POSTGRADUATE DISSERTATION E-TRACKER: A
STUDENT RESEARCH PROGRESS TRACKING TOOL

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ABSTRACT

Information Technology (IT) has changed the way most business units in both the private and public sector conduct their operations. Reduced costs and simplified processes are but simply some of the benefits being reaped by the private sector through improve technology usage. In the education industry, IT is significantly beneficial as it increases efficiency and at the same time reduces operational costs. However, having the latest IT technology will not be beneficial to an organization if it is does not meet the organization needs or requirements and / or if it is not put into proper use.

Consistent progress monitoring is an essential component to determine the effectiveness of instruction and student learning. Studies showed that automated student progress tracking systems would help to reduce the amount of time that students take to graduate and reduce excess hours.

This project constructs a workflow consisting of process logic that defines the sequence of tasks; and routing rules. The workflow allows the researcher to capture the collaborative business process or procedure and automate it. With the workflow defined, a system prototype (Postgraduate Dissertation e-Tracker system) is designed and developed to enable the University to track its students’ progress anytime and it allows the students to update and report their progress online anywhere. The functionality of the Postgraduate Dissertation e-Tracker prototype system is tested with several users to identify its strengths and weaknesses.
The aim of Postgraduate Dissertation e-Tracker prototype system implementation is to provide the university with timely and accurate data collection and reporting on students taking the dissertation course for university management, administrator, lecturers and students serves as the vehicle to collect all post-graduate student taking the dissertation course related information electronically and web-based.

This project, automating several dissertation processes via the Postgraduate Dissertation e-Tracker system aims to monitor postgraduate students’ progress doing research dissertation more effectively and at the same time to increase the students’ motivations to complete their dissertation in timely manner.
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# TABLE OF CONTENT

ABSTRACT ........................................................................................................................................... ii

ACKNOWLEDGEMENT ................................................................................................................... iv

TABLE OF CONTENT .................................................................................................................... v

LIST OF FIGURES ........................................................................................................................ ix

LIST OF TABLES / APPENDICES ................................................................................................ xi

CHAPTER 1 .............................................................................................................................................. 1

INTRODUCTION ..................................................................................................................................... 1

1.1 Background ................................................................................................................................. 1

1.2 Statement of Problem ................................................................................................................. 3

1.3 Objectives of Project ................................................................................................................... 4

1.4 Research Questions .................................................................................................................... 4

1.5 Definitions .................................................................................................................................. 5

1.5.1 Postgraduate Research Supervision ..................................................................................... 6

1.5.2 Progress Monitoring and Tracking ..................................................................................... 8

1.5.3 Workflow and Process Automation ..................................................................................... 8

1.6 Motivation for Research ............................................................................................................. 11

1.7 Significance of Project ............................................................................................................... 11

1.8 Organization of the Remainder of the Research ...................................................................... 12

CHAPTER 2 .............................................................................................................................................. 13

REVIEW OF LITERATURE .................................................................................................................. 13

2.1 Introduction ................................................................................................................................ 13

2.2 Postgraduate Research Supervision .......................................................................................... 14

2.3 The Importance and Benefits of Student Progress Monitoring and Tracking 15

2.4 Theoretical Framework ............................................................................................................. 22

2.5 Case Study on Dissertation Tracking Process and Workflow Automation in the Education Arena ............................................................................................................ 24
CHAPTER 3 ......................................................... 49

RESEARCH METHODOLOGY ................................................................. 49
3.1 Introduction ......................................................................................... 49
3.2 Sample Selection .................................................................................. 50
  3.2.1 Sample Selection for Interview ......................................................... 50
  3.2.2 Sample Selection for Questionnaire / Survey ...................................... 50
3.3 Requirement Gathering Instruments .................................................... 51
  3.3.1 Questionnaire / Survey ..................................................................... 51
3.4 Data Analysis ......................................................................................... 53
3.5 Adoption of the IBM® Rational Unified Process® .................................... 54
  3.5.1 Phase 1: Inception (Define Scope and Value) ...................................... 57
  3.5.2 Phase 2: Elaboration (Pilot Solution and Create Mentors) ....................... 57
  3.5.3 Phase 3: Development & Implementation (Construction) ...................... 58
  3.5.4 Phase 4: Maintaining the Solution (Transition) .................................... 58
3.6 Summary ................................................................................................. 59

CHAPTER 4 .............................................................................................. 60

FINDINGS, ANALYSIS AND DESIGN OF THE STUDY ............................. 60
4.1 Introduction ......................................................................................... 60
4.2 Response Rate ...................................................................................... 60
4.3 Demographic Data ................................................................................ 61
4.4 Survey Findings ..................................................................................... 62
4.4.1 Understanding of the dissertation process ..............................................62
4.4.2 Identified shortcomings of the dissertation process..............................63
4.4.3 Identified areas of the improvements ..................................................64
4.5 Other Findings .......................................................................................66
4.5.1 Understanding of the existing system used to track postgraduate dissertation .................................................................................66
4.5.2 Current Challenges..............................................................................67
4.5.3 List of Improvements and Key Requirements ........................................68
4.6 Analysis and Design of Workflow Process and Postgraduate Dissertation e-Tracker system .................................................................69
4.6.1 Dissertation General Workflow ............................................................69
4.6.2 Use Case Diagram for Dissertation.......................................................72
4.6.3 Scope of the Postgraduate Dissertation e-Tracker system ....................73
4.6.4 e-Tracker system Analysis and Design Workflow ...................................74
4.6.5 System analysis and design .................................................................82
4.7 Summary of Findings .............................................................................87

CHAPTER 5 ..................................................................................................88

PROTOTYPE DEVELOPMENT, IMPLEMENTATION AND RESULTS ..........88
5.1 Introduction .............................................................................................88
5.2 Infrastructure Requirements .................................................................88
5.2.1 Software Requirements .....................................................................88
5.2.2 Database Requirements ....................................................................90
5.2.3 Hardware Requirements ...................................................................90
5.3 System Prototype ..................................................................................91
5.3.1 Login Page .......................................................................................91
5.3.2 e-Tracker Home Page .......................................................................92
5.3.3 Supervisor and Topic ..........................................................................95
5.3.4 Schedule Meeting .............................................................................99
5.3.5 Meeting Logs ...................................................................................101
5.3.6 On-line Form Submission .................................................................103
5.3.7 Reporting modules ...........................................................................105
5.4 Evaluation Result ..................................................................................107
5.4.1 Mapping of Requirements to System Prototype ...................................107
5.4.2 System Testing and User Acceptance Testing ......................................109
5.5 Summary .......................................................................................................................110

CHAPTER 6 ..........................................................................................................................111

CONCLUSION AND FUTURE WORK ............................................................................111

6.1 Introduction ...................................................................................................................111

6.2 Summary .....................................................................................................................111

6.2.1 Purpose of the Study ...............................................................................................111

6.2.2 Fact Findings and Requirement Gathering ..............................................................112

6.2.3 Data Gathered and Analysis ....................................................................................112

6.3 Accomplished Objectives ...........................................................................................113

6.4 Advantage and Limitation of the e-Tracker System ..................................................115

6.4.1 Identified Advantages ............................................................................................115

6.4.2 Identified Limitations .............................................................................................117

6.5 Problems Encountered ...............................................................................................117

6.6 Others ..........................................................................................................................117

6.7 Recommendations for Further Study .........................................................................118

REFERENCES ....................................................................................................................119

APPENDIX A - Questionnaire on Student Dissertation Progress Tracker System for Postgraduate Students .................................................................................................................................124

APPENDIX B - Interview Material for University of Malaya Dissertation Administrative and Management .................................................................................................................................128
LIST OF FIGURES

Figure 2.1: Progress Monitoring in RTI ................................................................. 18
Figure 2.2: Expected input and output of this research .............................................. 23
Figure 2.3: Snapshot of Thesis Submission Notice Form used by UKM ...................... 27
Figure 2.4: Snapshot of page 1of 9 in the Progress Report used by UTM .................. 28
Figure 2.5: Snapshot of dissertation process in UTAR ................................................... 31
Figure 2.6: Snapshot of Progress Report used by UTAR ................................................ 32
Figure 2.7: Snapshot of Dissertation Submission Intension form used by UTAR .......... 33
Figure 2.8: Sample screenshots of “Adviser” in GSPS .................................................. 38
Figure 2.9: Sample screenshots of “Required Forms and Benchmarks” in GSPS ........ 39
Figure 2.10: Sample screenshots of “Progress Reports” in GSPS ............................... 40
Figure 2.11: Sample screenshots of “My Students” in GSPS ....................................... 41
Figure 2.12: Sample screenshots of “Student Information Page/Assessment Report” in GSPS .................................................................................................................................................................................. 42
Figure 2.13: Sample screenshots of “Summary Reports” in GSPS ................................ 43
Figure 2.14: Screenshots of McGill University Graduate student research progress tracking website where forms are used .................................................................................. 45
Figure 2.15: Snapshot of forms (progress report form) used in McGill University ...... 46
Figure 2.16: Screenshots of UBC’s Annual Progress Report ................................ .......... 46
Figure 2.17: Snapshot of forms (progress report form) used in UNSW ....................... 47
Figure 3.1: RUP® phases and disciplines ....................................................................... 54
Figure 4.1: Survey Sample Statistic Pie Chart ............................................................... 61
Figure 4.2: Level of Understanding on Dissertation Process Statistics Chart ............. 62
Figure 4.3: Identified Short Comings ............................................................................... 63
Figure 4.4: Identified Areas of Improvements ................................................................. 64
Figure 4.5: Constructed Dissertation Workflow for UM ............................................... 71
Figure 4.6: Use Case Diagram for the Proposed e-Tracker System .............................. 72
Figure 4.7: Activity Diagram for the Proposed e-Tracker System .................................. 75
Figure 4.8: e-Tracker System: Dissertation Registration Workflow ............................. 76
Figure 4.9: e-Tracker System: Dissertation Execution Workflow ................................. 78
Figure 4.10: e-Tracker System: Dissertation Submission Workflow ............................ 79
Figure 4.11: e-Tracker System: Final Submission Workflow ........................................ 81
Figure 4.12: Context Diagram for the Proposed e-Tracker System ............................... 82
Figure 4.13: Level 1 Data Flow Diagram of the Proposed e-Tracker System.................84
Figure 4.14: Level 2 Data Flow Diagram that refines Process 7.0 for the Proposed e-Tracker System ..................................................................................................85
Figure 4.15: Level 2 Data Flow Diagram that refines Process 8.0 for the Proposed e-Tracker System ..................................................................................................86
Figure 5.1: e-Tracker System Login Page ................................................................92
Figure 5.2: Student Home Page ..............................................................................93
Figure 5.2: Student Home Page, continued ............................................................93
Figure 5.3: Supervisor Home Page ..........................................................................94
Figure 5.4: Faculty Administration Home Page .....................................................95
Figure 5.5: Supervisor and Topic (Student View) ..................................................96
Figure 5.6: Supervisor and Topic (Student View) – Notification prompt ..............97
Figure 5.7: Supervisor and Topic request by student - Faculty view for approval ......98
Figure 5.8: Sample Notification to Student .............................................................98
Figure 5.9: Schedule Meeting – Supervisor View ...............................................100
Figure 5.10: Schedule Meeting – Student View .....................................................100
Figure 5.11: Meeting Log – Student View ...............................................................102
Figure 5.11: Meeting Log (Part 2) – Student View, continued ..............................103
Figure 5.12: Snapshot of the Online Form Module in e-Tracker system ..........104
Figure 5.13: Snapshot of the Online Form Module in e-Tracker system ..........105
Figure 5.14: Snapshot of the Reporting Module by Student ..............................106
Figure 5.14: Snapshot of the Reporting Module by Student, continued ..........106
Figure 5.15: Snapshot of the Reporting Module for Faculty Administration .......107
LIST OF TABLES / APPENDICES

Table 1.1: Supervisor Beliefs.................................................................6
Table 1.1: Supervisor Beliefs, continued.................................................7
Table 2.1: Comparison of Dissertation Tracking processes and workflows........34
Table 2.2: Features and Functions of the GSPS...........................................36
Table 2.2: Features and Functions of the GSPS, continued..............................37
Table 3.1 Static Workflows in Rational Unified Process .................................55
Table 4.1: Description of the main Dissertation Processes...........................63
Table 4.2: Description of the Identified Areas of Improvements ..................65
Table 5.1: Mapping of Requirements to Developed Prototype ....................108
CHAPTER 1

INTRODUCTION

1.1 Background

University of Malaya, or UM, being the oldest institution of higher learning, is today the highest ranked Malaysian institution at rank 39 in Asia and 180 in the World for the year 2009 (source: http://www.topuniversities.com). UM is also recognized as a premier university in Malaysia. UM offers postgraduate studies in its many faculties ranging from Law to Medicine. Computer Science and Information Technology is one of the many faculties within UM which offers Master’s degree where research dissertation is an essential requirement to be fulfilled in order for graduation. The dissertation is said to be an important element as it provides students with a broader based training in research before embarking on a PhD or industrial research career (Green, Shaw & Hammill, 2001).

Population of postgraduate students in UM is growing as the government continues to market Malaysia as the regional hub for education. Amongst the growing population, working adults constitute a large number of enrolled postgraduate students where UM has much to offer as life-long learning is vital for self development and career progression (Reader's Digest, June 2009). The 1993 White Paper Realising Our Potential suggests that “for most students who have undertaken a first degree, the Master’s qualification will provide an opportunity to acquire extra knowledge and skills, either in preparation for a period of research training leading to a PhD or for employment” (HMSO, 1993, p. 61).
Hence, with growing number of postgraduate students and UM’s vision “to be an internationally renowned institution of higher learning in research, innovation, publication and teaching”, producing excellent graduates is significant. In the New Sunday Times dated March 29, 2009, it is reported that “UM is emphasizing on the quality of cutting-edge research to become a top class research university.” Therefore, it is important that UM is able to manage, track, monitor and provide support to postgraduate students through completion of the postgraduate programmes.

This dissertation highlights the current challenges the University face to track through completion of each postgraduate dissertation, the need for an automated tracking system, the construction of dissertation workflow, the design, development and testing of such automated tracking system.

This project aims to design and develop a prototype of the postgraduate dissertation progress tracking system (named Postgraduate Dissertation e-Tracker system also known as in abbreviation the e-Tracker system) to provide the University with timely and accurate data collection and reporting on students taking the dissertation course for university management, administrator, lecturers and students. The design and the development of the e-Tracker system prototype shall automates partly if not completely the processes involved in the dissertation registration through to the dissertation submission and at the same time offering tracking mechanism to monitor the progress of the students in their dissertation based on the constructed process workflow which captures the University’s business processes in managing postgraduate dissertation/research.
Hence, the intent of this project is to define a process workflow and to initiate the design, development and implementation of a system that can serve as the vehicle to collect all postgraduate student taking the dissertation related information electronically and web-based. With the developed system, it addresses the current core problems faced today as described in the below sections by the university.

In the following sections of this chapter, the researcher presents the statement of problem that is being researched, definition of terms and last but not least the significance of this study.

1.2 Statement of Problem

Today, tracking of course works completion is through student class attendance and via the sitting of the relevant examinations where results are tracked in the current student information system. However, the tracking of the student research in the dissertation module poses a problem as it is not currently being tracked via IT systems and only basic information are kept or compiled into the existing IT systems. Hence, checking of each student’s progress is manually done.

As day to day operations such as information searching, student progress reports compiling, administration reporting are mostly done manually, it is rather time consuming. Consequently, this makes it difficult for follow-up actions to be carried out either with the students or the university management. Further to that, today, when it comes to the dissertation progress reporting, when the students submits their semester progress report to their respective supervisors, it is only a one way communication. There are no acknowledgement processes in place for feedbacks from the supervisors or any kind of follow up which can be tracked.
As such, there is minimal or no tracking of students’ progress in completing their dissertation which as a result, indirectly causes delays in completion (this is especially true for part time students).

1.3 Objectives of Project

The researcher aims to study, design and develop the Postgraduate Dissertation e-Tracker: A Student Research Progress Tracking Tool for University of Malaya with the following objectives in mind:

a) To study and understand the current student information systems in University of Malaya;

b) To investigate and identify the problems / challenges as well as opportunities that occurs in the current student information systems used in University of Malaya;

c) To highlight the benefits and the importance of progress tracking;

d) To construct a workflow that captures the collaborative business process or procedure and automate it; and

e) To propose, design, develop and test the conceptual solution that can be implemented collaborating with the current student information systems used in University of Malaya to enable the tracking of post graduate students taking the dissertation course.

1.4 Research Questions

The main research questions of the study encompassed the current practices of student dissertation monitoring and tracking, the challenges faced today, improvements that can be put in place via automation and its benefits.
a) What is the level of understanding of the current dissertation processes, what it lacks and how it can be improved?
   Method: Student Survey
   Expected findings: Outcome on how much students know about the current processes to get started with their dissertation through completion. Identification of the current problems faced by students and the improvements students seek for.

b) What are the management and administrative challenges faced today, the ways to overcome the challenges and what might be the benefits derived via automation of the dissertation processes.
   Method: Management and Administration Interview
   Expected Findings: Barriers faced and requirements to improve via automation the current dissertation processes.

c) Are there tools that are readily available to monitor and track postgraduate dissertation progress through completion?
   Method: Archival Research
   Expected Findings: Features and functions of tools which can be used to monitor and track postgraduate dissertation progress through completion.

1.5 Definitions

Terms used in this research are defined in this section to facilitate smooth and clear reading for all categories of readers. Some of the terms defined are Postgraduate research supervision, progress tracking and online system / distributed system.
1.5.1 Postgraduate Research Supervision

Research supervision refers to activities conducted by a supervisor to oversee an academic research project. Researchers liaise with their research supervisor on a regular basis to advise him or her on the research status and receive any guidelines.

In this case, Postgraduate Research Supervision refers to activities conducted to supervise graduates during the course of their research.

Traditionally, research supervision adopts a master and apprentice model where an apprentice researcher follows the lead of a master, conducting specified research tasks, and observing the master's research characteristics so that, ultimately, the apprentice would also become a master in the same mould as the original. Today, however, as the environment changes are so rapidly, the "apprentice" may well be a senior industry professional who has more overall professional experience (if not research experience) than the "master". Hence, maintaining the traditional master/apprentice model becomes difficult (Toncich, 2006). Another model that can be adopted in research supervision is the Laissez-Faire model. A range of some commonly-held beliefs as per suggested by Darion Toncich is depicted in Table 1.1 below.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Master/Apprentice Supervisor's Beliefs</th>
<th>Laissez-Faire Supervisor's Beliefs</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Research Student</td>
<td>Needs to be carefully trained by an expert</td>
<td>Is already qualified and capable of self-learning</td>
</tr>
<tr>
<td>Issue</td>
<td>Master/Apprentice Supervisor's Beliefs</td>
<td>Laissez-Faire Supervisor's Beliefs</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td><strong>The Research Program</strong></td>
<td>Needs to be mapped out by an expert in order to avoid mistakes</td>
<td>Needs to be mapped out by the student as part of the learning process</td>
</tr>
<tr>
<td><strong>Independence</strong></td>
<td>Something that is earned after the apprenticeship</td>
<td>An integral part of the learning process</td>
</tr>
<tr>
<td><strong>Publication</strong></td>
<td>The master's name should always appear first because the apprentice is only an assistant in the program</td>
<td>The student's name should always appear first because the student is the driving force and the supervisor is the guide</td>
</tr>
<tr>
<td><strong>Interaction</strong></td>
<td>Daily interaction and discussion</td>
<td>Weekly or monthly Interaction</td>
</tr>
<tr>
<td><strong>Supervisor's Knowledge</strong></td>
<td>Should be far greater and deeper than the student's in the specific field of research</td>
<td>The student may have more depth in the specific field but the supervisor has more overall knowledge about the process of research</td>
</tr>
</tbody>
</table>

Whichever model adopted in the research supervision, the alliance between the research student and the supervisor needs to be a two-way relationship.
1.5.2 Progress Monitoring and Tracking

Progress monitoring is a scientifically based practice that is used to assess students' academic performance and evaluate the effectiveness of instruction. Progress monitoring can be implemented with individual students or an entire faculty.

Studies show that people do better when they keep track of their progress as it motivates the individual. Research has demonstrated that when teachers use student progress monitoring, students learn more, teacher decision making improves, and students become more aware of their own performance. A significant body of research conducted over the past 30 years has shown this method to be a reliable and valid predictor of subsequent performance on a variety of outcome measures, and thus useful for a wide range of instructional decisions (Deno, 2003; Fuchs, Deno, & Mirkin, 1984; Good & Jefferson, 1998).

Progress tracking in this research means to track meeting schedules, research progress, due dates and issues.

1.5.3 Workflow and Process Automation

In any organization, a set of activities or operations are carried out day to day. These set of activities or operations are known also known as business process. A business process is defined as a set of linked business activities that take one or more inputs and transform them to create an output. Ideally, the transformation that occurs in the process should add value to the input and create an output that is more useful and effective to the recipient either upstream or downstream in the processing chain (Johansson, 1993).
A consultant from IBM shared that useful business processes make and save money for the enterprise. More importantly, the value of creating business processes for an enterprise is in the intellectual assets that those processes represent. It is well worth the time and effort it takes to define and document business processes as having documented business processes reduces the risk of knowledge lost especially in a situation where the enterprise business process knowledge solely exist in the head of one or several key personnel.

With the business processes documented, not only it serves as a point of reference for knowledge sharing where it can be studied, changed, evaluated, and changed again since it is visible to all and not restricted to one or several key personnel who may leave the company, conflicts and confusions can also be avoided.

Granularly, Cichocki, Helal, Rusinkiewicz & Woelk, (1998) defines a process as a description and ordering of work activities across time and space that is designed to yield specific products or services while ensuring the organization's overall objectives. It provides a conceptual basis for the integration and coordination of distributed resources, tasks and individuals.

Therefore, effective management of processes is critical to the development as well as sustainment of any organizational capabilities. Processes can be mapped into steps and actions that are executed manually. Alternatively, they can be mapped into workflows which are process descriptions that can be executed automatically by a workflow automation program/system, which is also known as process automation.
Process automation consists of integrating applications, cutting labor wherever possible, and using software applications throughout the organization where it minimizes manual intervention. With manual intervention reduced, human error can be avoided. Typically, process automation is the process an organization uses to contain costs. According to IBM, process automation optimizes productivity and resources, removes inefficiencies, ensures compliance, and lowers costs.

Process automation covers the breadth of technologies that can be deployed to improve the performance for an organization including measurements, control, sequence automation, optimization and decision support (Love, 2007). In order to automate the business processes, a workflow is first constructed as workflow will capture all the business process or procedure that can then be automated.

Workflow can be described as the movement of documents and activities through a business process. Workflow describes how work is defined, allocated and scheduled. It also defines the sequence and conditions of each task according to a set of rules, routes and roles or resources (such as people, systems or machines).

A workflow is an automated organizational process, which means that the coordination, control and communication of activities is automated but the activities themselves can be either automated or performed by people (Sheth, Georgakopoulos, Joosten, Reusinkiewicz, Scacchi, Wileden & Wolf, 1996).
1.6 Motivation for Research

In this project, the scope of work is on designing and developing a system that tracks and monitors post graduate students taking the dissertation through its completion. To help more postgraduate students move forward in completing the required dissertation fulfilling the requirements to obtain the graduate degree.

1.7 Significance of Project

This research project on the Postgraduate Dissertation e-Tracker was done for the following major reasons:

a) Supervisor manages students better as the system creates more awareness improving ease of communication.

b) Students able to check and update the status of their progress and plan ahead with their supervisors via the web-based systems. Students also able to inform their supervisor of their where-about should it affect the progress meeting schedules.

c) With all the reminders and alerts, the system acts as a mean to keep students (especially part time students on track and at par).

d) Provides the university management and administrator a holistic view on student’s progress through the completion of the dissertation

With all the above, it encourages students to progress and move forward, hence this system hopes to assist in increasing the graduation of the university post graduate statistics, helping the country to achieve its national target.
1.8 Organization of the Remainder of the Research

Chapter 1 has presented the introduction, statement of the problem, research questions, significance of the study, research motivation, definition of terms, and limitations of the study. Chapter 2 contains the review of related literature and research related to the problem being investigated. The methodology and procedures used to gather data for the study are presented in Chapter 3. The results of analyses and findings to emerge from the study are contained in Chapter 4. Chapter 4 also describes the construction of the dissertation workflow and the design of the proposed Postgraduate Dissertation e-Tracker system prototype. Chapter 5 on the other hand, records the development and implementation of the Postgraduate Dissertation e-Tracker system prototype. Finally, Chapter 6 contains a summary of the study and findings, conclusions drawn from the findings, a discussion, and recommendations for further study.
CHAPTER 2

REVIEW OF LITERATURE

2.1 Introduction

In order to meet the research objectives as stated in the earlier chapter, accessing the need for dissertation supervision, progress monitoring and tracking is significant. To facilitate the design and development of the Postgraduate Dissertation e-Tracker system, reviewing existing progress tracking process, workflow automation system is fundamental.

Hence, in this section, the researcher first discusses the scope of the research and then the related works that were published by other researchers. This chapter is organized into sections that include (a) postgraduate research supervision, (b) the benefits of Student Progress Tracking Systems, (c) theoretical framework of this research (d) related case studies on postgraduate research progress tracking tools and (e) related case study on workflow automation system, where existing works/researches related to workflow management system is studied: its types, their role in an organization and their advantages.

The literature review was conducted between May, 2009 and April, 2010 on papers aged 12 years and below. The researcher followed the search method advocated by Webster and Watson (2002) which describes a multi-stage iterative process designed to provide maximum coverage of a topic for the purposes of a narrative literature review.
2.2 Postgraduate Research Supervision

A research degree is about research training as well as contributing to knowledge and although it is not impossible to find ways of training oneself, the whole process is designed to be guided by a supervisor (Cryer, 2000). Today, postgraduate research supervision is done in many ways. Besides face to face meetings and discussion between supervisors and students, most supervisors communicate using generic online / network tools. However, “generic network tools (such as e-mail, computer conferencing, and newsgroups) impose significant user overhead because they were not specifically designed to support educational activities as they did not provide: (i) a standard way to organize course material; (ii) prior evidence of the environment’s effectiveness in instructional uses; (iii) tools to support basic instructional activities, such as course design, organization of group spaces and personal space, grading, and easy integration of multiple media files; or (iv) models to support learning strategies that involve collaborative learning, knowledge building, and multiple representations of ideas and knowledge structures” (Harasim, 1999).

A study done concluded that an effective research supervision requires a supervisor that is easy to meet-up with, discuss and can negotiate with students other than to provide comment and guidance (Affero Ismail & Norhasni Zainal Abiddin, 2009). As mentioned by Brown and Krager (1985), Hockey (1996) and Russell (1996), a supervisor should make equal information, time and energy available to all students and should also meet regularly with students. Research has shown that constant, thoughtful supervision and availability is the key to successful graduate programme completion (Donald et al. 1995; Holdaway 1991). Of course, students themselves should also be committed to completing their graduate programme.
It is known that “online learning environment offers a great opportunity to customize the learning experience as per the needs of the student and his/her learner profile” (Rehani & Sasikumar, 2002). Hence, in this project, the researcher studies to design and implement a progress tracking system, known as the ‘Postgraduate Dissertation e-Tracker’ for postgraduate research dissertation as a vehicle to track progress and as a media that can be utilized to meet the needs of both supervisors and students.

2.3 The Importance and Benefits of Student Progress Monitoring and Tracking

Progress as defined in most dictionaries means “headway; forward movement; development; advancement”; whilst monitoring refers to the routine tracking of the key elements of a programme or project performance, usually inputs and outputs, through record-keeping, regular reporting and surveillance systems as well as observation and surveys.

The researcher defines progress monitoring and tracking as an act of communication, collecting of information, carrying out supervision, recording the actions and inputs of a project or personnel to measure and evaluate the performance of the project or personnel for the purpose of referencing, maintaining and improving of an individual, a project, procedural standards and eventually advances an organization as a whole.

Today, the community in general exercises progress monitoring day to day. For instance, in a home, parents monitor the progress of their child’s growth; in any businesses, stakeholders monitor the progress of their companies to know whether or not profits are earned; in a project, the project manager monitors the progress of the project through to completion ensuring that the project is completed timely, within budget and meeting its
requirements; in the everyday lives of each individual, some form of progress monitoring is practiced to ensure a set target is met. Many organization be it commercial businesses in any industries; health, entertainment productions, manufacturing companies, practices progress monitoring and tracking to promote improvements and expand market share.

In education, progress monitoring is a scientifically-based practice of continuous monitoring that teachers use to evaluate the effectiveness of instruction for the purposes to (i) determine whether students are making appropriate progress in the core instructional program; and (ii) build more effective programs for the students who are not making appropriate progress (Fuchs and Fuchs, 2002). Kalashnikova (2002) explains the monitoring of learning process as control of the student’s work, forming of the individual student behavior model, and production of the individual learning recommendations.

Tracking of progress and monitoring has always been a best practice in teaching and learning. However, in an era of accountability ongoing, consistent progress monitoring is an essential component to determine the effectiveness of education institution’s instruction as well as student learning and achievement.

In order to be able to monitor a student’s progress, identifying useful data, collecting and analyzing it to guide instruction to meet the needs of the student is important. Another vital consideration is the frequency with which to monitor student progress.

Progress monitoring plays four critical roles:
a) Determine whether primary prevention (i.e., the core instructional program) is working for a given student;

b) Distinguish adequate from inadequate response to the secondary prevention and thereby identify students at higher risk for having a learning disability.

c) Inductively design individualized instruction programs to optimize learning at the tertiary prevention in students who likely have learning disabilities.

d) Determine when the student’s response to tertiary prevention indicates that a return to primary or secondary prevention is possible.

Without effective progress monitoring, an educator cannot determine whether or not their methods are working. Therefore, it is essential to think about how an education institution monitors students’ progress, how often it is monitored, and how the findings are used to plan instruction so students learn and master the appropriate skills and strategies.

There is several progress monitoring methods or models used in education. Two of the more popular models are:

(i) **Response To Intervention (RTI)**

According to 'National Center on Response to Intervention', RTI integrates assessment and intervention within a multi-level prevention system to maximize student achievement and to reduce behavioral problems. With RTI, schools use data to identify students at risk for poor learning outcomes, monitor student progress, provide evidence-based interventions and adjust the intensity and nature of those interventions depending on a student’s responsiveness, and identify students with learning disabilities or other disabilities.
RTI is a framework for providing comprehensive support to students and is not an instructional practice. RTI is a prevention oriented approach to linking assessment and instruction that can inform educators’ decisions about how best to teach their students. A goal of RTI is to minimize the risk for long-term negative learning outcomes by responding quickly and efficiently to documented learning or behavioral problems and ensuring appropriate identification of students with disabilities.

RTI has three levels of prevention: primary, secondary, and tertiary. Through the RTI Prevention Framework, student assessment and instruction are linked for data-based decision-making. If students move through the framework’s specified levels of prevention, their instructional program becomes more intensive and more individualized to target their specific areas of learning or behavioral need. The figure below depicts the progress monitoring in RTI.

![Figure 2.1: Progress Monitoring in RTI](image)
The advantages of the RTI approach according to Fuchs & Fuchs (2002) are as listed:

a) Provides assistance to needy children in timely fashion. It is not a wait-to-fail model.

b) Helps ensure that the student’s poor academic performance is not due to poor instruction.

c) Assessment data are collected to inform the teacher and improve instruction. Assessments and interventions are closely linked.

(ii) **Curriculum-Based Measurement (CBM)**

CBM is also referred to as a general outcomes measures (GOMs) of a student’s performance in either basic skills or content knowledge. It is a method teachers/instructors use to find out how students are progressing in basic academic areas such as math, reading, writing, and spelling. CBM was developed by Stanley Deno, Phyllis Mirkin, and others at the University of Minnesota. The roots of CBM are in the Data-Based Program Modification (DBPM) model created by Deno and Mirkin in the late 1970’s. (Deno, 1985).

Deno’s work led to the establishment of measurement systems in reading, writing, and spelling that were (i) easy to construct, (ii) brief in administration and scoring, (iii) had technical adequacy (reliability and various types of validity evidence for use in making educational decisions), and (iv) provided alternate forms to allow time series data to be collected on student progress.

In the Progress Monitoring Study Group developed by Stanley Deno, Erica Lembke and Amy Reschly Anderson, the following are some of the advantages
of CBM approach over traditional norm-referenced assessment and other informal measures of student performance:

a) Based on typically used curriculum – most often that used by the school or district

b) Individually referenced (an individual’s performance is compared to his/her own performance over time);

c) Peer referenced (a student’s performance is compared to their same-grade peers) A tool that can provide teachers with information to make instructional change decisions;

d) A method that allows for direct and continuous monitoring of student achievement related to expected curriculum outcomes;

e) Highly sensitive to student growth, detecting even small changes in student performance;

f) Time efficient (passages require only one-minute to administer);

g) Cost effective (elaborate materials are not needed); and

h) A method that produces results that are easier to understand than normative tests using standard scores.

A comprehensive progress monitoring improvement process includes multiple assessment methods that have different strengths and meet different needs (NCEO Synthesis Report 53, 2004). For example, CBM are used to target focused skill development which in turn helps inform the design of teacher-developed classroom assessments across content areas; RTI used to prevent students maximize student achievement and reduce behavioral problems.
Often, progress monitoring is practiced in a classroom environment; however, the researcher believes that it is all the more important to monitor students’ progress when outside of classroom specifically when doing dissertation because there are no homework, test or examination results, assignment or attendance to mark. According to a report from The Florida Legislature's Office of Program Policy Analysis & Government Accountability (OPPAGA Report No. 09-22, 2009), automated student progress tracking systems that monitors student’s progress would help to reduce the amount of time that students take to graduate and reduce excess hours. Progress monitoring also enhances student graduation and retention rates (OPPAGA Report No. 06-48, 2006).

In this research, the researcher will blend the various methods following the needs of this project and tailors to meet the University’s requirements.

In conclusion, when progress monitoring is implemented correctly, the benefits are great for everyone involved. Some benefits include:

a) Accelerated learning / growth because students are receiving more appropriate instruction;

b) More informed instructional decisions;

c) Documentation of student progress for accountability purposes;

d) More efficient communication with other professionals about students’ progress;

e) Higher expectations for students by supervisors; and

f) Automation of various manual administrative activities
To help an individual to move forward, whether in research, a career or in education, with development in any area of research, the key is to effectively monitor progress. When a progress monitoring program or process is in place, an instructor or a manager or a parent can keep tabs on what the subject is doing right, where the subject needs improvement and what kinds of improvement are needed. The knowledge of such progress contributes to meeting a specific need of the individual and in this research, enables the University to meets its target of producing graduates and students to advance.

2.4 Theoretical Framework

The researcher aims to examine the current dissertation process through interviews with selected administrators, supervisors and students. The study investigates manners in which the University can provide a more efficient and effective dissertation supervision through process automation. The researcher also looks for challenges that were encountered by both supervisor and students throughout the dissertation. The theoretical framework can be depicted as input and output in Figure 2.2 below.

In order to explain the scope of the Postgraduate Dissertation e-Tracker system implementation that is implied in this paper, the researcher presents the theoretical framework in three sections. The first section shows that the researcher will conduct surveys with university students to gather information on the current processes of dissertation supervision, it shortcomings and requirements from the student’s perspectives.
In the next chapter, the researcher will conduct interviews with special target groups of university administrators, supervisors and management personnel to extract information on the challenges that are currently faced throughout the dissertation in terms of process and technology. The researcher also aims to collect requirements through discussions with the university management.

In the third section, the researcher aims to collect evidence pertaining to existing dissertation progress tracking tool, if there are any in the market. Finally, the analysis and conclusions will be used to draw a conclusion for the proposed ‘Postgraduate Dissertation e-Tracker’ system prototype design and implementation.

---

**Research Aim**

- **Student Survey and Interview**
  - Understanding of current dissertation process from student’s view
  - Identification of the current problems faced by students
  - Improvements students seek

- **Supervisor and Management Interview**
  - Understanding of current dissertation process from administrative view
  - Challenges faced by management
  - Management requirements
  - Benefits of automation

- **Archival Research**
  - Features and functions of existing tools in the market which can be used to monitor and track postgraduate dissertation progress through completion

- **The Result**
  - Constructed process workflow and Proposed ‘Postgraduate Dissertation e-Tracker’ system prototype design and implementation

---

*Figure 2.2: Expected input and output of this research*
2.5 Case Study on Dissertation Tracking Process and Workflow Automation in the Education Arena

In any organization, there are bound to be business processes whether documented or exist solely in the heads of the executer(s). In this review, the researcher sampled a few peer universities in Malaysia for the following purposes:

a) To study the existing process or procedure used for postgraduate dissertation
b) To investigate if an automation of workflow is available

Due to time constraint, the scope of the review for each sampled university is contained within the dissertation process in the universities’ Information Technology faculty respectively.

The sampled local universities are as follows:

a) National University of Malaysia (UKM)
b) University of Technology, Malaysia (UTM)
c) Putra University, Malaysia (UPM)
d) Universiti Utara Malaysia (UUM)
e) Tun Abdul Razak University, Malaysia (UTAR)

Before discussing on the workflow that maybe or may not be used by the sampled universities, the researcher first discusses the benefits of workflow.

2.5.1 The Benefits of Workflow Automation

As described by Hollingsworth (1995), workflow is often seen as a key integration technology, bringing together business processes with the information to support them,
and linking legacy and desktop applications into a flexible and adaptable distributed infrastructure. Workflow is concerned with the automation of procedures where documents, information or tasks are passed between participants according to a defined set of rules to achieve, or contribute to, an overall business goal. Whilst workflow may be manually organized, in practice most workflow is normally organized within the context of an IT system to provide computerized support for the procedural automation.

Mostly referring to Plesums (2003), many organizations have put in place workflows automation to gain the benefits listed below:

a) Improves control of the process as chance for delays or misplaced work are lessen;
b) Improves the quality of service by responding more quickly;
c) Lowers the cost of training staff since the work can be guided through complex procedures where procedures are formally documented and followed exactly, ensuring that the work is performed in the way planned by management, meeting all business and regulatory requirements;
d) Lowers the cost of management as having a workflow allows a wider span of control as it helps the managers to focus and concentrate on nurturing the employees and handling special cases rather than routine reporting and distribution of repetitive tasks;
e) Parallel processing, where two or more tasks are performed concurrently;
f) Information easily accessible;
g) Logging and tracking as workflow systems typically record the processing history, and provide the opportunity for the users to enter comments. The automated log of who/how/when the work was processed is a substantial advantage, improving the record of what was done and when, while eliminating the manual logs and searching of paper documents;
h) Enable search for work in process where the status of an identified work can be found; and

i) Monitoring is enabled since workflow systems include reporting and analysis such as the total work accomplished, number of work still undone, and other statistical information. A few systems send reminder and notification.

Having the best suited individual doing the important work following a set of correct procedures, not only is the work is carried out more effectively, but also costs are lowered as productivity is gained and the service to the customers/clients/end-users/students is generally better. As such, having workflow is beneficial for the organization, customers, and users; in this case beneficial for the University, faculty staffs, management, supervisors and students.

**2.5.2 Postgraduate Dissertation Process / Workflow in UKM**

Study materials related to UKM dissertation processes/procedures/guideline were obtained online. From the available information, the researcher found that the steps required to register the dissertation, execute the research and report on progress are not available. The information that is vastly available is with regards to the dissertation template and its style of formatting.

However from the source of the information, the researcher discovered that the tools used to manage postgraduate dissertation and act as a form of communication are manual form submission. Figure 2.3 below depicts the sample of forms used in UKM. Among the collection of forms listed, forms pertaining to reporting of report were not found.
From this study, the researcher assumes that there is no process or tools used to track the progress of the postgraduate dissertation.

2.5.3 Postgraduate Dissertation Process / Workflow in UTM

In UTM, the written guideline in UTM’s Graduate Studies Rules and Regulations describes the steps to be taken by the students to manage their dissertation/research through to completion.

Upon analyzing the UTM guidelines, the researcher noticed that there is similarity to the steps taken in University of Malaya (UM) for students working on dissertation. The similarities are as such:

a) A master student is required to submit his/her thesis/dissertation/master project report to the faculty for evaluation according to the specified requirements.
b) A student should submit Notice For Submission of Thesis approved by the supervisor at least three (3) months prior to submission of the thesis for examination, or three (3) months before expiry of the maximum study duration.

c) The final date for submission of thesis/dissertation for examination is the last working day of the examination week of the semester.

d) A student is required to submit a Progress Report within the stipulated period to the faculty every normal semester.

From the UTM guidelines, the researcher observed that the process taken by UTM is similar to those in UM. The submission of progress reports and other forms are also done manually. Figure 2.4 below shows that progress report form to be submitted in every semester.

![Figure 2.4: Snapshot of page 1 of 9 in the Progress Report used by UTM](image-url)
2.5.4 Postgraduate Dissertation Process / Workflow in UPM

For this sampled university, the researcher studied the information available on the Internet and has interviewed an existing postgraduate student from UPM. It is confirmed that the postgraduate programme in the Faculty of Computer Science and Information Technology does offer coursework only program structure. Thus, the researcher could not proceed with the review for dissertation process or workflow for UPM.

2.5.5 Postgraduate Dissertation Process / Workflow in UUM

While studying the materials available on the Internet and after interviewing one of postgraduate from UUM, it is found that in UUM, the Master of Science (Information Technology) programme is structured to provide coursework only. However, there are still requirements in the programme to carry out a supervised project and submit a report on the work performed. Hence, the Information Technology MSc Projects is not as flexible where there specific timeline given. The following are the phases of project to be undertaken by all the programme candidates:

a) Selection of project title and supervisor (Before you go for semester break);

b) Drafting of proposal for the project (During semester break);

c) Submission of proposal (Week 3);

d) Presentation of Proposal (Week 4);

e) Execution of project (Week 3 – 14);

f) Presentation of findings in project seminar and submission of draft report, (Week 14) and;

g) Submission of project report/ documentation (Week 15).
From the above phases of the project for the UUM Master of Science (Information Technology programme, the researcher notice that it can represent a high level project process and that there is a control point is in place where within 15 weeks, the postgraduate candidate have to complete their project. However, there is no process or procedure or a control point to track the student’s progress during the three months of project execution. As the project time frame is short, there is no existence of any kind of progress report submission either.

2.5.6 Postgraduate Dissertation Process / Workflow in UTAR

The researcher has also sampled a private local university to complete this literature review. During the review, the research discovered that UTAR has documentation on project handbook for postgraduate in the Faculty of Information and Communication Technology which defines the process required to be adhered to, to begin and complete the dissertation, also known as project paper in UTAR. The process put in place is as illustrated in Figure 2.5 below.
From the process depicted in Figure 2.5, the researcher noticed that students who has commenced on the project paper are required to periodically meet their supervisor at least four times in one semester. This is being tracked manually by the supervisor themselves.
As for the other tracking mechanism, again, forms are used. Figure 2.6 and Figure 2.7 below shows the progress report form and thesis submission notification form respectively.

![Progress Report Form](image)

**Figure 2.6: Snapshot of Progress Report used by UTAR**
2.5.7 Overall Observation for the Case Study of Process and Workflow in the Education Institution

There are many benefits gained from putting in place workflow automation where having the best suited individual doing the important work following a set of correct procedures, not only is the work is carried out more effectively, but also costs are lowered as productivity is gained and the service to the customers is generally better.

Upon studying the sampled peer local universities, it is found that all of the sampled universities have simple postgraduate dissertation processes and procedures that are similar to the current University of Malaya dissertation process.
Summarizing from the study of the sampled peer universities in the above sections, Table 2.1 shows the comparison of the processes and workflows.

Table 2.1: Comparison of Dissertation Tracking processes and workflows

<table>
<thead>
<tr>
<th></th>
<th>UM</th>
<th>UKM</th>
<th>UTM</th>
<th>UPM</th>
<th>UUM</th>
<th>UTAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing processes or procedure used</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existing online documentation processes and procedures</td>
<td>Yes, recently developed</td>
<td>No, not made available</td>
<td>Yes</td>
<td>Not Applicable (N/A)</td>
<td>Not Applicable (N/A)</td>
<td>Yes</td>
</tr>
<tr>
<td>(Guide To The Preparations Of Research Reports, Dissertations &amp; Theses)</td>
<td>Only manual forms available</td>
<td></td>
<td>(Graduate Studies Rules and Regulations)</td>
<td>UPM offers only coursework programs</td>
<td>UUM offers only coursework programs with supervised projects</td>
<td>(Project Paper Handbook)</td>
</tr>
<tr>
<td>1. Registering for Dissertation</td>
<td>Yes, by form</td>
<td>No, not available</td>
<td>Yes, by form</td>
<td>N/A</td>
<td>N/A</td>
<td>Yes, by form</td>
</tr>
<tr>
<td>2. Submission of Student Progress Report</td>
<td>Yes, by form at every end of the semester</td>
<td>None</td>
<td>Yes, by form</td>
<td>N/A</td>
<td>N/A</td>
<td>Yes, by form every 6th-monthly</td>
</tr>
<tr>
<td>3. Submission of Dissertation Submission Intention Form) before handing in your research proposal</td>
<td>Yes, by form. Three months prior to submission</td>
<td>Yes, by form. Three months prior to submission</td>
<td>Yes, by form. Three months prior to submission</td>
<td>N/A</td>
<td>N/A</td>
<td>Yes, by form. Three months prior to submission</td>
</tr>
<tr>
<td>4. Submission of Dissertation for Examination</td>
<td>Yes, by form</td>
<td>Yes, by form</td>
<td>Yes, by form, however dissertation is submitted online</td>
<td>N/A</td>
<td>N/A</td>
<td>Yes, by form</td>
</tr>
<tr>
<td>5. Re-submission of Dissertation, if required</td>
<td>Yes, by form</td>
<td>Yes, by form</td>
<td>None, however a different form is submitted (Certification On The Correction Of Thesis By Supervisor)</td>
<td>N/A</td>
<td>N/A</td>
<td>Yes, by form</td>
</tr>
</tbody>
</table>

| Automation of workflow                                          |                                 |                          |                                  |                                  |                                  |                                   |
| Existing Automated Tool                                         | No                              | No                       | No                               | No                               | No                               | No                                |
Mostly forms are used as a means to track the progress of the student dissertation through submission. The researcher noticed that no workflow automation is set up in any of the sampled universities.

In a nutshell, progress tracking is significant to help an individual or even an organization to know their progress status. The process in tracking of progress is practiced in all if not most organizations scaling from small and medium business to large enterprises. One of the renowned freight and forwarding company that relies on their progress tracking process is DHL where DHL is constantly tracking the goods being delivered and promptly informing their users on the where-about of the delivery.

Hence, the researcher stresses that the progress tracking is important in the education industry as well enabling management to track the where-about of the students and guide them towards completion of their education.

2.6 Related Case Studies on Student Progress Tracking Tools

2.6.1 Graduate Student Progress System

There are many online tracking systems that are being developed to help companies track business issues and manage them through to resolution.

In universities, tracking of student progress are essential. The researcher has studied on a commercial graduate student progress tracking systems available in the marketplace, namely the Graduate Student Progress System (GSPS). The GSPS a tool for assessing graduate students and other academic professionals developed by University of Missouri-Columbia Graduate School.
According to University of Missouri-Columbia (2008), the Graduate Student Progress System is designed to facilitate the collection of information necessary to properly assess the progress of graduate students. The Graduate Student Progress System (GSPS) allows faculty and staff to collect the essential information necessary to assess academic professionals, specifically graduate students. The system can also initiate a feedback loop between student and adviser, allow academic programs to generate aggregate reports on their student's achievements, and create a curriculum vita for a student.

The GSPS is web-based software that allows for collecting achievement data (such as presentations, publications, awards) from students or other academics. This information is made available to advisers or departmental leaders in individual or aggregate reports. The generated reports are available as HTML, PDF or Microsoft Excel files.

GSPS has many features ranging from recording student’s basic profile to interacting with students to obtain progress reports. It also has an interface with the administrative view. Table 2.2 depicts the summary of features and functions of the GSPS.

Table 2.2: Features and Functions of the GSPS

<table>
<thead>
<tr>
<th>GSPS Features and Functions (Student view)</th>
<th>GSPS Features and Functions (Faculty staff and management view)</th>
</tr>
</thead>
<tbody>
<tr>
<td>– Achievement Categories</td>
<td>– My Information</td>
</tr>
<tr>
<td>* Basic Information</td>
<td>– My Students</td>
</tr>
<tr>
<td>* Advisers</td>
<td>– Degree Program Students</td>
</tr>
<tr>
<td>* Required Forms</td>
<td>– Degree Program Settings/Personal Settings</td>
</tr>
<tr>
<td>* Progress Reports</td>
<td>– Student Information Page/Individual Assessment Reports</td>
</tr>
<tr>
<td>* Awards &amp; Honors</td>
<td>– Summary Reports</td>
</tr>
<tr>
<td>* Conferences</td>
<td>– Frequently Asked Questions</td>
</tr>
<tr>
<td>* Creative Activities</td>
<td></td>
</tr>
<tr>
<td>* Employment</td>
<td></td>
</tr>
<tr>
<td>* Grants &amp; Fellowships</td>
<td></td>
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<tr>
<td>* Placement</td>
<td></td>
</tr>
<tr>
<td>* Presentations</td>
<td></td>
</tr>
<tr>
<td>* Publications</td>
<td></td>
</tr>
<tr>
<td>* Service Activities</td>
<td></td>
</tr>
<tr>
<td>* Stipend Support</td>
<td></td>
</tr>
</tbody>
</table>
As shown in Table 2.2, the GSPS has two types of views, one for students and another for the faculty staff and management.

While observing some of the GSPS features in both the student and administrator views, the researcher drilled into a few selected functions of the GSPS based on its relevance to the researcher’s project.

2.6.1.1 Observation of the GSPS features in the student view

GSPS features selected for observations in the student view:

a) Advisers

b) Required Forms and Benchmarks

c) Progress Reports

Advisers
Advisers in GSPS are faculty members who have a need to review and provide feedback on the information the students put into the GSPS. In this feature, the student will be able to add an adviser and grant the added advisor to access the student’s records within the system. The adviser(s) will be able to view all of the student’s information, and to respond to the student’s "Progress Reports". Figure 2.8 below shows a screenshot of the GSPS Adviser feature.

![Figure 2.8: Sample screenshots of “Adviser” in GSPS](image)

**Required Forms and Benchmarks**
The GSPS has a feature where it acts as a repository of all the forms required to be completed by graduates known as “Required Forms”. It also tracks other events, called "Benchmarks". This feature allows the faculty to know about the students’ completion of required administrative paperwork. It is a tool used to make sure students have completed all administrative requirements and it also serves as a guide to students to be aware of all the forms they need to complete. The following Figure 2.9 shows the snapshot of the GSPS.

Figure 2.9: Sample screenshots of “Required Forms and Benchmarks” in GSPS

Progress Report
GSPS has the function to record progress reports, however, its Progress and Teaching Reports are questionnaires created by the university department so that graduates can provide a written self-assessment of their progress toward their degree. The following Figure 2.10 shows the snapshot of the GSPS.

![Sample screenshots of “Progress Reports” in GSPS](image)

**Figure 2.10: Sample screenshots of “Progress Reports” in GSPS**

2.6.1.2 *Observation of the GSPS features in the faculty staff and management view*

GSPS features selected for observations in the faculty staff and management view:

a) My Students

b) Student Information Page/Assessment Report

c) Summary Reports

**My Students**
Under the "Students" tab in GSPS, a faculty staff can see a number of menu choices, including one called "My Students". This feature in GSPS, records all the students who have listed the faculty staff as an adviser.

As the faculty staff, he/she then confirms the student as an advisee. Upon confirming the student as an advisee, the faculty staff can click the student's name in the "My Advisees" section to see details and generate reports for that student. The figure below shows an example of the “My Students” feature in GSPS.

![Figure 2.11: Sample screenshots of “My Students” in GSPS](image)

**Student Information Page/Assessment Report**

Once the faculty staff clicked on a student's name, a page devoted exclusively to that student will be shown. The information shown is as follows:

a) General Information - Four kinds of information including student's academic status, including student number, student status, and program entry date. A list of degree programs the student is currently enrolled in and the student's advisers are also listed in the "General Information" section, as well as any Required Forms and Benchmarks.
b) Respond to Progress Reports submitted by <student’s name> - In this section the faculty staff will see links to progress reports submitted by the student. Underneath each link is an indication of the responses to that progress report - either "No Responses" or a list of names of other advisers who have responded to the report. By clicking on the link, a page that displays the student’s progress report and a response box will be shown.

c) Create Assessment Summary for <student’s name> - In this section, a faculty staff can create an Assessment Summary Report for the student.

d) Modify <student’s name> Record - In this section, there are links for handling some additional tasks related to the student. One of the links is to allow the faculty staff to "Submit comments for a missing progress report".

The figure below shows an example of the “Student Information Page/Assessment Report” feature in GSPS.

![Sample screenshots of “Student Information Page/Assessment Report” in GSPS](image-url)

Figure 2.12: Sample screenshots of “Student Information Page/Assessment Report” in GSPS
Summary Reports

Under the "Summary Reports" tab a faculty staff can create aggregate reports for his/her advisees, alumni students, attritional students, and the students from any degree programs he/she have administrative privileges to.

In this feature, there are two standard reports; (i) the "Dean's Report Card Summary" report is the information that the Graduate School will retain and include on the Dean's Report Card and (ii) the "Last Login" report will show the last time each member of your selected population logged into the Graduate Student Progress System.

The figure 2.13 below shows an example of the “Summary Reports” feature in GSPS.

Figure 2.13: Sample screenshots of “Summary Reports” in GSPS
2.6.1.3 *Observation Summary of the GSPS*

With the many features in GSPS, it lacks the features that continuously track and monitor students’ progress through dissertation. It also lacks the ability to schedule meetings and send reminders to fellow students.

In a nutshell, the GSPS is generalized to cater for the collection of information of graduate student in terms of academic results. It also serves as a mean of repository for student and the faculty / university, where for the students, the repository allows the students to create a curriculum vita whilst for the faculty, and it serves as vehicle to generate aggregate reports on the student's achievements at the same time being able to trace alumni.

There are many other online student monitoring products, however, mostly are designed and developed for online course teaching and/or virtual university as listed in a previous research done on student monitoring and student modelling by Sumi (2007).

2.6.2 *Dissertation Tracking Tools used in peer universities*

It is also known that other universities have their own set of research tracking processes and procedures. Due to time constrain and limitation, a few universities has been randomly sampled by the researcher for the purpose of this literature review. The sampled universities are namely:

a) McGill University, Canada

b) University of British Columbia, Canada (UBC)

c) University of New South Wales, Australia (UNSW)

d) North Carolina State University, United States (NCSU)
The review studies the tools and/or systems used in the said monitoring and tracking. The purpose of this review is to understand the current standing of the UM versus other world ranking universities.

After studying the sampled peer international universities, it is found that there are some similarities especially on how the sampled universities track their postgraduate research. Mostly tracks the students via forms which where some are online forms that are filled online and submitted manually while others are submitted electronically. Figure 2.14, Figure 2.15, Figure 2.16 and Figure 2.17 below shows a screen snapshot of the online forms used in one of the sampled universities respectively. As for NCSU, students are required to submit forms manually however, the very thesis or dissertation is submitted online.

Figure 2.14: Screenshots of McGill University Graduate student research progress tracking website where forms are used
Figure 2.15: Snapshot of forms (progress report form) used in McGill University

Figure 2.16: Screenshots of UBC’s Annual Progress Report
From this study, the researcher concludes that tracking and monitoring of postgraduate research progress is essential and as technology advances, automation of such activities is significant to move forward in this fast growing phase.

### 2.7 Summary

The literature study conducted revealed that tracking of progress is essential as a means for referencing, to maintain and improve performance. In the arena of education, progress tracking is an essential component to determine the effectiveness of education institution’s instruction and student learning / achievement.
Benefits that can be achieved by tracking and monitoring progress that was highlighted earlier has been strengthened by the literatures analyzed in this chapter. The researcher learnt that the advantages of having a progress tracking system are able to address the shortcomings faced by the University today with regards to student dissertation.

From the literatures, the researcher also found that there are many tools readily available in the marketplace for progress tracking. However, the researcher found that most commercial student monitoring system and student progress tracking systems tracks at course levels, where it mostly tracks the number of times an individual logged into the system to retrieve course materials, test scores, the number of assignments submitted and some the number of messages read only. Other than that, most commercial systems are built for online course teaching and/or virtual university.

Besides studying tools which are available in the marketplace, the researcher also looked into the business processes on dissertation from the selected samples of peer universities. It is found that most local university has a simple dissertation guideline / process similar to the current dissertation process used in University of Malaya where tracking are mostly done via forms submitted manually. It is learnt that having workflow automation is beneficial to an organization, its customers and its users.

Hence, with the benefits of progress tracking identified and the importance of workflow automation studied, the researcher proposes the automation of the dissertation progress tracking for UM as it will provide the university with timely and accurate data collection and reporting on students taking the dissertation and it serves as the vehicle to collect all post-graduate student taking the dissertation course related information electronically and web-based which can be obtained anytime, anywhere.
CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter addresses the methodologies and instruments that will be used to gather and analyze data and to achieve the research objectives.

The researcher will use the survey method in order to gather quantitative data via questionnaires to describe the characteristics of the current postgraduate research processes, the current system and what improvement would deemed achievable. The findings are expected to contribute towards the designing and development of the Postgraduate Dissertation e-Tracker system, which is the main objective of this research.

Next, the researcher plans to administer questions during face-to-face and / or telephone interviews with selected university management, administrators and supervisors to support the quantitative data that will be collected and direct the questions towards the needs and the requirements (in the area of postgraduate dissertation) which will directly or indirectly drive towards a higher postgraduate student retention and completion statistic.

For the development of the system prototype, the research will apply the Microsoft .NET Framework. The prototype system being developed is named as the Postgraduate Dissertation e-Tracker system. The prototype system will also be referred to as e-Tracker in the rest of this document.
3.2 Sample Selection

3.2.1 Sample Selection for Interview

An ideal sample for the management interview would be to identify all the stakeholders and the users from both the administrative and management level in FCSIT. As this would require excessive amount of time, this sampling is modified by identifying only several named key users who are actively involved in management of the student dissertation. In order to gather information for the literature review, the researcher has also interview a few postgraduate from the few of the sampled local universities.

3.2.2 Sample Selection for Questionnaire / Survey

All FCSIT postgraduate students are the perfect population for survey samples. The researcher will distribute both manual survey handouts. However, as the postgraduates are widespread the researcher finds that online survey via e-mail is more feasible.

The researcher will allocate 2 to 4 weeks for all the FCSIT postgraduate students to response to the online survey. It is anticipated that not all the samples would participate and response timely. Hence, the researcher is expecting a return of survey response rate at 10% of the entire population of postgraduate in FCSIT.

The findings will be experienced based, rather than rhetoric-driven because this survey concentrated on three areas:

a) The current understanding of the dissertation process
b) Overall opinion of the current dissertation process / system
c) Suggestions of improvement to the dissertation process / system
While handing out survey forms to the samples, the researcher will also perform ad-hoc short interview session with the some randomly selected postgraduates to further understand their experience, their pain points and to gather requirements that can improvement problematic areas in the current research tracking practices.

### 3.3 Requirement Gathering Instruments

In gathering requirements, the researcher uses a multi-method approach that combines qualitative and quantitative data (Jick, 1979). This method is used because data collection from various sources increases the trustworthiness and validity of data (Todd 1979; Yin 2003; Saunders et al 2003).

The instrumentation that will be used on the research questions is a survey of the FCSIT postgraduate students via questionnaires. FCSIT faculty staffs and management personnel who will be key users of the e-Tracker will be interviewed via telephone and where possible, via face-to-face meetings.

#### 3.3.1 Questionnaire / Survey

The survey questions used is in the form of ratings on a Likert scale, directed to FCSIT postgraduate students. The objectives of the questionnaire / student survey are:

a) to find out the student’s understanding of the current dissertation process in the Faculty of Computer Science and Information Technology in University of Malaya;

b) To identify any shortcoming of the current system; and

c) To identify the areas of improvement in the Dissertation Process.
In a nutshell, the questionnaire aims to highlight all the current dissertation processes involved, the might-be shortcomings of the current dissertation process and what students would like to see improved.

The questions in the survey were constructed based on initial discussions with the faculty administration staffs and also guided by the existing materials on the current dissertation processes and procedures. The questionnaires are categorized in three parts, where each part is designed to tackle the objectives of the survey:

a) Part 1 – Targets to obtain demographic information of students / samples doing the survey. It also aims to understand if the student is in the midst of the dissertation execution and how long has the student taken at doing the dissertation.

b) Part 2 – Targets to obtain the level of knowing / understanding of the current dissertation process based on the students’ experiences. This is to find out if there is lack of information pertaining to the dissertation.

c) Part 3 – Aims to identify any shortcomings of the current dissertation process based on students’ experiences and targets to improve the identified shortcomings.

A list of the suggested questions can be found in Appendix A. Majority of the questions is guided by key selection points to ensure that responses collected are within the scope of this research. Questions are in the form of multiple choice answers.

Scales will be included in any question that required a respondent to measure the strength or level of a theoretical construct. In its simplest form in the survey, a scale asked a respondent to rate the level of on a five-point scale.
The scales that will be used in the surveys will be generally balanced - that is, they allowed the respondents to express one of the two extremes of view (e.g. limited and significant). These scales are also designed with a midpoint that allowed respondents to enter a ‘moderate’ response. When interpreting scales it is important to realize that there is not an ordinal relationship between points in a scale. That is, the strength of opinion to shift a respondent from ‘moderate’ to ‘limited’ may be much smaller than the strength required for shifting a respondent to ‘significant’.

The questionnaire instruments that are directed to both the administrative and management level in FCSIT samples will be administered via face to face interview. Appointment slots for interview made and therefore it is dependant of the interviewee’s available time.

3.4 Data Analysis

As this survey is sent to all FCSIT postgraduate students, it is unlikely that the researcher could follow-up with non-respondents. As such, for analysis presented in this report it is assumed that there will be no significant bias between those who responded in the survey and those who did not respond.

The results are calculated under the assumption that responding samples answer in the same way as non-respondents. This will be considered when using the data to make inferences on the current dissertation processes and tools used.
3.5 Adoption of the IBM® Rational Unified Process®

The IBM Rational Unified Process (RUP®) is a software development process incorporating mature, proven techniques and the best practices covering the end to end software development life cycle. According to IBM in the Rational Software White Paper (TP026B, Rev 11/01), it is a comprehensive process framework that provides industry-tested practices for software and systems delivery and implementation and for effective project management.

The RUP® promotes iterative development and organizes the development of software and systems into four phases, each consisting of one or more executable iterations of the software at that stage of development. The four phases are Inception, Elaboration, Construction and Transition.

One of the central best practices of RUP® is the notion of developing iteratively. The RUP® organizes projects in terms of disciplines and phases, each consisting of one or
more iterations. Within each iteration, the tasks are categorized into nine disciplines; six "engineering disciplines / core process workflow" (Business Modeling, Requirements, Analysis and Design, Implementation, Test, Deployment) and three supporting disciplines / workflow (Configuration and Change Management, Project Management, Environment). Figure 3.1 above depicts the RUP® phases and disciplines.

The core engineering and supporting workflows are described in Table 3.1

**Table 3.1 Static Workflows in Rational Unified Process**

<table>
<thead>
<tr>
<th>Workflow</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business modelling</td>
<td>The business processes are modelled using business use cases.</td>
</tr>
<tr>
<td>Requirements</td>
<td>Actors who interact with the system are identified and use cases are developed to model the system requirements.</td>
</tr>
<tr>
<td>Analysis and design</td>
<td>A design model is created and documented using architectural models, component models, object models and sequence models.</td>
</tr>
<tr>
<td>Implementation</td>
<td>The components in the system are implemented and structured into implementation sub-systems. Automatic code generation from design models helps accelerate this process.</td>
</tr>
<tr>
<td>Test</td>
<td>Testing is an iterative process that is carried out in conjunction with implementation. System testing follows the completion of the implementation.</td>
</tr>
<tr>
<td>Deployment</td>
<td>A product release is created, distributed to users and installed on their workplace.</td>
</tr>
<tr>
<td>Configuration and change management</td>
<td>This supporting workflow manages changes to the system.</td>
</tr>
<tr>
<td>Project management</td>
<td>This supporting workflow manages the system development.</td>
</tr>
<tr>
<td>Environment</td>
<td>This workflow is concerned with making appropriate software tools available to the software development team.</td>
</tr>
</tbody>
</table>


With the iterative approach, the emphasis of each workflow will vary throughout the lifecycle. The iterative approach helps users address risk early and continuously,
through demonstrable progress and frequent executable releases. These features of RUP
made it a good candidate model for supporting the development of the e-Tracker.

Hence, the four phases of RUP® is adopted to carry out the entire research process from
understanding the domain through the system implementation. The iterative and
incremental nature of RUP® will help to develop the prototype in a series of controlled
iterations. When the inadequacies in requirements analysis become evitable in design
and subsequent phases; RUP® allows reworking on the version of previous increment.
The amount of time spent in each phase varies.

The adaptation of Inception to Transition phase in this research can be summarized as
the following six-step process:

a) Conduct interviews with key users to gather the current pain points faced using the
current dissertation process and to identify improvement requirements;
b) Conduct survey to understand the students’ understanding of the current dissertation
process, and to identify the shortcomings and improvements from students’ point of
view;
c) Study of existing research and existing commercial tools to understand in detail the
research problem;
d) Designing of the e-Tracker system prototype;
e) Development and implementation of the e-Tracker system prototype; and
f) Evaluation of the E e-Tracker system prototype.

The following sections will describe the adoption of the phases of RUP from inception
to transition to carry out the entire research process from understanding the domain by
literature review to the user evaluation.
3.5.1 Phase 1: Inception (Define Scope and Value)

In this phase, the researcher will conduct data gathering thru the fact finding techniques and methodology identified in the earlier sections of this chapter.

With the information gathered, the researcher aims to scope the requirements of the targeted system to define what is included, and what is not.

3.5.2 Phase 2: Elaboration (Pilot Solution and Create Mentors)

In the adoption of this phase, the researcher aims to analyze the problem domain, and to establish a sound architectural foundation. The following task will be performed:

- Refine scope (refinements or elaborations of the inception phase)
- Design prototype
- Pilot Test solution design

In this phase, the requirements gathered from requirements captured are analyzed. Requirements captured provide the user centered view of the system whereas the requirement analysis helps to arrive at a model that describes the internal structure and behavior of the prototype.

As one of the requirements demanded the prototype to be a web-based tool, the Visual Studio Express 2008 and SQL Server Express 2008 from Microsoft are used for the development of the e-Tracker system.
3.5.3  **Phase 3: Development & Implementation (Construction)**

The primary objective is to build the prototype system. In this phase, the main focus is on the development of components and other features of the system being designed. This is the phase when the bulk of the coding takes place to produce demonstrable prototype.

3.5.4  **Phase 4: Maintaining the Solution (Transition)**

In the phase, the objective is to 'transition' the system from development into production, making it available to and understood by the users. The activities of this phase include training of the users and maintainers and beta testing of the system to validate it against the users' expectations. However, as this research intends to develop prototype of the e-Tracker, the researcher will select a two to three users to evaluate workability of the prototype and future process and enhancement initiatives. As this is a system prototype, the system will not be roll-out to production.
3.6 Summary

This research targets to find out how much the postgraduate students understand the current dissertation process, to identify the challenges and shortcomings (if any) faced by postgraduates, supervisors, administrative and management staff. It intends to improve the current postgraduate dissertation tracking and monitoring practices by introducing process automation that would simplify tracking and monitoring of progress.

By administering the instruments described earlier, students are surveyed to gather empirical data that can help the research to identify challenging areas which can be enhanced. Some interview sessions will be set with key decision makers in order to support the empirical data.

Data gathered will assist in the design and development of the Postgraduate Dissertation e-Tracker system using the IBM Rational Unified Process as the system development life cycle process. The system prototype designs and development tools used to enable an online automation system shall be discussed in the below chapters.
CHAPTER 4

FINDINGS, ANALYSIS AND DESIGN OF THE STUDY

4.1 Introduction

Findings of this research paper are presented in the terms of input and output. The inputs to the research are the understanding of the current dissertation tracking practices, its challenges and improvement requirements which were obtained from the surveys that were conducted via questionnaires and interviews. Additional data that was obtained via archival and web searches are used as reference.

The outputs in this case will be the design and the development of the e-Tracker system prototype.

4.2 Response Rate

A mass distribution of survey was distributed to all the FCSIT postgraduate students via e-mail. An estimate of 358 students (319 students doing course and dissertation module; 39 students doing dissertation only module) were targeted to be on the e-mail listing. Samples were given one month to respond to the questionnaires. However, the researcher only received feedback from 30 (10 percent) of the total samples. Thus, the researcher took a different approach to gather the survey data. The researcher handed out the questionnaires physically to random students and managed to obtain another 20 completed questionnaires. These totals up to 15 percent response rate of the survey sample made out of FCSIT postgraduates. The breakdown of the samples following the FCSIT programmes is shown in the below Figure 4.1.
As for the interview, supervisor and management team of FCSIT were contacted and interviewed face to face as planned.

### 4.3 Demographic Data

65 percent of the postgraduates who participated in the survey were mainly full time students, while the remaining 35 percent are part time students. Samples who responded mostly have started working on their dissertation (70 percent), the remaining 30 percent has yet to begin working on the dissertation.

As for the interview samples, 10 management / administration and supervisors were targeted to be interview. 60 percent of the targeted samples responded and were mainly from the management / administration personnel. Out of the total respondents, 80 percent were a mix of management and administration staffs, while the remaining is supervisors.
4.4 Survey Findings

The survey handed to the postgraduate students in FCSIT to gather the following information: (a) student’s understanding of the current dissertation process in the FCSIT in University of Malaya; (b) identified shortcoming of the current system/process, if any and (c) identified areas of improvement in the current dissertation process.

The information gathered were analyzed then calculated and presented in the following sub-sections.

4.4.1 Understanding of the dissertation process

After analyzing the surveys response, it is found that most student know very little of the process that needs to be taken in order to complete dissertation. A summary of the current understanding of the dissertation process as identified by the students as depicted in the below figure.

![Figure 4.2: Level of Understanding on Dissertation Process Statistics Chart](image)

The items 1 to 13 as shown in Figure 4.2 are also listed in the below Table 4.1.
Table 4.1: Description of the main Dissertation Processes

<table>
<thead>
<tr>
<th>Dissertation Process</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 1</td>
<td>Registering for Dissertation</td>
</tr>
<tr>
<td>Item 2</td>
<td>Selection / Appointment of Supervisor</td>
</tr>
<tr>
<td>Item 3</td>
<td>Proposing Dissertation title / topic</td>
</tr>
<tr>
<td>Item 4</td>
<td>Getting Dissertation topic approved</td>
</tr>
<tr>
<td>Item 5</td>
<td>Proposal Acceptance</td>
</tr>
<tr>
<td>Item 6</td>
<td>Submission of Student Progress Report</td>
</tr>
<tr>
<td>Item 7</td>
<td>Student-Supervisor Discussion</td>
</tr>
<tr>
<td>Item 8</td>
<td>Obtaining Feedback on Progress</td>
</tr>
<tr>
<td>Item 9</td>
<td>Submission of Borang A (Dissertation Submission Intention Form) before handing in your research proposal</td>
</tr>
<tr>
<td>Item 10</td>
<td>Submission of Dissertation</td>
</tr>
<tr>
<td>Item 11</td>
<td>Obtaining information on Dissertation correction, if any</td>
</tr>
<tr>
<td>Item 12</td>
<td>Re-submission of Dissertation, if required</td>
</tr>
<tr>
<td>Item 13</td>
<td>Final submission of Dissertation</td>
</tr>
</tbody>
</table>

4.4.2 Identified shortcomings of the dissertation process

Most students has experience at least one or two shortcomings of the current dissertation process. Some of the shortcomings identified are as shown in the Figure 4.3.

![Figure 4.3: Identified Short Comings](image)
Besides the above listed shortcomings, some of the survey respondents have also shared with the researcher on other findings on the shortcomings of the dissertation process. They are summarized as follows:

a) No clear directions on completing the dissertation;

b) Upon initial dissertation submission / re-submission, feedback and/or updates from examiner(s) are not given timely to students.

In this finding, the researcher summarize that there are room for improvement on the end-to-end dissertation process.

4.4.3 Identified areas of the improvements

To address the identified shortcomings, areas of improvements were also studied. The survey result shows that all of the survey respondents either agrees or strongly agrees with the suggested improvements. Details of the results are shown in the below stacked-bar chart.

![Figure 4.4: Identified Areas of Improvements](image)

The list of improvements depicted in Figure 4.4 is elaborated in the following Table 4.2.
<table>
<thead>
<tr>
<th>List of Identified Improvements</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improvement 1</td>
<td>Automated tracking of student candidature</td>
</tr>
<tr>
<td>Improvement 2</td>
<td>Improved distribution of information and communication both with student and supervisor. (e.g. Provide regular update)</td>
</tr>
<tr>
<td>Improvement 3</td>
<td>Provide more efficient/effective feedback mechanism (e.g. facilitate regular feedback between student and supervisor)</td>
</tr>
<tr>
<td>Improvement 4</td>
<td>Tracking of issues raised with regards to dissertation</td>
</tr>
<tr>
<td>Improvement 5</td>
<td>Scheduling of meetings with supervisors</td>
</tr>
<tr>
<td>Improvement 6</td>
<td>Provide reminder on scheduled meetings and submission of progress report</td>
</tr>
<tr>
<td>Improvement 7</td>
<td>Online tracking of dissertation progress</td>
</tr>
<tr>
<td>Improvement 8</td>
<td>Repository of student progress report (e.g. collect student progress data, progress meeting minutes)</td>
</tr>
<tr>
<td>Improvement 9</td>
<td>Generating of reports</td>
</tr>
</tbody>
</table>

From the results of the list of improvements, the most agreed and strongly agreed improvements sought by the respondents are the need for ‘online tracking of dissertation progress’ (Improvement 7) at 91 percent, followed by ‘tracking of issues raised with regards to dissertation’ (Improvement 4) which is also at 91 percent. The need to have an online system that can assist in the ‘scheduling of meetings with supervisors’, also scores an agreement percentage of 73 percent.
In a nutshell, the results show that an online system that can perform the identified list of improvements is preferred if not required. This finding is one of the most significant findings to assist the researcher to gathering the requirements of the proposed on-line system (Postgraduate Dissertation E-Tracker system).

4.5 Other Findings

In the interview sessions, the researcher set out to seek requirements from supervisor / management and administration point of view. The objectives for the interviews were to (1) understand the existing system that is used to track / monitor postgraduate student’s dissertation progress; (2) find out the challenges faced today in monitoring the progress of student in completing their dissertation; (3) identify ways to overcome known challenges and (4) list key requirements to successfully overcome the current short comings of the dissertation process and management.

4.5.1 Understanding of the existing system used to track postgraduate dissertation

When asked what tools are being used to monitor or track the dissertation progress during the interview sessions, the respondents generally explained that tracking are done manually today. The definition of “manual” was further elaborated. The researcher was made to understand that obtaining information of student dissertation progress were based on physical files while getting general information of students such as registration date, course results are from another system known as UMISISWEB (Student Portal) owned by the University’s Institute of Graduate Studies (“IPS”).
4.5.2 Current Challenges

Challenges arise as the current way of tracking dissertation progress is done manually. One of the challenges identified during the interviews is that the faculty is unable to track students’ progress and where-a-bout with regards to dissertation such as not being able to know if the students are making any sound progress, not knowing if students are regularly meeting up with their supervisor(s).

Another challenge discussed is on the lengthy time spent physically locating student files and manually sending email reminders to students. Not only that, the faculty also found it difficult to track students’ status (whether the students are active or not) both in the registry as well as doing their dissertation as notification of student registration (by IPS) is sent via letter; as such, the faculty is slow to know student’s status. With the lack of close to real-time information, sending timely notice of students especially to student whose candidature terms will lapse are not easy.

From the interviews, the research also found out that, it is difficult to communicate with students as most students do not read their emails regularly. As such, reminders that are sent close to the lapse time are not read. Not only that the faculty is unable to track the students, tracking of supervisors (such as number of students assigned to a supervisor) is also done manually. This posse another challenge, whereby a supervisor can be over assigned with students or vice versa.

During the interview session with the Assistant Registrar (Postgraduate), he mentioned that out of 358 active postgraduate students (count as at end of 2009), only 33 percent of the active students graduated in 2009. In that 33 percent of graduates, 35 percent
comprises of postgraduate students from the Masters in Information Technology programme which dissertation is not required.

In total, students which are required to submit their dissertation who graduated are only at 21%. The Assistant Registrar (Postgraduate) stated that most students were not able to graduate were mainly due to not having their dissertation completed in a timely manner. From this finding, the researcher reckons that completing dissertation itself poses a challenge.

**4.5.3 List of Improvements and Key Requirements**

In most of the interview sessions, both with the management and administration staff at FCSIT, the key requirements are to be able to “see everything in one view”. When asked to further elaborate, the researcher understands that is it the faculty’s requirement is to be able to view students’ information with regards to dissertation progress in a single visual display. This triggers the researcher to propose a system that is able to capture and store information related to the student, their progress and feedback from their supervisors.

Another key point mentioned during the interview that can address the identified challenges is to be able to help students to remember where they have progressed. Most of the requirements shared during the interviews are similar to those stated in section 4.4.3 Identified areas of the improvements.

On a separate note, one of the interviewee mentioned that the proposed system shall be managed by faculty and eventually used university wide, which shall be then be managed by the University’s ICT Services department.
4.6 Analysis and Design of Workflow Process and Postgraduate Dissertation e-Tracker system

Upon gathering the requirements identified, this section describes the workflow and scope of the proposed online systems. As there were no workflow that was already put in place, the workflow were constructed based on the existing postgraduate dissertation process and procedures, modified and enhanced with the identified improvements.

4.6.1 Dissertation General Workflow

With the information obtained from the surveys and interviews conducted, the researcher put together a dissertation workflow for the University.

The workflow begins with the student selecting his/her supervisor(s). The students can opt to either select a title suggested by the supervisor or proposes his/her own dissertation topic. Once the selected supervisor agrees to supervise the student, the student can then submit a dissertation registration form which would need to be approved by the faculty. Upon approval from the faculty, a notification will be sent to the both the supervisor and the student. With such notification, students can then proceed to register for a new semester with the University.

After registration, the student can begin executing the dissertation and to facilitate the progress of the dissertation, the student is responsible to schedule meetings with their supervisor for continuous discussion for progress improvement. Constant meetings between supervisor and student are essential as the meetings keep the students on track and inline to the dissertation topic and it serves as an important form of communication, communicating on progress, action items, feedbacks and promotes further development.
A progress report reviewed by supervisor and approved by the faculty, is mandatory to in order to register for each new semester should more time is required to complete the dissertation.

Once the dissertation is close to completion, a form to notify the management on dissertation submission is required to be sent to the faculty. Such form must be approved by the supervisor prior to submission. Upon notification, the dissertation title shall be firmed and the supervisor together with the faculty will identify an internal and an external examiner to examine the dissertation. The student will then be notified of the final title to proceed with submission of dissertation for examination.

To submit the dissertation for examination, the student must submit a form known as the “Submission Of Research Report/Dissertation/Thesis For Examination/Re-Examination” where the students will obtain endorsement from both supervisor and faculty. Upon submission, dissertation will be examined and results will be informed to the students and supervisor. Depending on the results, corrective measures may need to be taken (i.e. minor or major correction as per advised by examiners). Should there be any corrections required, the steps taken to execute the dissertation are repeated.

Finally, upon satisfaction of supervisor, faculty or examiners on the corrections made, the student can submit the final copy of dissertation, where prior to submission a form titled “Final Submission For Research Report/Dissertation/Thesis After Examination” is to be submitted.

The workflow shown in Figure 4.5 illustrates the high-level step-by-step tasks required to begin and complete postgraduate dissertation in UM.
Figure 4.5: Constructed Dissertation Workflow for UM
4.6.2 Use Case Diagram for Dissertation

With the dissertation workflow constructed in the earlier section, the researcher is able to build a Use Case Diagram as the Requirements Workflow discussed in Chapter 3. The Use Case Diagram is used to describe what the proposed prototype system should do. To achieve this, the researcher elicits, organizes, and documents the required functionality. The researcher uses the Rational Software Modeler 7.5.5.1.

The Use Case Diagram below shows what system functions are performed for which actor.

Figure 4.6: Use Case Diagram for the Proposed e-Tracker System
4.6.3 Scope of the Postgraduate Dissertation e-Tracker system

The proposed Postgraduate Dissertation E-Tracker system will focus on developing a system that allows both UM administrators and supervisors to track the dissertation progress of each student and the students in turn are able to update/report their status and keep up-to-date their candidatureship in this one stop online information point. This system will also provide an integrated view/report to the UM stakeholders.

The system will provide for:

a) A single point of information retrieval on suggested topics and available supervisors;
b) Registration of student on the dissertation supervisor and dissertation topic.
c) Integrated view of the students’ profile, courses and results, and dissertation progress;
d) Tracking students from supervisors to supervisors should there be a transfer, enabling the university administrator to track supervisor to students;
e) Tracking and monitoring of student progress through the completion of the dissertation;
f) Alerts to students, supervisors and the university administrator on student candidature expiration;
g) Alert on students who’s progress are falling behind schedule;
h) Scheduling of progress meeting with supervisor (at a minimum of once a month);
i) Reminding students of scheduled progress meeting with supervisor as well on submission of progress report;
j) Repository of progress report and progress meetings / discussion (i.e. minutes of meeting for each progress meeting with the supervisor);
k) Collecting performance and program participation data for each student taking the dissertation course;
1) Reporting timely and accurate information/data through standardized reporting capabilities; and

m) To produced standardized report on an ad-hoc basis for management to make quick & timely decisions.

4.6.4 e-Tracker system Analysis and Design Workflow

Adopting the IBM RUP®, the researcher worked on the analysis and design workflow with the aim to show how the system will be realized in the implementation phase. Activity diagrams are used to represent the business and operational step-by-step workflows of components in a system.

In this section, the processes and sub-processes are depicted in a form of workflows. Figure 4.7 shows the Activity Diagram for the Dissertation Workflow where it depicts the processes involved in registering the dissertation through to final submission of the dissertation on an elevated view.
The Activity Diagram depicted in Figure 4.7 is further elaborated as each use case depicted is complex enough to merits its own activity diagram. Figures 4.8, 4.9, 4.10 and 4.11 illustrate such elaborated activities.

In Figure 4.8, detailed process related to registration of the dissertation is depicted. The workflow begins with the student identifying a supervisor. The students can opt to either select a title suggested by the supervisor or proposes his/her own dissertation topic. Once the selected supervisor agrees to supervise the student, the student can then submit a dissertation registration form which would need to be approved by the faculty. Upon approval from the faculty, a notification will be sent to the both the supervisor and the student. With such notification, students can then proceed to register for a new semester with the University. The process repeats should the registration fails to be approved.
Figure 4.8: e-Tracker System: Dissertation Registration Workflow
Figure 4.9 below illustrates the steps required to be taken during the execution of the dissertation. The student is responsible to schedule meetings with their supervisor for continuous discussion for progress improvement at least once a month. In order to schedule for meetings, the student must first check the availability of the supervisor. The supervisor on the other hand is responsible to inform the student of their available time table. Upon mutual agreement, a meeting shall take place. Every meeting shall be logged in order for progress tracking. Each logged meeting, inputs are required from both supervisor and students. Reminders will be sent to both supervisor and students should a logged is not created a timeframe (i.e. 1 week) from the accepted meeting schedule. The process of scheduling a meeting, conducting of meeting and logging of meeting outcomes shall be continuous and repeated though to readiness of dissertation submission.

A progress report reviewed by supervisor and approved by the faculty, is mandatory to in order to register for each new semester should more time is required to complete the dissertation.

As progress is being tracked, notification and reminders can be sent out to the student reminder students of their candidature terms.
Meet with supervisor to update status of dissertation at least once a month in a semester.

Reminders will be sent to the student if student has not log the discussion of the meeting after an agreed time frame (i.e., 1 week after the scheduled meeting took place).

Figure 4.9: e-Tracker System: Dissertation Execution Workflow
Figure 4.10: e-Tracker System: Dissertation Submission Workflow
Figure 4.10 shows the processes involved in submitting the dissertation. The workflow figure below showed that upon finalization or once the dissertation is close to completion, a form to notify the management on dissertation submission is required to be sent to the faculty. Such form must be approved by the supervisor prior to submission. Upon notification, the dissertation title shall be firmed and the supervisor together with the faculty will identify an internal and an external examiner to examine the dissertation. The student will then be notified of the final title to proceed with submission of dissertation for examination. Prior to submission for examination, the dissertation is also checked for plagiarism and the originality of the dissertation is declared. A form on submission of dissertation with endorsement from both supervisor and faculty is required alongside with copies of the dissertation.

Upon submission, dissertation will be examined and results will be informed to the students and supervisor. Figure 4.11 depicts that when results are obtained, depending on the results, corrective measures may need to be taken (i.e. minor or major correction as per advised by examiners with a timeframe given). Should there be any corrections required, the steps taken to execute the dissertation are repeated. Student and supervisor discussions shall continue.

Finally, upon satisfaction of supervisor, faculty or examiners on the corrections made, the student can submit the final copy of dissertation together with a form where the supervisor(s) and faculty recommendation are detailed. Once the final submission of the dissertation is done and approved, the workflow terminates.
Figure 4.11: e-Tracker System: Final Submission Workflow
4.6.5 System analysis and design

To provide an indication of how data are transformed as they move through the proposed system and to depict the functions that transform the data flow, the researcher choose to represent the information using data modeling by drawing Data Flow Diagrams (DFD).

Figure 4.12 shows the System Context Diagram (also known as the Level 0 DFD) for the proposed e-Tracker system to focus attention on external factors and events that should be considered in developing a complete set of system requirements and constraints (Kossiakoff, & Sweet, 2003). This context diagram is an alternative to the Use Case Diagram shown in the earlier section.

![Figure 4.12: Context Diagram for the Proposed e-Tracker System](image-url)
The Context Diagram depicted in Figure 4.12 is then elaborated further to show more
detail of the proposed system. The context diagram “exploded” producing Level 1 DFD
and subsequently Level 2 DFD.

In the Level 1 DFD, the graphical representation shows how the system is divided into
sub-systems (processes), each of which deals with one or more of the data flows to or
from an external agent, and which together provide all of the functionality of the system
as a whole. The diagram also identifies internal data stores and shows the flow of data
between the various parts of the system. Level 2 DFD is the decomposition of a process
shown in the Level 1 DFD.

Figure 4.13 depicts the Level 1 Data Flow Diagram of the Proposed e-Tracker System,
while Figure 4.14 and Figure 4.15 illustrate the Level 2 Data Flow Diagram that refines
Process 7.0 and Level 2 Data Flow Diagram that refines Process 8.0 for the Proposed e-
Tracker System respectively.
Figure 4.13: Level 1 Data Flow Diagram of the Proposed e-Tracker System
Figure 4.14: Level 2 Data Flow Diagram that refines Process 7.0 for the Proposed e-Tracker System
Figure 4.15: Level 2 Data Flow Diagram that refines Process 8.0 for the Proposed e-Tracker System
4.7 Summary of Findings

Throughout the surveys and interview sessions, consistent results are obtained. It is learnt that currently, majority of the postgraduates required to complete their dissertation knows very little of the processes / activities required to progress towards dissertation completion which are key to graduate from the Masters programme. Yet, there are no tools today that can help the students move forward by tracking the students’ progress. The main challenges that were identified besides difficulty in getting started and selecting a title were mainly the lack of supervisor feedback. In order to address the challenges identified, areas of improvements are identified. One of the areas of improvement is to put in a place an online tracking system that tracks dissertation progress and issues raised with regards to dissertation.

In a nutshell, it is concluded that an online automation system is required in to track student dissertation progress and eventually result in expediting the number of graduates.

As the need of an online automation system identified, the research built requirement model and process workflows to scope and design the e-Tracker system prototype.
CHAPTER 5

PROTOTYPE DEVELOPMENT, IMPLEMENTATION AND RESULTS

5.1 Introduction

This chapter describes the development and proposed implementation of the e-Tracker prototype. Later section in this chapter explains the evaluation results of the prototype that had been developed.

5.2 Infrastructure Requirements

Prior to development of the prototype system, choosing the suitable technology, tools and programming languages is significant. The following sections explain in details the technology, tools and programming languages used.

5.2.1 Software Requirements

In the development of the prototype, the application platform used is on ASP.NET using Microsoft .NET Framework 3.5. The Microsoft .NET Framework is a software framework that can be installed on computers running Microsoft Windows operating systems. It includes a large library of coded solutions to common programming problems and a virtual machine that manages the execution of programs written specifically for the framework. The .NET framework supports multiple programming languages in a manner that allows language interoperability, whereby each language can utilize code written in other languages; in particular, the .NET library is available to all the programming languages that .NET encompasses.
The .NET Framework is a Microsoft offering and is intended to be used by most new applications created for the Windows platform.

ASP.NET is a web application framework developed and marketed by Microsoft to allow programmers to build dynamic web sites, web applications and web services. It was first released in January 2002 with version 1.0 of the .NET Framework, and is the successor to Microsoft's Active Server Pages (ASP) technology. ASP.NET is built on the Common Language Runtime (CLR), allowing programmers to write ASP.NET code using any supported .NET language. The ASP.NET SOAP extension framework allows ASP.NET components to process SOAP messages.

To minimize the risks surrounding Internet security, the researcher's did not use genuine user information and field properties for the prototype. Microsoft Internet Information Server (IIS) is used as the web hosting tool.

As for the tools used to program the prototype, Visual Web Developer Express 2008 is used. The Visual Web Developer Express is a freeware web development tool that allows the researcher to evaluate the web development and editing capabilities of the other Visual Studio 2008 editions at no charge. Its main function is to create ASP.NET websites. It has a WYSIWYG interface, drag-and-drop user interface designer; enhanced HTML & code editors; a (limited) database explorer; support for other web technologies (e.g., CSS, JavaScript, XML); and integrated, design-time validation for standards including XHTML 1.0/1.1 and CSS 2.1.
VS2008 Express Web Developer SP1 supports both class library and Web Application projects. It also includes a new integrated HTML designer based on Microsoft Expression Web.

5.2.2 Database Requirements

Microsoft SQL Server Express 2008 is used as the repository mechanism. It is a freely-downloadable and distributable version of Microsoft's SQL Server relational database management system, comprises a database specifically targeted for embedded and smaller-scale applications. Should the proposed prototype system be expanded, the researcher suggest MSSQL 2005 and above as for the prototype purposes, the Microsoft SQL Server Express 2008 used that can only cater for smaller-scale applications with technical restrictions which make it undesirable for large-scale deployments.

5.2.3 Hardware Requirements

The Postgraduate Dissertation e-Tracker system requires only to be installed on a web server and an application cum database server. The researcher proposes to use the IBM System x3650 machine as the server for the web, application and database server. Users (the students, supervisors, management personnel, including the administrator) do not need to install any software or application driver on their desktop computers. Each desktop will need only to have installed a supported web browser such as Internet Explorer, Mozilla Firefox and other Internet browsers available.
5.3 System Prototype

Due to time and resource constrains, the researcher developed besides the login and main/home page, only three modules of the prototype which are functional, namely the Schedule Meeting, Meeting Logs, On-line Form Submission and Reporting modules.

5.3.1 Login Page

Users of the Postgraduate Dissertation e-Tracker system are required to login to the system before the system can become available for use. In this system, users comprise of students, supervisors, administrator and management staff of the University. For this prototype module, users of the FCSIT assumed.

When logged in as a student by keying in their student matrix card number and an assigned password similar to the registration system (UMISISWEB password), the students will then enter into their personal home page. In this prototype, as the researcher is not permitted to gain access to the actual database of the University’s registration system, dummy identification numbers and passwords are assumed, used and stored in the prototype system’s database. This case is similar for supervisor, administrator and management staff where they will be assigned login identification and a password. At the present moment, the prototype system does not to keep track of the number of invalid logins which will cause the system to lock out the user attempting after several tries. The following screenshot depicts the login function on the login page.
There are three different views of the home page available in the e-Tracker system. The three views are the student home page for students, supervisor home page for supervisor and faculty staff home page for management and administration staff. Upon login in, each user will be able to view their personal homepage. The home page itself has different options ready to be selected by the users respectively following their needs.

The below Figure 5.2, Figure 5.3 and Figure 5.4 depicts the home page for students, supervisors and faculty management / administration staff respectively.
Figure 5.2: Student Home Page

Figure 5.2: Student Home Page, continued
In the student’s home page, the student’s semester progress are shown and it serves as a constant reminder for the students on how far they have progressed in terms of semesters with the University. This is to ensure the students are aware of their candidature expiration especially for the part time students.

![Supervisor Home Page](image)

*Figure 5.3: Supervisor Home Page*
The supervisor and faculty staff home page on the other hand enables the supervisor and faculty administrator / management to access to the options of the e-Tracker system.

5.3.3 Supervisor and Topic

In this module, the students are able to propose to select their preferred supervisor to supervise their dissertation / thesis. In the same view, students are also able to view and select the topics suggested by the selected supervisor. An option to propose the student’s own research topic is also made available in this module. The figure below (Figure 5.5) shows a snapshot of that features available in the Supervisor and Topic module.
Upon selecting the supervisor and a topic, the student then send the request to the supervisor for endorsement with a click of button available in the Supervisor and Topic page. Notification of the selection will be sent to the assigned faculty administrator, the selected supervisor and the student him/herself. In this prototype, as the resources required for an SMS gateway is not available, only e-mail notification will be sent. The purpose and intent of this system is to also enable notification via SMS to be sent.
While the notification is being sent, the system also updates the database and the student’s request for a supervisor and a topic are routed to be approved by both the supervisor and the assigned faculty administrator. Figure 5.7 the screenshot of the faculty view displaying the options that can be taken to approve or reject the student’s request.
Figure 5.7: Supervisor and Topic request by student - Faculty view for approval

Upon approval / disapproval from the faculty staff, students will be notified to check on the status. The figure below is an example of such notice.

Figure 5.8: Sample Notification to Student
5.3.4 Schedule Meeting

The Schedule Meeting module is to assist the students in finding supervisor’s available time slot that the supervisor publishes in the system. In this module, supervisors can create and publish time slots that are available for the students to view and select. While student on the other hand can view the supervisor published time slot and select one at a time the preferred time slot. Upon selection of the time slot by the students, notification will be sent to the users involved.

This module is targeted to address one of the identified shortcomings of the current mode of time scheduling between supervisor and student as this reduces the need to negotiate on a time slot both suitable for the supervisor and student.

Figure 5.9 and Figure 5.10 shows the Schedule Meeting modules for supervisor view and student view respectively.
Figure 5.9: Schedule Meeting – Supervisor View

Figure 5.10: Schedule Meeting – Student View
5.3.5  *Meeting Logs*

This module works hand in hand with the earlier discussed module, Schedule Meeting. The logic of this is that upon scheduling and confirming the meeting time slot, actual meeting should take place whether the meeting is a face to face meeting or via telephone or on-line meeting.

The objective of this module is to be able to capture the gist of what was discussed during the scheduled meeting similar to a minutes of meeting document. The concept of this is that students will be send reminders to log in the meeting information upon an agreed timeframe. As this is a prototype system, the reminder feature is not fully functional.

Upon capturing the meeting information, students can choose to save as draft for later submission or students can choose to submit to the supervisor for their feedback. Figure 5.11 shows a sample of the meeting log.
Figure 5.11: Meeting Log – Student View
5.3.6 On-line Form Submission

The on-line form submission module is another part of automation concept for the Dissertation e-Tracker system. The idea of this module is to eliminate paper-based forms. Hence, instead of submitting paper-based forms and having to physically send the forms to the respective approvals and reviewers for their approval, the on-line form module allows the student to view, update and submit the forms electronically. Figure 5.12 and 5.13 below depicts the available on-line forms.

Figure 5.11: Meeting Log (Part 2) – Student View, continued
Having this module, the students be more productive as it will reduce wait time of having to be present physically to submit the forms and reduces the need to constantly check for the approvers and/or reviewers availability and if they have responded to the forms that were submitted. This module also eliminates incident of misplace or lost of physical form related to dissertation, in this case.

Figure 5.12: Snapshot of the Online Form Module in e-Tracker system
5.3.7 Reporting modules

Reporting modules in the e-Tracker are also segregated into three different views, a view for students, supervisor and faculty staff and management. Figure 5.14 and Figure 5.15 shows the reporting view respectively.
Figure 5.14: Snapshot of the Reporting Module by Student

Figure 5.14: Snapshot of the Reporting Module by Student, continued
5.4 Evaluation Result

5.4.1 Mapping of Requirements to System Prototype

From data gathered from surveys and interviews as discussed in the earlier chapter, in order to the identified short comings, areas of improvements identified. From the identified improvements, it served as a point of direction for the design and development of the system prototype.

Table 5.1 below summarizes the mapping of the requirements to the designed system prototype.
### Table 5.1: Mapping of Requirements to Developed Prototype

<table>
<thead>
<tr>
<th>List of Identified Improvements</th>
<th>Developed Prototype</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Improvement 1</strong>&lt;br&gt;Automated tracking of student candidature</td>
<td>Design and development of System prototype: e-Tracker System</td>
</tr>
<tr>
<td><strong>Improvement 2</strong>&lt;br&gt;Improved distribution of information and communication both with student and supervisor.&lt;br&gt;(e.g. Provide regular update)</td>
<td>Online e-Tracker system where students, supervisors, faculty staff and management are able to log on to the system anytime and anywhere to check students’ dissertation progress statuses.</td>
</tr>
<tr>
<td><strong>Improvement 3</strong>&lt;br&gt;Provide more efficient/effective feedback mechanism (e.g. facilitate regular feedback between student and supervisor)</td>
<td>e-Tracker System: Meeting Log Module (described in Section 5.3.5) where both students and supervisors are required to log items discussed and feedbacks are required.</td>
</tr>
<tr>
<td><strong>Improvement 4</strong>&lt;br&gt;Tracking of issues raised with regards to dissertation</td>
<td>e-Tracker System: Meeting Log Module (described in Section 5.3.5) where information of the meeting are logged so that it can be tracked with action and follow-ups.</td>
</tr>
<tr>
<td><strong>Improvement 5</strong>&lt;br&gt;Scheduling of meetings with supervisors</td>
<td>e-Tracker System: Scheduling Meeting Module (described in Section 5.3.4) where both students and supervisor are able to schedule meetings online</td>
</tr>
<tr>
<td><strong>Improvement 6</strong>&lt;br&gt;Provide reminder on scheduled meetings and submission of progress report</td>
<td>Reminders and notifications via email and/or mobile sms will be sent to students, supervisors.</td>
</tr>
<tr>
<td><strong>Improvement 7</strong>&lt;br&gt;Online tracking of dissertation progress</td>
<td>e-Tracker System: On-Line Form Module (described in Section 5.3.6)</td>
</tr>
<tr>
<td><strong>Improvement 8</strong>&lt;br&gt;Repository of student progress report (e.g. collect student progress data, progress meeting minutes)</td>
<td>As the e-Tracker system logs meeting discussions and action items, online form submission, it acts as a information repository where users can obtain historical information online.</td>
</tr>
<tr>
<td><strong>Improvement 9</strong>&lt;br&gt;Generating of reports</td>
<td>e-Tracker System: Reporting Module (described in Section 5.3.7) where standard or ad-hoc reports can be obtained online.</td>
</tr>
</tbody>
</table>
5.4.2 System Testing and User Acceptance Testing

In this study, two type of testing are performed: (i) system testing and (ii) User Acceptance Test (UAT).

In system testing, the e-Tracker system is tested as a whole to test its functionality. A variety of tests on the system is performed to explore functionality and to identify problems. It is done before and after the prototype system is put in place. As this is a prototype with not all modules fully functioning, only working modules were tested.

For the UAT, the developed e-Tracker system prototype is tested with three students separately and one faculty administrator. The test sessions were conduction in the aspect of system functionality. As some of the features of the prototype are not fully functioning, during the test sessions, the researcher also shared with the testers on the conceptual design and functionality of the system. Positive feedbacks were obtained, some of the feedbacks as follows:

a) Single point of communication for all dissertation related information. Having a repository to store all communication is favorable;

b) Ability to view student progress in terms of candidature and the current status of the dissertation;

c) Able to have a holistic view on items that has been submitted and items which are still pending actions;

d) Reporting capability (by individual or by groups following selected criteria); and

e) Elimination of manual sending of reminders.
5.5 Summary

In summary, the prototype that has been proposed requires further development although its design and concepts are proposed and discussed here. The functions of the prototype that was developed by the researcher, namely the dissertation registration (supervisor and topic selection and approval), dissertation tracking (scheduling and logging of meeting minutes), dissertation progress reporting and online form submission gives a feel of the main objective only without the frills and fancies. All the developed functions are built with conditions which will send reminders upon exceeding such conditions.

Although the e-Tracker system is design to collaborate with the existing systems in the University, system integration is not discussed as it is beyond this paper. With the implementation of the e-Tracker prototype much benefit are reaped.

In the next chapter, the researcher will discussed on the advantages and limitation of the proposed system based on the evaluation of the prototype.
CHAPTER 6

CONCLUSION AND FUTURE WORK

6.1 Introduction

This last chapter will discuss the important facts that are determined through this research, objectives that were accomplished, advantages and limitations of the e-Tracker. This chapter shall log problems that were encountered during the research process. Future improvements on this research will also be discussed.

6.2 Summary

6.2.1 Purpose of the Study

This research paper was written with the objective of first understanding the challenges the University faces with regards to tracking postgraduate dissertation progress and subsequently finding a solution to address the challenges. While gathering requirements, advantages and benefits of monitoring and tracking one’s progress also being studied.

With the data gathered and analyzed, a prototype system is designed and developed to meet the identified requirement to overcome the experienced challenges.
6.2.2 Fact Findings and Requirement Gathering

The researcher adopted the survey method for economic reasons as the samples are large. Samples were sent paper based questionnaires via mail. This group of sample contributed to the development of findings for challenges face and improvements to address the challenges faced from the postgraduate angle.

The second category of samples, were the University staff, comprising supervisors, administrators and management were called for interview sessions. These interviews retrieved the key challenges faced by the University staff involved in tracking the postgraduate progress. The interview sessions which also gathered needs and wants of the University staff which significantly contributed to the requirements for the e-Tracker system.

6.2.3 Data Gathered and Analysis

Tracking the postgraduate dissertation manually is a challenging task as there are no specified classes or meetings that can motivate a student, no attendant list to track the student’s degree of involvement and examination or test to determine the student’s level of understanding. Also lacking of a single point of reference and repository for students’ progress data and reports makes it difficult to quickly mine data to make prompt decisions.

During the literature review study, available data were reviewed and several local postgraduates from sampled university were interviewed. From the information gathered, it is found that most university uses form as a tool to monitor student progress.
The data gathered led the researcher to conclude that monitoring is essential to drive postgraduate to complete dissertation.

The researcher then set out to gather information on the current UM practices with regards to postgraduate dissertation. From this, information on the pain points (problem and issues faced) and requirements on how to improve the current practices were obtained. With requirements solicited, process workflows were constructed, scoping of the prototype system was conducted, analysis and design of the system detailed.

With workflows, analysis and design in place, a prototype that meets the requirements gathered and accomplishes the objectives of this research that was put forth in Chapter 1 were developed.

### 6.3 Accomplished Objectives

In the beginning of this research, several objectives were named and set forth in Chapter 1. Throughout this study, the researcher aimed to design and develop a system with objectives listed in mind.

Finally, the researcher concludes that the following objectives were achieved to fulfill the research purpose:

a) To study and understand the current student information systems in University of Malaya

   Faculty staffs involved in managing and monitoring postgraduate dissertation progress were interviewed and with the data gathered, the researcher was able to study and understand the current student information system in the University.
The findings obtained from this information gathered is that current, for dissertation tracking, no IT system are used and monitoring of progress are solely perform via paper-based forms.

b) To investigate and identify the problems / challenges as well as opportunities that occurs in the current student information systems used in University of Malaya;

In order to obtain information on the problems / challenges faced, the researcher has also conducted surveys with postgraduate student in the Faculty of Computer Science and Information Technology (FSCIT). Ad-hoc interview sessions were also carried out with randomly sampled students to gain more in-depth information. Further to that, interviews with faculty staff and management were also conducted. The data gathered on the problems / challenges / opportunities were then transformed into requirements for the proposed system.

c) To highlight the benefits and the importance of progress tracking;

Benefits of monitoring and tracking of progress is highlighted. Summary of the benefits as follows:

- Accelerated learning / growth because students are receiving more appropriate instruction;
- More informed instructional decisions;
- Documentation of student progress for accountability purposes;
- More efficient communication with other professionals about students’ progress;
- Higher expectations for students by supervisors; and
- Automation of various manual administrative activities.
d) To construct a workflow that captures the collaborative business process or procedure and automate it;

Process workflows were constructed to capture the step by step activities / tasks involved in managing the postgraduate dissertation from the beginning through completion. With the workflows put in place, scope of the proposed system were able to be contained and aid the organization of the prototype system at the same time automating partly the activities required to progress in the management of dissertation.

e) To propose, design and develop a conceptual solution that can be implemented collaborating with the current student information systems used in University of Malaya to enable the tracking of post graduate students taking the dissertation course.

With the requirements gathered, process workflow constructed to conceptualize all the activities required, a prototype system proposed. The prototype system is designed and developed with several working functions / modules, namely the dissertation registration (supervisor and topic selection and approval), dissertation tracking (scheduling and logging of meeting minutes), dissertation progress reporting and online form submission.

6.4 Advantage and Limitation of the e-Tracker System

6.4.1 Identified Advantages

Evaluating the e-Tracker system prototype among the a few selected postgraduate, supervisor, administrative staff and management, some of the system advantages are revealed.
The advantages vary as some are tangible while others are intangible. Both tangible and intangible advantages are described as follows:

a) The ability to track the progress of the dissertation;

b) The ability to provide up to date status to the supervisor on the status of the student progress;

c) The ability to remind the student on the timeline of the dissertation, both in the dissertation progress and the number of semester left till completion;

d) As students are constantly being reminded, it serves as a source of motivation for the students to press forward to completion of their dissertation;

e) Provide reporting on the student progress individually or by selected criteria which can be saved as a PDF file for offline perusal;

f) Aside from electronic reminders and alerts, the system provides automation / simplification of dissertation process where forms are submitted electronically and approvals / reviews are performed electronically;

g) With automation put in place, timeliness has improved as wait time previously used for physically handing in forms and waiting for the forms to be returned are eliminated, especially in a scenario where the supervisor has approved the form however not sent to the subsequent approval in the faculty office as it sits in the outgoing tray; and

h) Improve productivity as wait time is reduced, faculty staff and management knows the status of each postgraduate, timely decisions can be made and both supervisor and students are informed of the latest development which are captured in the system. As forms are now electronic, misplace of forms can be eliminated.
6.4.2 Identified Limitations

Despite of the several advantages, the e-Tracker system has some limitations. The identified limitations are described as follows:

a) Workflow activities are hardcoded making it difficult to change business process;

b) The system does not cater for transfer of supervisor or change of dissertation title;

6.5 Problems Encountered

During the research, the researcher has also encountered several problems pertaining to the data gathering, designing and development of the system.

a) Lack of participant from postgraduate students as during the time the survey was conducted (i.e. both physical handouts and electronic survey), semester examination was on-going, thereafter semester break begun; and

b) There were difficulties in obtaining tools in terms of licensing, specifically the IBM Rational Software Modeller that is used for UML modeling.

6.6 Others

The researcher noticed that near the end of the project completion, the faculty has put in place a “Guide To The Preparation Of Research Reports, Dissertations & Theses” in the University webpage that can be found at the following address http://www.fsktm.um.edu.my/web/Guide%20To%20The%20Preparation%20of%20Research%20Reports,%20Dissertation%20and%20Theses.pdf.
6.7 Recommendations for Further Study

Over the period of conducting this research, some limitations as listed in the above subsection found and recommendations for further study to better improve the e-Tracker System are as follows:

a) As this is a prototype, not all modules and features are fully functional; hence one of the future work is to enable the following features:

- Notification of action required for supervisor and/or faculty staff to appear in the home pages respectively upon login;
- Full functionality of reminders and alerts where SMS reminders via mobile phone can be included. The concept of this system is to be able to send reminders via SMS as students rarely check their emails for notices. However, due to lack of resources, SMS reminders were not included in the system prototype;
- Full functionality of on-line form submission, the prototype does not capture data input from the form;

b) Identify and suggest implementation plans for possible system integration of the e-Tracker system with the University’s existing / legacy application systems; such as the IPS online registration system, the faculty Intranet, etc.;

c) Include workflow engine to support the dissertation tracking system to enable workflow change in cases where the business process requires improvement and transformation. With the workflow engine put in place, the system can be suggested to be used university wide or introduced to be used for other universities; and

d) As the current prototype system and workflow proposed and designed in this paper does not include tracking of both internal and external examiners, suggest to include a new module on tracking of examiner and result as part of future works.
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APPENDIX A - Questionnaire on Student Dissertation

Progress Tracker System for Postgraduate Students

Student Survey
Target Sample: Postgraduate Students

Objectives:
- To find out the student’s understanding of the current Dissertation process in the Faculty of Computer Science and Information Technology in University of Malaya.
- To identify any shortcoming of the current system.
- To identify the areas of improvement in the Dissertation Process.

Instructions:

PART 1: Demographic information. Please tick (✓) the answer that best describes you.

<table>
<thead>
<tr>
<th>Item</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Full Time</td>
</tr>
<tr>
<td>Currently working on dissertation?</td>
<td>Yes</td>
</tr>
<tr>
<td>If you are currently working on your dissertation…</td>
<td></td>
</tr>
<tr>
<td>What stage are you in now? (you may tick more than one)</td>
<td>Proposing Title</td>
</tr>
<tr>
<td></td>
<td>Literature Review</td>
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<td></td>
<td>Requirement Gathering</td>
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<td>Which Semester are you currently in? (e.g. 5th Semester)</td>
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<td>Semester</td>
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<td>How long have you been at doing the dissertation? (in terms of total number of semesters, e.g. 3 semesters)</td>
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<td>Semesters</td>
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<td>Today’s Date</td>
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<td>_____(dd) / _____(mm) / _____(yyyy)</td>
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</tbody>
</table>
PART 2: Please read the statements below and indicate your opinion based on your experience by ticking (✓) a number between 1 and 5.

1 indicating ‘Do not know’
2 indicating ‘Not Sure’
3 indicating ‘Know a little’
4 indicating ‘Know enough’
5 indicating ‘Know very well’

<table>
<thead>
<tr>
<th></th>
<th>Please indicate your current understanding of the dissertation process.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Registering for Dissertation</td>
<td></td>
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<td>2</td>
<td>Selection / Appointment of Supervisor</td>
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<td>3</td>
<td>Proposing Dissertation title / topic</td>
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<td>4</td>
<td>Getting Dissertation topic approved</td>
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<td>5</td>
<td>Proposal Acceptance</td>
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<td>6</td>
<td>Submission of Student Progress Report</td>
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<td>7</td>
<td>Student-Supervisor Discussion</td>
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<td>8</td>
<td>Obtaining Feedback on Progress</td>
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<td>9</td>
<td>Submission of Borang A (Dissertation Submission Intention Form) before handing in your research proposal</td>
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<td>10</td>
<td>Submission of Dissertation</td>
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<td>11</td>
<td>Obtaining information on Dissertation correction, if any</td>
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<td>12</td>
<td>Re-submission of Dissertation, if required</td>
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<tr>
<td>13</td>
<td>Final submission of Dissertation</td>
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<td>14</td>
<td>Others. Please specify :</td>
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</tbody>
</table>
If you are not currently doing the dissertation, kindly skip Part 3 of this survey and proceed to the last page.

PART 3: Please read the statements below and indicate your opinion based on your experience by ticking a number on a scale between 1 and 5. Leave blank for a non-applicable criteria.

1 indicating ‘Strongly disagree’
2 indicating ‘Disagree’
3 indicating ‘Neither agree nor disagree’
4 indicating ‘Agree’
5 indicating ‘Strongly agree’

<table>
<thead>
<tr>
<th></th>
<th>From your experience, do you think there are any shortcomings of the dissertation process / system, suggest your opinion.</th>
<th>1</th>
<th>2</th>
<th>3</th>
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<th>5</th>
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<tbody>
<tr>
<td>1</td>
<td>Lack of direction in getting started (e.g. no single point of information sourcing with regards to dissertation)</td>
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<td>2</td>
<td>Difficulty in title selection / obtaining a dissertation title</td>
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<td>3</td>
<td>Difficulty in scheduling regular discussion with supervisor</td>
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<td>4</td>
<td>Lack of feedback from supervisor</td>
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<td>5</td>
<td>No follow-ups on dissertation whereabouts (e.g. no reminders, no email alerts)</td>
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<td>6</td>
<td>Others: Please specify</td>
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<td>B</td>
<td>What improvement would you like to see / to have to assist you to completing of the dissertation?</td>
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<td>1</td>
<td>Automated tracking of student candidature</td>
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<td>2</td>
<td>Improved distribution of information and communication both with student and supervisor. (e.g. Provide regular update)</td>
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<td>3</td>
<td>Provide more efficient/effective feedback mechanism (e.g. facilitate regular feedback between student and supervisor)</td>
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<td>4</td>
<td>Tracking of issues raised with regards to dissertation</td>
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<td>5</td>
<td>Scheduling of meetings with supervisors</td>
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<td>6</td>
<td>Provide reminder on scheduled meetings and submission of progress report</td>
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<td>7</td>
<td>Online tracking of dissertation progress</td>
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<td>8</td>
<td>Repository of student progress report (e.g. collect student progress data, progress meeting minutes)</td>
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<td>9</td>
<td>Generating of reports</td>
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<td>10</td>
<td>Other improvement. Please specify :</td>
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</table>

A big **Thank You** for taking time to complete this set of questionnaires.

Would appreciate if you could provide your name and contact information for the purpose of verification of the validity of the survey data collected. This information will not be used by the researcher to present the findings. All information provided will be treated with strict confidence by the researcher and will not be disclosed.

<table>
<thead>
<tr>
<th>Name:</th>
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<td>Contact No:</td>
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</table>
APPENDIX B - Interview Material for University of Malaya

Dissertation Administrative and Management

Management Interview

Target Sample: Key decision makers in the university

Objectives:

- To understand the existing system that is used to track / monitor postgraduate student’s dissertation progress
- To find out the challenges faced today in monitoring the progress of student in completing their dissertation
- To identify ways to overcome known challenges
- To list key requirements to successfully overcome the current short comings of the dissertation process and management

1. Currently, how many postgraduate students are there at FSKTM? How many postgraduate students are doing their dissertation in the program(s) you are managing?

2. What is the current statistics of graduates in the Faculty of Computer Science & Information Technology? About how many students graduate each year? How many are dissertation students?

3. How the dissertation does play a role in the completion of the Master’s degree programme? What are the objectives of the faculty in terms of student completion of dissertation? Is there any KPI for it?
4. Currently, how are postgraduate students doing the dissertation being tracked / monitor? What system is currently being used to track the students’ progress?

5. If a system is currently being used, what are the functionalities of this current system? (explain the term ‘functionalities’ – use layman terms, as staff are non-IT personnel). If none, what are the current processes / checklist put in place?

6. Is the current system / processes satisfactory? If not, what would you like to see improved?

7. What are the challenges faced today (from the administrative point) with students working on their dissertations?

8. Do you think having an online / automated system to track the students' progress from start of dissertation through completion would help the faculty? Why do you say so?

9. What would be the requirements of the system?

10. How should the system be developed? Who should manage the system -- PTM or the Faculty? Why do you say so?
11. In what way will the system help the faculty attain its objectives (mentioned in Q 3 above)

_________________________________________________________

_________________________________________________________