening

This step is aimed at reducing the set of methodologies being considered to a manageable number. This is achieved by dividing the methodologies into Project Size and Project Type. Methodologies selected are listed across the columns of the decision matrix.

ii. Identify Selection Criteria

The aim of this step is to identify criteria for the methodology selection. Once the criteria have been identified, each criterion is listed down each row of the decision matrix.

iii. Methodology Scoring

Once the criteria have been set, the methodologies can now be scored for comparison. Generally, the evaluator is predisposed toward a favorite methodology for a variety of subjective reasons. This "favorite" should be selected as the reference methodology or the datum. Any methodology may be selected in the absence of a favorite. Other methodologies are then rated against the datum for each criterion as indicated in the following Table 1:

Table 1: Methodology scoring rates

Relative Performance	Rating
Worse than the datum	-
Same as the datum	0
Better than the datum	+

iv. Score Evaluation and Methodology Selection

Once the methodologies have been rated, the total number of '+', '0' and '-' is calculated for every criterion. The best methodology shall be determined by the highest number of '+' scores. The datum then, should be changed to re-evaluate all the methodologies evenly. If one or more methodologies remain strong through out the iterations then the methodology will be the most likely candidate.

v. Multimedia Methodology Matrix

This is the phase where the final multimedia methodology matrix will be created by combining the matrix results from the previous steps.

3.3 Phase 4: Review

The multimedia methodology matrix is evaluated in this phase.

3.3.1 Questionnaire

To achieve the second objective of this study (determining the effectiveness of the matrix), a questionnaire was developed and given to the respondents to collect their view and experience after using the methodology matrix.

They were asked to respond to each statement in terms of their own agreement or disagreement. The questionnaire uses a close-ended question on a five-point Likert-scale. The respective scores used are "Strongly-disagree – 1", "Disagree – 2", "Undecided – 3", "Agree – 4" and "Strongly agree – 5".

The questionnaire covered the following segments:

- Students' reaction after using the methodology matrix
- Students' perception towards the methodology matrix

3.3.2 Subjects used

The methodology matrix is given to a class of 24 third-year students from MIIT-UNIKL undertaking Bachelor of Multimedia Technology (Hons) in Interactive Multimedia Design. The students are divided into tested and control groups. The tested group (using suggested methodology) consists of 14 students shall use the methodology matrix for the development of small to medium size interactive multimedia applications and hypermedia applications to fulfil the requirement of the assignment in the following subjects :

i. Web Application Development
ii. Multimedia Authoring

The remaining 10 students are involved as the control group (using datum). All other aspects of the developments are the same. To prepare the students for evaluation, both groups received literature materials related to the methodology that will be adopted. They are given time to read and understand the requirements and details of the methodology.

4.0 RESULTS AND FINDINGS

4.1 The Multimedia Methodology Matrix

Step 1: Methodology Prescreening

To reduce the set of methodologies being considered to a manageable number, the methodologies are first divided into the size of project that is suitable for them. This is done according to Charvat's matrix (Charvat, 2003) and the methodologies are grouped as Small to Medium (S-M) or Medium to Large (M-L). Next, the methodologies are divided into project type. Generally, the methodologies selected fall into two types. They are grouped as Hypermedia (H) or Interactive Multimedia (IM).

Based on the project size and type, the methodologies are grouped as follows:

i. Small to Medium Interactive Multimedia methodologies
ii. Medium to Large Interactive Multimedia methodologies
iii. Small to Medium Hypermedia methodologies
iv. Medium to Large Hypermedia methodologies

The division by categories above as shown in Table 2 has managed to reduce the set of methodologies to a manageable number. The methodologies assigned to the categories are now listed in the columns of the decision matrix.

Step 2: Identify Selection Criteria

The aim of this step is to identify criteria for selection which occupies the rows in the decision matrix. The following criteria reflect the multidisciplinary nature of multimedia (Heller & Martin, 1999) and shall be used as the selection criteria for the matrix of Interactive Multimedia methodologies in this study:

- Audience - Does the methodology consider target audience's characteristics?
- Information content and purpose - Is content selection included in any of the activities?
- Interactivity - Does the methodology consider issues of interactivity? Is there any method for documenting interactivity?
- Aesthetic - Is there any process on interface design?
- Quality - Does the methodology include testing and evaluation? Is there a wide variety of testing and evaluation methods available?

The above criteria shall also be use for Hypermedia methodologies selection matrix with an addition of "Navigation" which is described as below:

- Navigation
  Does the methodology provide methods on documenting navigational structures?

Step 3: Methodology Scoring

Once the criteria have been set, the methodologies can now be scored for comparison. The reference methodology or the DATUM used is usually based on the evaluator's favourite.

Table 2: Methodologies grouped by project size and type

Categories	Methodologies
Small to Medium Interactive Multimedia methodologies	MUDPY(Sharda, 2004)
	Pragmatic Courseware Design Model, PCD (Carswell & Murphy, 1994)
	Interactive Multimedia Courseware Production, IMCP (Nicholson & Ngai, 1996)
	D.A.S.E.D(Sturman & Fabry, 1997)
	Development methodology for educational interactive multimedia, DMEIM (Phillips, 1996)
Medium to Large Interactive Multimedia methodologies	Development Methodology for Interactive Multimedia Courseware, DMIMC, (Barker & Giller, 2002)
	Multimedia Product and Systems Development Methodology, MPSDM (Sherwood & Rout, 1998)
	PROFIL(Koper, 1995)
	Analyse-Organise-Synthesis methodology, AOS (Cybulski & Linden, 1999)
Small to Medium Hypermedia methodologies	Web development methodology, WDM1 (Ste ele & Carter, 2001)
	Web development methodology, WDM2 (Howcroft & Carroll, 2000)
	Web applications model, WAM (Uden,2002)
	The Web Site Design Method, WSDM (De Troyer & Leune, 1998)
Medium to Large Hypermedia methodologies	Index-Driven Hypermedia Design Methodology, IHDM (Woojong & Heeseok, 2001)
	A View-Based Hypermedia Design Methodology, VHDM (Lee et al., 1999)
	The Object-Oriented Design Method , OODM (Rossi and Schwabe,1998)
	Relationship Management Methodology, RMM (Isakowitz et.al., 1995)
	Ariadne Development Method, ADM (Diaz et.al, 2001)

However, as mentioned previously, any tool may be selected in the absence of a favourite. Scoring rates for the matrix are shown in Table 1 in the previous chapter. For each category, the total number of '+', '0' and '-', is calculated for every criterion of a methodology. The best methodology is the one that has the highest '+' scores.

Step 4: Scoring Evaluation and Methodology Selection

This step shows the score evaluation process of the completed decision matrix by category.

Small to Medium Interactive Multimedia methodologies matrix

In this category, the MUDPY model is used as the datum. After the scoring process is completed, the evaluation as depicted in Table 3 shows that the Pragmatic Courseware Design(PCD) model appeared to be the winning methodology.

Table 3: Decision matrix for small to medium interactive multimedia methodologies

		Methodologies			
Criteria		PCD	IMCP	DASED	DMEIM
Audience	**D**	+	0	0	0
Information content and purpose	**A**	+	+	+	+
Interactivity	**T**	-	-	0	-
Aesthetic	**U**	+	0	+	+
Quality	**M**	+	+	0	0
Sum of (+)		4	2	2	2
Sum of (0)		0	2	3	2
Sum of (-)		1	1	0	1
Winning Concept		✓			

Medium to Large Interactive Multimedia methodologies matrix

As for this category, the Analyse-Organise-Synthesis model is used as the datum. The evaluation as depicted in Table 4 shows that two models have the same highest number of + score. To resolve this, a second iteration of the decision matrix is made. In the second round, the datum is changed to Multimedia Product and Systems Development Methodology, MPSDM. Finally, the Development Methodology for Interactive Multimedia Courseware (DMIMC) as illustrated in Table 5 is picked as the winning methodology.

Table 4: Decision matrix for medium to large interactive multimedia methodologies

		Methodologies		
Criteria		DMIMC	MPSDM	PROFIL
Audience	**D**	+	+	+
Information content and purpose	**A**	0	0	0
Interactivity	**T**	+	0	+
Aesthetic	**U**	+	+	+
Quality	**M**	+	+	+
Sum of (+)		4	3	4
Sum of (0)		1	2	1
Sum of (-)		0	0	0
Winning concept		✓		✓

Table 5: Second iteration of decision matrix for medium to large interactive multimedia methodologies

		Methodologies		
Criteria		DMEMC	PROFIL	AOS
Audience	**D**	0	0	-
Information content and purpose	**A**	+	+	+
Interactivity	**T**	+	0	-
Aesthetic	**U**	0	+	-
Quality	**M**	+	0	-
Sum of (+)		3	2	1
Sum of (0)		2	3	0
Sum of (-)		0	0	4
Winning concept		✓		

Small to Medium Hypermedia methodologies matrix

The Small to Medium Hypermedia category, used the Web Site Design Method, WSDM as the datum. Another criterion, which is Navigation, is added to the row of the matrix. After the scoring process is completed, the evaluation as depicted in Table 6 shows that the Web Application Model, WAM appeared to be the winning methodology.

Table 6: Decision matrix for small to medium hypermedia methodologies

		Methodologies		
Criteria		WDM1	WDM2	WAM
Audience	**D**	0	0	+
Information content and purpose	**A**	-	+	+
Interactivity	**T**	-	-	+
Aesthetic	**U**	0	+	-
Quality	**M**	-	+	+
Navigation		-	-	+
Sum of (+)		0	3	5
Sum of (0)		2	1	0
Sum of (-)		4	2	1
Winning Concept				✓

Medium to Large Hypermedia methodologies matrix

In this category, the Ariadne Development Method, ADM is used as the datum. After the scoring process is completed, the evaluation as depicted in Table 7 shows that the RMM model appeared to be the strongest candidate and thus is picked as the winning methodology.

Table 8 shows the multimedia methodologies matrix with winning concepts from the previous steps. The matrix is a 2 by 2 matrix in which an appropriate multimedia methodology can be selected according to the application size and type.

Table 7: Decision matrix for medium to large hypermedia methodologies

		Methodologies			
Criteria		IHDM	VHDM	OODM	RMM
Audience	**D**	-	+	+	-
Information content and purpose	**A**	+	-	-	+
Interactivity	**T**	-	-	+	+
Aesthetic	**U**	+	-	+	+
Quality	**M**	-	-	-	+
Navigation		+	+	+	+
Sum of (+)		3	2	4	5
Sum of (0)		0	0	0	0
Sum of (-)		3	4	2	1
Winning Concept					✓

Table 8: A 2 by 2 multimedia methodologies matrix

Size/Type	Interactive Multimedia	Hypermedia
Small to Medium	Pragmatic Courseware Design Model	Web Application Model
Medium to Large	Development Methodology for Interactive Multimedia Courseware	Relationship Management Methodology

4.2 Analysis of Results

The findings of this study are presented in the following order: (1) Demographic Profiles of Respondents; (2) Perception of the Methodology. Population frame is 24. Respondents are divided into two (2) groups, test and control groups. Both groups are divided equally into two types of application development which are Interactive Multimedia and Hypermedia. Questionnaires were sent to both groups which consist of 20 and 10 students respectively. All students returned back their responses (100%).

4.2.1 Demographic Information

As stated in Table 9, there are a total of 14 respondents for the tested group, 57% of the respondents were male and the remaining 43 % were female.

Table 9: Demographic Distribution for Tested Group

Demographic Variable Gender	**Total (N=14)**	**Percent**
Female	6	43%
Male	8	57%
Total	**14**	**100%**

Respondents for the control group consist of 10 students. 80% were female and 20% were male. Table 10 depicted the distribution of control group population.

Table 10: Demographic Distribution for Control Group

Demographic Variable Gender	Total (N=10)	Percent
Female	8	80%
Male	2	20%
Total	**10**	**100%**

4.2.2 **Perception of the suggested methodology**

All students are assumed to be novice multimedia developer. This section includes questions, which tests students on their overall perception towards the suggested methodology. Table 11 presents detailed questions in the survey questionnaire.

Table 11: Detailed Question Descriptions

Question Number	Question Description
Q1	Using the methodology makes it easier to develop the application
Q2	The methodology can help me better organize many development processes.
Q3	The advantages of using the methodology outweigh the disadvantages
Q4	I would like to use this methodology in many project
Q6	Learning the methodology was easy
Q7	The methodology is clear and understandable
Q8	The methodology steps are vague and difficult to understand
Q9	A novice developer will face difficulties using the methodology
Q10	I would have no difficulty telling others about the results of using the methodology
Q11	The results of using the methodology are apparent to me

From the data collected, result shows that both tested and control groups find the methodologies used, helpful for their application development. Both groups have high percentage of agreement (86% for tested and 80% for control) for the Interactive Multimedia application development. Similar result is also achieved for the Hypermedia application development (72% for tested and 60% for control).

However, on preferences of the methodology used, result shows that the tested group have higher preferences compared to the control group. For Interactive Multimedia application development, 86% of the respondents in the tested group would like to use the methodology in other projects. As for the control group only 60% of the respondents would like to use the methodology in other future projects.

Five respondents (72%) from the tested group for Hypermedia application development agree to use the methodology in other projects while only 40% of the respondents in the control group agree to use the methodology in other projects.

5.0 SIGNIFICANCE/CONTRIBUTIONS

The multimedia methodology matrix developed can be used as a starting point for selecting methodology for a novice multimedia developer. It can also be used as a reference to other researchers for different types of multimedia applications in future. This project provides an example of how decision matrix is developed and it can be reuse for any other methodology selections.

6.0 CONCLUSIONS

Overall, the main objective of this study which was to develop a multimedia methodology matrix had been achieved. Findings suggested that the methodologies recommended by the matrix are helpful and generally preferred by novice multimedia developer. However, this study is limited to only two types of multimedia applications and testing is done only to the small to medium size project. Therefore, findings of the study were limited to these two types and size. Hopefully, in the future study various type of multimedia applications can be included.

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