



A Technology Integration Framework and Co-operative Reflection Model for Service Learning

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A Technology Integration Framework and Co-operative Reflection Model for Service Learning

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DECLARATION

I, Maimoona Salam (16010003) from Faculty of Computer Science and Information Technology UNIMAS hereby declare that the work entitled **A Technology Integration Framework and Co-operative Reflection Model for Service Learning** is the original work of the author alone. The contents of dissertation are the result of my own ideas, except for others specified as a reference. The thesis has not been previously accepted for any degree and is not concurrently been submitted anywhere for the award of any other degree. I confirm that parts of this research work were published in scientific journals (listed on p. 272), as per the requirements of Universiti Malaysia Sarawak (UNIMAS) to graduate.

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DEDICATION

To My Beloved Mother

&

Husband

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In the name of ALLAH, the most Generous, the most Gracious and the most Merciful.

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ABSTRACT

In the current era of technological advancement, ICT plays a significant role in education to enrich both teaching and learning processes. However, there is a lack of research regarding the integration and effective application of technology in service learning to identify the factors, which can possibly affect the technology integration process. In addition, research on co-operative reflection is currently limited in order to understand its outcomes from students' overall learning perspective in the service-learning context. This study aims to propose the technology integration framework and co-operative reflection model for service learning. The Design Science Research Methodology (DSRM) has been adopted to design, develop and evaluate the proposed technology integration framework and co-operative reflection model. The first contribution of this study is a proposed framework, which comprises of three major components, that include identification of general phases for service learning (building on Kolb's experiential learning theory); a technology support layer for all phases; and stakeholders' involvement patterns in service learning. Findings revealed that all three main components proposed in the framework of this study are effective for technology integration in service learning. Furthermore, findings of this study also unveiled several constraints of different technologies employed in various phases (e.g. reflection) of service learning. The second contribution of this study is the proposed Co-operative Reflection Model (CRM), which offers a new approach towards group reflection and explores the synergy between co-operative reflection and knowledge-building. The proposed model was validated through a prototype system, which was assessed through a case study. Findings confirmed the presence of different levels of reflective thinking such as: 34% of co-operative reflection data was marked for creating results (level 4), 25% for referring to experience (level 2), 22% for describing experience (level 1), and 19% for developing

connection between experience and theories (level 3). The presence of collaborative knowledge-building is also confirmed as 68% data of co-operative reflection was marked for different levels of knowledge-building and only 28% was marked for task coordination. Further findings of this study also confirmed that there is a significant relationship between co-operative reflection and knowledge-building, which validates the notion of knowledge-building, through co-operative reflection activity. The usability and effectiveness of prototype system was validated by using the information system success model, which was empirically evaluated by using Partial Least Square based Structural Equation Modelling (PLS-SEM) approach. Results showed that system quality, service quality and sociability quality are strong predictors of usage behavior and user satisfaction. As a conclusion, this study contributed towards technology enhanced service learning by elaborating the concept of technology integration and adoption in service learning.

Keywords: Service learning, technology integration framework, co-operative reflection model, experiential learning, information system success

Rangka Kerja Integrasi Teknologi dan Model Refleksi Koperasi untuk Pembelajaran Perkhidmatan

ABSTRAK

Dalam era kemajuan teknologi terkini, teknologi maklumat dan komunikasi memainkan peranan penting dalam sektor pendidikan untuk memperkayakan proses pengajaran dan pembelajaran. Walau bagaimanapun, terdapat kekurangan penyelidikan mengenai integrasi dan penggunaan teknologi yang berkesan dalam pembelajaran perkhidmatan untuk mengenal pasti faktor-faktor yang mungkin memberi kesan kepada proses integrasi teknologi. Isu lain berkaitan dengan refleksi koperasi adalah memahami hasil daripada perspektif keseluruhan pembelajaran pelajar dalam konteks pembelajaran perkhidmatan. Kajian ini bertujuan untuk mencadangkan rangka kerja integrasi teknologi dan model refleksi koperasi untuk pembelajaran perkhidmatan. Kaedah Penyelidikan Sains Reka Bentuk (DSRM) telah digunakan untuk merekabentuk, membangun dan menilai rangka kerja integrasi teknologi dan model refleksi koperasi yang dicadangkan. Sumbangan pertama kajian ini adalah rangka kerja yang dicadangkan, yang terdiri daripada tiga komponen utama, termasuk pengenalan fasa umum untuk pembelajaran perkhidmatan (daripada teori belajar pengalaman Kolb); lapisan sokongan teknologi untuk semua fasa; dan corak penglibatan pihak berkepentingan dalam pembelajaran perkhidmatan. Penemuan mendapati bahawa ketiga-tiga komponen utama yang dicadangkan dalam rangka kajian ini adalah berkesan untuk integrasi teknologi dalam pembelajaran perkhidmatan. Selain itu, penemuan kajian ini juga telah mengenalpasti beberapa kekangan teknologi yang digunakan dalam pelbagai fasa (contohnya refleksi) pembelajaran perkhidmatan. Sumbangan kedua kajian ini adalah satu model refleksi koperasi (CRM) yang menawarkan pendekatan maju ke arah refleksi kumpulan dan meneroka sinergi antara refleksi koperasi dan pembinaan pengetahuan. Validasi model yang dicadangkan dibuat melalui sistem

prototaip, yang dinilai menggunakan kajian kes refleksi koperasi. Hasil penemuan menunjukkan tahap pemikiran reflektif yang berbeza seperti: 34% data pantulan koperasi ditandakan untuk menghasilkan hasil (tahap 4), 25% untuk merujuk pengalaman (tahap 2), 22% untuk menggambarkan pengalaman (tahap 1), dan 19% untuk membangunkan hubungan antara pengalaman dan teori (tahap 3). Kehadiran pembinaan pengetahuan kolaboratif juga disahkan sebagai 68% data refleksi koperasi ditandakan untuk tahap pengetahuan yang berbeza dan hanya 28% ditandai untuk koordinasi tugas. Selain itu, penemuan kajian ini juga mengesahkan bahawa terdapat hubungan yang signifikan antara refleksi koperasi dan membina pengetahuan, yang mengesahkan tanggapan pembinaan pengetahuan, melalui aktiviti refleksi koperasi. Selain itu, kebolehgunaan dan keberkesanan sistem prototaip juga telah disahkan dengan menyesuaikan model kejayaan sistem maklumat, yang dinilai secara empirikal dengan menggunakan pendekatan Partial Least Square berdasarkan Model Persamaan Struktur (PLS-SEM). Keputusan menunjukkan bahawa kualiti sistem, kualiti perkhidmatan dan kualiti sosial adalah peramal yang kuat terhadap tingkah laku penggunaan dan kepuasan pengguna. Sebagai kesimpulan, sumbangan kajian ini kepada teknologi adalah meningkatkan perkhidmatan pembelajaran melalui penguraian konsep integrasi teknologi dan penerimaan dalam pembelajaran perkhidmatan.

Kata kunci: *Pembelajaran perkhidmatan, rangka kerja integrasi teknologi, model pantulan kooperatif, pembelajaran pengalaman, kejayaan sistem maklumat*

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LIST OF ABBREVIATIONS

AMA	American Management Association
AVE	Average Variance Extracted
CAPSL	Comprehensive Action Plan for Service Learning
CRM	Co-operative Reflection Model
CRP	Co-operative Reflection Process
CACL	Computer Supported Collaborative Learning
CSCRS	Computer Supported Co-operative Reflection System
DSRM	Design Science Research Methodology
ELT	Experiential Learning Theory
GoF	Goodness of Fit
HEI's	Higher Education Institutes
HTMT	Heterotrait-Monotrait Ratio
ICT	Information and Communication Technology
IQ	Information Quality
IS	Information System
ISSM	Information System Success Model
MOE	Ministry of Education
MOOC	Massive Open Online Course
NB	Net Benefits
NS	Non-Significant
PLS	Partial Least Square
PLS-SEM	Partial Least Square- Structural Equation Modelling
SAMR	Substitution, Augmentation, Modification, Redefinition

SEM	Structural Equation Modelling
SERQ	Service Quality
SL	Service Learning
SOQ	Sociability Quality
SQ	System Quality
TAM	Technology Acceptance Model
TIFSL	Technology Integration Framework for Service Learning
TPACK	Technological, Pedagogical and Content Knowledge
U	Use
US	User Satisfaction
UTAUT	Unified Theory of Acceptance and Use of Technology

CHAPTER 1

INTRODUCTION

1.1 Background

Due to the growing demand of highly skilled and qualified graduates by industries to operate in the 21st century, Malaysian Higher Education institutes have taken initiatives to introduce experiential learning pedagogies. In this regard, one of the five aspirations published in the latest Malaysian Higher Education Blueprint 2015-2025, is to enhance students' learning experience "*by increasing the use of **experiential learning** and **service learning** to develop 21st century skills and leveraging **technology enabled models** to facilitate more personalised learning*" (MOEM, 2015, p. 14). The concept of service learning is explained through the theory of experiential learning by John Dewey that is "*learning by doing*" (Giles et al., 1994, p. 79). The main goal of service learning is to create partnership between academic institutes and communities to promote the idea of learning through real-world experience.

Service learning presents outstanding opportunity for bridging the gap between academic institutes (that is where theories are taught), and communities (which presents real-world experience to better understand these theories). There are many challenges linked with the practical application of Information and Communication Technology (ICT) in service learning as it provides foundation for the success of learning experience in this modern age of technology. Keane et al. (2014) argued that the use of ICT is vital for developing 21st century skills (which are creativity, communication, collaboration and critical thinking) along with understanding of its positive impact on the overall learning experience.

Technology-enhanced learning recognises the importance of ICT to successfully support teaching and learning in universities (Kirkwood & Price, 2014). The continuous use of diverse ICT, as supporting component of education process is a reality of modern era that

gave rise to the concept of technology integration in experiential learning pedagogies. In other words, the effective use of ICT in experiential learning pedagogies (e.g. service learning in our case) is expected to have a great impact on the quality of teaching and learning, that is similar to the traditional education systems. Existing literature (Boe et al., 2015; Caird & Lane, 2015; Kirkwood & Price, 2014; Walker et al., 2016) shows that the use of ICT in the delivery of traditional education systems is well-explained; however, the adoption and integration of ICT in service learning pedagogy is largely unknown (Rutti et al., 2016; Turnley, 2007).

Turnley (2007) describes how practical and social dimensions of communication technologies assist students to collaborate with communities during service-learning projects. However, it is pertinent to mention that Turnley (2007) specifically focused on the diverse aspects of technical communication courses and explained the application of communication technologies during service learning projects instead of considering technology integration concept as a distinctive concern in service learning pedagogy. Thus, Rutti et al. (2016) has called for further research to investigate ways to effectively use technology in service learning projects, and also to explore the limitations of existing technological usage in service learning pedagogy. This is a crucial aspect, which needs to be considered, especially in the service-learning pedagogy, where structure of service-learning projects and involvement of different stakeholders play a significant role in the success of mutual learning experience. Challenges associated with the practical application of ICT in service-learning pedagogy are clustered in two groups.

Firstly, the adoption and effective use of ICT in service-learning projects are important to understand the complete process of service-learning implementation in a specific curriculum. As pedagogical structure includes a variety of experiential learning activities,

students must actively participate in community service in order to fulfil community requirements and achieve academic learning objectives. Furthermore, reciprocal learning environment is also pivotal, which means the involvement of three stakeholders which are faculty, students and community. Although the involvement of third party posed obvious dilemma, service-learning pedagogical nature is quite complex. This means that there are several factors which need to be considered for technology integration, which may positively affect the practical application of ICT in service-learning pedagogy. Existing service-learning frameworks are subject specific, and they have especially focused on technical and institutionalizing aspects; therefore, there is a dire need to consider technology integration perspective in this pedagogy. Accordingly, reducing the limitations of existing frameworks for technology integration, along with finding the factors that can affect technology integration, should be the primary concern for designing a new framework.

Secondly, the importance of reflection to re-evaluate service experience, bridging the gap between learning and service is proven by the fact that reflection is a critical component in service learning. The reflection on service experience allows to generate better understandings of course contents, broader perception of theories and greater sense of civic responsibility (Bringle & Clayton, 2012). However, critical review of service-learning literature shows that existing reflection models focused on individual reflection only and considered reflection as an individual learning activity. In the context of group-based service-learning projects, in order to re-evaluate service experience, structured co-operative reflection may be affective to generate collaborative understanding or knowledge. Co-operative reflection emphasises on the structured collective critical thinking process, which involves both cognitive and affective interactions among two or more individuals to achieve

shared understanding by working and learning together in small groups (Huggard et al., 2014; Leino, 1995; Yukawa, 2006).

The concept of co-operative/collaborative reflection has been studied by scholars (Prilla *et al.*, 2012; Yukawa, 2006) however, they just focused on describing the process for professional reflective learning at workplace instead of considering its outcomes. This has opened a new research direction in service learning context, generally reflection is used to assess students' learning from service experience. However, existing models do not present a comprehensive view of co-operative reflection process and assessment of its outcomes. Moreover, existing technologies do not provide ample support, for conducting structured co-operative reflection and assessing its outcomes (Prilla *et al.*, 2012; Smit and Tremethick, 2017).

It is pertinent to note that the current reflection models from service-learning literature and available technologies do not provide much support for structured co-operative reflection especially to understand how collaborative critical thinking and knowledge builds together. In this context, an effective solution along with technological support is required, to facilitate structured co-operative reflection, to understand the process of collaborative knowledge-building, to overcome the aforementioned challenges. Therefore, the primary consideration of this study is designing a new co-operative reflection model, and implementing a prototype system for the proof of concept. This study covers both strands of research discussed above and develops a technology integration framework for service learning and designs and implements a co-operative reflection model. In addition, rigorous evaluation methods are employed for the verification and validation of proposed concepts.

1.2 Motivation

There are several justifications for this research study, one of them is to promote experiential learning in higher education. Several scholars (Giles et al., 1994; Kolb, 1984) have considered that students can learn more from experience as compared to traditional classroom activity of merely taking notes in lectures. Another reason to promote experiential learning in the discipline of computer science is the inherent difficulty of related courses, which needs computer science graduates to completely understand the applicability of theories, computing concepts and actual usability and effectiveness of technologies in real life that can be possible by incorporating service learning in curriculum which provides real-world working experience. Insufficient information for the adoption and effective use of ICT in service-learning projects along with its effects on experiential learning (Rutti et al., 2016) is another justification for conducting this research study. The specific motivations for this study are to:

1. research on the adoption and effective use of ICT in experiential education particularly case of service learning.
2. research on the exploration of important factors that can affect technology integration process in service learning.
3. research on the concept of reflection which is an important component of service-learning pedagogy particularly co-operative reflection and effective technology support for it.

1.3 Problem Statement

The use of ICT is vital in the digital era, it has been recognized that ICT plays significant role in education sector for teaching and learning process. However, the application and integration of technology in service learning (which is a type of experiential learning) to

identify the factors that possibly affect technology integration process is still a complex issue. Referring to the reflection, which is an important phase of service learning, literature indicates a theoretical gap for co-operative reflection to understand its outcomes from the service-learning perspective. The research problem of this thesis can be separated into the following:

1. a critical review of current service learning literature showed that existing frameworks do not explore the technology integration in service learning pedagogy (Bartleet et al., 2019). In this context, Turnely (2007), Rutti et al. (2016) and Bartleet et al. (2019) stated that further rigorous research studies of technology integration for service learning is needed;
2. existing reflection models do not provide understanding of co-operative reflection outcomes from students' overall learning perspective. Although importance of group reflection for developing critical thinking skills among students through service learning program is noted by Smit and Tremethick (2017); however, there is lack of research to understand the knowledge-building outcomes during co-operative reflection activity in service learning context (Erdogan, 2019; Hong et al., 2019); and
3. existing technologies are not adequately designed to conduct structured co-operative reflection in controlled environment, which can support students in collaborative knowledge-building from individual reflection to group reflection (Blunk et al., 2016; Siegel & Schraagen, 2017). A similar investigation has been conducted by Prilla et al. (2012; 2015) in designing and implementing technology support for collaborative reflection at workplace which mainly focused on documenting experience related data in different episodes and later use this data for collaborative reflection. In addition, the evaluation of collaborative learning technology is also

critical to assess its success and acceptance by users (Kreijns & Kirschner, 2018; Weidlich & Bastiaens, 2019). In this context it is required to assess the impact of social component (function) of the technology, its usage and user satisfaction.

1.4 Research Questions

Considering the research problem, the following research questions have been identified:

1. What is a suitable framework for ICT integration in service learning?

The use of ICT in education sector shows its positive and significant impact on teaching and learning (Bayne, 2015; Kirkwood & Price, 2014; Rashid & Asghar, 2016). In order to explore ICT effective use in experiential learning pedagogy than traditional education system, it is vital to investigate the factors that can affect successful integration of technology in this pedagogy. As previously stated by Turnley (2007) and Rutti et al. (2016) existing studies does not provide sufficient information about adoption and effective use of ICT in service learning. Therefore, to fill this gap, a proposal for a technology integration framework, based on Kolb's experiential learning theory has been developed.

In order to answer this first research question, the understanding of service-learning incorporation in curriculum and important factors that can influence technology integration is needed. The Kolb's experiential learning cycle (1984), which is based on John Dewey's theory of experiential learning is the widely used theoretical framework for service learning implementation. A comprehensive action plan for service learning implementation proposed by Bringle and Hatcher (1996, p. 224) described the list of activities performed for service learning institutionalisation. Various service-learning frameworks have been proposed to implement service learning in different disciplines. Most of them are complex and subject-oriented, mainly focused on institutionalising and

technical aspects according to the requirements of desired discipline. These frameworks narrowing their perspective to the requirements of a particular discipline therefore, the concept of technology integration in service learning is neglected (Rutti et al., 2016; Salam et al., 2017, 2019; Turnley, 2007). This study addresses this issue by designing and evaluating a holistic technology integration framework for service learning.

2. How can we design a Co-operative Reflection Model (CRM)?

As stated by service-learning scholars' (Asghar & Rowe, 2017; Ash & Clayton, 2004; Bloomquist, 2015; Bringle & Hatcher, 1999) reflection is an important component of service learning that differentiates it from other types of experiential learning pedagogies. Therefore, the next research problem addresses in this study is related to the component of reflection. There are three aspects that need to be considered in designing an effective reflection in service learning, which are reflection model, reflection mode and time period.

After an exhaustive literature review, the researcher found that there are several models proposed to define the reflective learning process. Most are considered reflection as individual learning process for example Gibb's reflection model (1988), Boud et al. reflection process (1985) and DEAL reflection model (2009). There are some studies (Krogstie et al., 2012; Prilla et al., 2012; Yukawa, 2006) that described the concept of collaborative reflection with reference of professional learning on the workplace. However, the issue is the concept of co-operative reflection, particularly in the context of service learning is largely unknown. As argued by Smit and Tremethick (2017) co-operative reflection has significant impact for enhancing level of critical thinking among students. However, further research is required to delineate structured co-operative reflection process to understand its outcomes from the perspective of students learning

(Hong et al., 2019). This study addresses this issue by designing a Co-operative Reflection Model (CRM) which is theoretically based on both, social constructivism theory and collaborative knowledge-building theory. This model aims to view the process of collaborative knowledge-building through co-operative reflection process.

3. What is the effectiveness of the proposed CRM?

In order to evaluate the feasibility of proposed CRM, the design, implementation and evaluation of CRM system are provided. The first step is the design and implementation of CRM system to validate and prove the concept of proposed model. With this aim this study particularly focuses on implementing a system to facilitate computer supported structured co-operative reflection at inter-group level. The second step is verification and validation which is performed by combining different methods to verify CRM concept and validate overall success of CRM system. In order to verify CRM, face validity evaluation method was used and to validate CRM system's success we adapted information system success theory, which is widely used by scholars for the assessment of specific information system.

1.5 Research Objectives

To address the identified research questions, following are the research objectives:

- i. to design and propose a framework for technology integration in service learning;
- ii. to propose a Co-operative Reflection Model (CRM) and view its outcomes from service-learning perspective; and
- iii. to evaluate the technology integration framework, CRM system usability and effectiveness.

The mapping between research problem, questions, objectives, methods and outcomes is presented in Table 1.1.

Table 1.1: Mapping of Research Problem, Questions, Objectives, Methods and Outcomes

Research Problem	Research Questions	Research Objectives	Research Methods	Research Outcomes
• Rigorous research studies from technology integration perspective in service learning Salam et al. (2019) Turnely al. (2019) Rutti et al. (2016)	What is a suitable framework for ICT integration in service learning?	To design and propose a framework for technology integration in service learning.	• explanatory case study evaluation method by using mixed approach (survey and semi-structured interviews)	Technology Integration Framework for Service Learning
• Lack of research to understand the knowledge-building outcomes during co-operative reflection activity in service learning (Smit and Tremethick, (2017) (Hong et al., 2019).	How can we design a Co-operative Reflection Model (CRM)?	To propose a co-operative reflection model and view its outcomes from service learning perspective.	• CRM system implementation. • Workshops for CRM system testing • Face validity evaluation method with service learning experts by using content analysis for verification of CRM	Co-operative Reflection Model (CRM) and system
• Existing technologies are not adequately designed to conduct structured co-operative reflection (Blunk et al.,2016; Siegel et al., 2017). • Evaluation of co-operative reflection technology is also critical to assess its success and acceptance by users (Weidlich and Bastiaens, 2019).	What is the effectiveness of proposed CRM?	To evaluate the technology integration framework, CRM system usability and effectiveness	• CRM system validation by using quantitative research approach	CRM system evaluation which is based on information system success theory

1.6 Scope

This thesis focuses on the conceptual and theoretical aspects of technology enhanced experiential learning, particularly in the context of service learning. The scope of this research study is a technology integration framework, which is designed and evaluated by using a single case study method. Based on the findings of case study, this research presents a Co-operative Reflection Model (CRM) and system implementation, to validate and prove the concept of proposed model. The CRM system is demonstrated in real-world environment by conducting validation workshops in Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak. The CRM system usability and effectiveness are validated by employing information system success model.

1.7 Thesis Organization

The overall structure of this thesis and connection among chapters is illustrated in Figure 1.1. This thesis has been organized in seven chapters. The remaining thesis chapters are:

Chapter 2 contains the review of previous studies. The chapter starts with the general definition of service learning, along with its theoretical foundation and review of current status of service-learning incorporation in higher education in Malaysia. Chapter 2 also presents the critical review of existing service-learning frameworks and reflection models to highlight the research gap. This chapter also explores the application and limitations of existing technology, particularly challenges associated with conducting structured co-operative reflection. Then, details of evaluation methods and research methodology selected for this study is presented.

In Chapter 3, the research method is described. The research process adopted for this study was based on Design Science Research Methodology (DSRM). The detailed description of every phase involved in this research process were presented.

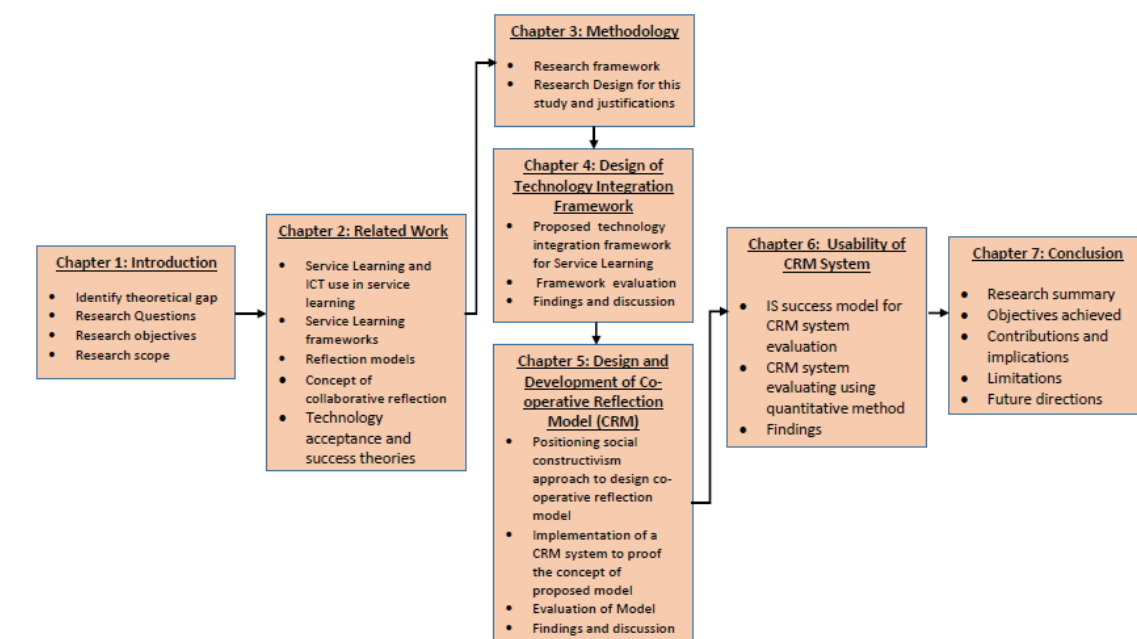


Figure 1.1: Overall Structure of Thesis

Chapter 4 presents the technology integration framework for service learning. The description of theoretical framework, the key components and evaluation of the proposed framework were explained. Furthermore, the details of findings and discussion are also presented.

Based on the findings of Chapter 4, Chapter 5 explains the design of a Co-operative Reflection Model (CRM). The theoretical framework for proposed model and the details of actual reflection activities used in service-learning projects are described. This chapter also includes the description of CRM system implementation, which follows the design of proposed co-operative reflection model. The evaluation of CRM and system demonstration in real world environment is presented which is followed by the findings and discussion.

In Chapter 6 the overall evaluation of CRM system is described. This chapter presents an adapted Information System Success Model for evaluating CRM system usability, effectiveness and success in the real-world environment. The proposed model is assessed by

employing Partial Least Square-Structural Equation Modelling (PLS-SEM) technique, which is a quantitative research approach.

Finally, Chapter 7 presents the research achievements in addressing the identified research problems, main theoretical and practical contributions, reports the limitations of this study and proposes possible research directions for future studies in this area.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter outlines the underlying concepts and previous literature on the adoption and use of ICT in service learning. This chapter starts with the basic definition of service learning and concepts related to service-learning implementation and technology integration. Further, detailed review of previous service-learning frameworks and reflection models are provided to highlight the research gaps and limitations of current technologies. Two key research areas, the development of technology integration framework; and design and development of co-operative reflection model are identified as key strands of this research. Then, this chapter presents a detailed review and discussion of commonly used methods in previous studies. This is followed by the details of research methodology adopted for this research.

2.2 Service Learning

In academic literature, “*Service Learning (SL)*” is a commonly used terminology, some scholars prefer to use “*academic service learning*” to link it with academic endeavors and others prefer to use “*community service learning*” to highlight the importance of community as a partner in this pedagogy (Julie, 2014). In this study, the researcher follows the term Service Learning (SL) to correspond to the more common usage.

Service learning is a type of experiential learning and its unique nature differentiates it, from other types of experiential learning (e.g. volunteerism). It is a combination of two things ‘Service’ and ‘Learning’; however, there are two fundamental concepts, reciprocity and reflection which are considered as major components of service learning and are different from volunteerism (Julie, 2014). Reciprocity is defined as the mutual learning between

faculty members, students and community partners (Hwang et al., 2014). Because of reciprocity nature, students and community partners engage in a mutually beneficial learning experience, where students act as service provider and community partner as recipient (Asghar & Rowe, 2017). There are three main stakeholders in service learning namely; faculty, students and community who works together for the purpose of mutual learning (Rutti et al., 2016). Faculty members have several roles to play, such as they act as supervisor, as evaluator for students' learning and as a mediator between students and community (Longart et al., 2017). Some scholars considered institute as a fourth stakeholder, because faculty and students are representatives of their institute (Bringle & Hatcher, 2000; Hill et al., 2014).

Previous research confirms that service learning is symbolized as purposeful learning experience, where students learn the applicability of course contents, which they learnt in classroom, faculty develops an advance understanding of course and community benefits by resolving community problems (Voss et al., 2015). The basic definition of service learning is integration of meaningful community service in curriculum for the purpose of students' learning, either as curricular or co-curricular activities. Most cited definition of service learning is provided by Bringle and Hatcher (1995a), which is as following:

“Course-based, credit-bearing educational experience in which students (a) participate in an organized service activity that meets identified community needs and (b) reflect on the service activity in such a way as to gain further understanding of course content, a broader appreciation of the discipline, and an enhanced sense of civic responsibility” (p. 112)

The researcher endorses this definition, because it enhances the international understanding of SL by highlighting the importance of academic learning, which occurs as a result of reflection on community service (Bringle & Hatcher, 2009).

2.3 Theoretical Foundation of Service Learning

The Experiential Learning Theory (ELT) is the foundation of service learning and provides theoretical framework for this research. ELT stems from the work of Dewey (1938), who explained the renowned experiential learning theory as learning through experience. He believed that memorization of course contents does not offer deep understanding of concepts, while learners should enhance their learning by authentic learning experience. Later on, David Kolb (1984) contributed to the improvement in the theory of experiential learning, and stated that experiential learning is a process in which knowledge is developed after the transformation of an experience, through the grouping of facts and grasping of ideas. David Kolb also created an experiential learning model which is based on research work of three philosophers, which are Dewey, Lewin and Piaget. Dewey described learning process as multifaceted intellectual mind operation which starts from personal experience, the feelings and desires obtained during concrete experience are transformed through learning process and turn into purposeful action (1984, p. 22). Dewey expressed that learning occurs through the careful examination of gathered information in experience, which is also referred as reflective thinking.

Lewin's theory also focuses on the inclusion of an experience, which provides a place for testing of abstract concepts. Likewise, Dewey also believed that personal experience provides a fundamental base for learning through experience. Students will be able to give a personal subjective meaning to theoretical concepts, at the same time they will be able to provide a physical reference for implementing and validating new ideas (Kolb, 1984).

Lewin's also emphasized on feedback which was later named as reflection. Reflection allows students to assess information gathered in their experience to link back with their desired objectives. Lastly, Piaget (1977) was another educationist and scholar who believed that knowledge is constructed through individual's interaction with environment. He described that, students' cognitive learning grows with age and reaches to maturity level in adulthood when he/she will be able to develop a worldview of various abstract ideas.

Kolb's experiential learning model is rooted in these three theories and it consists of four stages 1) Concrete Experience (CE), 2) Reflective Observation (RO), 3) Abstract Conceptualization (AC) and 4) Active Experimentation (AE). The idea presented in ELT relates to the concept of service learning. Dewey and Kolb's work provides an ideal theoretical framework for service learning, as they emphasized on learning from experience, critical reflection on that experience and engagement with community or real-world environment for validation and testing of abstract learning achieved through experience (Kolb, 1984). Relying on this theory researcher believes that service learning provides authentic learning experience for students and reflection is an important component to re-evaluate that experience and to develop a new understanding of experiential learning.

2.4 Service Learning in Malaysian's Higher Education

The Malaysian government has developed a comprehensive blueprint for the distribution of their national budget of next five years. Through these plans government is trying to attain a high-end economy and recognizes the need for more educated and skilled workforce in Malaysia (Baharom, 2013). The Ministry of Education (MOE) Malaysia strives to transform higher education teaching and learning strategies' to produce employable, knowledgeable and marketable graduates to meet the requirements of information rich 21st century. Therefore, current *Malaysia Education Blueprint 2015-2025* (2015), requires to integrate

‘Service Learning’ in their higher education academic disciplines for producing more educated and skilled graduates for 21st century.

The integration of service learning in higher education courses offers opportunity for students to apply their knowledge in real world and enhances their courses contents’ understanding. Therefore, in last few years Malaysian Higher Education Institutes (HEIs) have been integrating service learning in different academic disciplines e.g., business (Vinitha, 2015), education (Alias et al., 2017; Dickerson et al., 2017; Osman, 2011), pharmacy (Khan & Jacob, 2015), social science and computer science (Ali et al., 2012). Justification of why we need service learning in higher education is explained next.

2.4.1 Why Do We Need Service Learning in Higher Education?

It is believed that, after graduation students will be ready for professional working environment as they have learnt all necessary knowledge and skills. However, the reality is different due to the lack of experiential learning, lack of exposure to real-world environment and lack of necessary skills required by working industries. The traditional classrooms are teacher-centered where knowledge is transferred through lectures. Talbot and Bizzell (2016) have suggested student’s need active learning experience and skillful usage of advance technologies in modern age of 21st century.

In addition, to promote student-centered learning environment it is vital to integrate service learning in higher education; which, provides experience so that students can apply theories in their real-world situations, can enhance their professional working skills and civic responsibility. Service learning offers different views of learning by creation of knowledge through transformation of experience (Kolb, 1984). Academicians and government bodies of Higher Education Institutes (HEIs) have acknowledged that, it is essential for students to attain 21st century skills, which is another reason for encouraging experiential teaching and

learning strategies. Keane et al. (2013, p. 77) have synthesized these skills as the 4Cs: 1) Critical thinking and problem solving; 2) Communication; 3) Collaboration and team building and 4) Creativity and Innovation

In order to be effective in today's information rich society, academicians need to utilize and transform their teaching and learning process with the help of experiential learning (e.g., service learning) and with the use of advance technology (Hakkinen et al., 2017). To cater the growing demands for preparing students for 21st century, experiential learning (e.g., service learning) environment offers opportunity for students to enhance their aforementioned skills (Hakkinen et al., 2017). Various previous studies have indicated that service learning is an innovative pedagogy, which enhances student's ability of '*critical thinking and problem solving*' by providing an opportunity to solve and reflect on a real world problem based on some authentic community needs (Bloomquist, 2015; Carrington et al., 2015; Guo et al., 2016). This means that, in order to prepare graduates for 21st century, it is vital to integrate service learning programs in the curriculum along with introducing the use of ICT in these programs, which is necessary for developing competent workforce required by country. Next section presents the existing service learning frameworks.

2.5 Existing Service-Learning Frameworks

Service learning integration in higher education is a mutual partnership between academic institutions and communities where, institutions provide access to all their valuable resources (e.g. faculty, students, classrooms, libraries, technology and research expertise) to communities (Bringle & Hatcher, 1996). Service learning develops a culture of reciprocal learning and service between two parties (academic institutions and communities) which support economic development in their region. Bringle and Hatcher (1996) defined a Comprehensive Action Plan (CAPSL) model for service learning institutionalization or

integration in academic institutions, which consists of activities for all stakeholders. These activities include planning, awareness, prototype, resources, expansion, recognition, monitoring, evaluation, research and institutionalization. This model concentrates on service learning institutionalization and assessment of its status; however, it is complex to understand the main phases involved in the service learning integration of any academic course (Zhang et al., 2011).

There are number of service-learning frameworks found in literature, which describe the service learning integration in different academic disciplines. For instance, Petkus (2000) defined a framework for design and implementation of service learning in business discipline, which employed the Kolb's cycle of experiential learning as its underpinning theory. Roakes and Norris-Tirrell (2000) proposed a framework for service learning course design and development, which emphasized on experiential learning, reflective thinking, civic learning and deep understanding of its fundamental concepts.

In addition, literature review showed that service learning is more popular in medical and health sciences disciplines. Yoder (2006) developed a service learning framework for dental education, which described various important elements of service learning projects' design and implementation. Julie (2014) has defined service learning implementation framework for nursing faculty, which covers the policies and strategies for service learning institutionalization. Voss et al. (2015) have designed a service learning framework for nursing discipline, to measure the reciprocity and benefits of service learning projects for community.

More importantly, in the computer science discipline, Nejme (2012) developed a three dimensional framework for service learning integration in computer science courses. The first dimension of this framework defines the possible project types in this discipline e.g.,

custom software development, training, research, professional services and projects. The second dimension describes the range of activities performed in computer science and technology related service learning projects, such as research to identify problem, analysis, design, implementation, testing, transition and assessment. The last dimension of this framework elaborates a project mode, for example, curricular, co-curricular and hybrid (combination of first two). Furthermore, Ali et al. (2012) have proposed a research based service learning model to integrate teaching and learning in the curriculum of computer science. They have explicitly focused on four core components which are infrastructure, schedule, requirements and outcomes.

2.6 Comparative Analysis of Existing Service-Learning Frameworks

The critical review of service learning literature shows that, most of the previous service learning frameworks are subject specific (Cecil, 2012; Nejme, 2012; Yoder, 2006) and some have discussed various stakeholders' perspectives (Bartleet et al., 2014; Whitley & Walsh, 2014). However, all frameworks have shared some commonalities in term of their phases or stages, which are discussed in next section. Table 2.1 presents a quick comparison of existing service learning frameworks, with brief description of their important components or phases.

To the best of researcher's knowledge, there is indeed limited research on the technology integration or about the application of different technologies in service learning pedagogy, which is the focus of this study. The researcher has found some important phases of service learning, which will be discussed in detail in Chapter 4, and uses the Kolb's experiential learning model as base theory for designing a new framework with technology integration layer, which shows ICT's usage for different phases involved in the service learning pedagogy.

Table 2.1: Comparison of Existing Service-Learning Frameworks

Study	Underpinning Theory / Framework	Elements or Phases of Framework
Bringle and Hatcher (1996)	Own invention	Planning, awareness, prototype, resources, expansion, recognition, monitoring, evaluation, research and institutionalization
Petkus (2000)	Based on Kolb's experiential learning cycle	Concrete experience, reflection, abstract conceptualization, active experiment
Roakes and Norris-Tirrell (2000)	Based on Kolb's experiential learning cycle	Planning, understanding, experiential, reflective thinking
Yoder (2006)	Own invention	Academic link, sustained community partnership, goals, broad preparation, sustained service, reciprocal learning, guided reflection, community engagement, evaluation
Zhang et al. (2011)	Based on Stufflebeam's context, input, process and product evaluation model	Context, planning, implementing, assessing
Cecil (2012)	Own invention	Connect service learning with department, partnership, reciprocal learning, course design, develop activities
Ali et al. (2012)	Based on service learning implementation activities by Bringle and Hatcher (2000)	Infrastructure, schedule, requirements, program outcomes
Nejmeh (2012)	Based on software development models	Project activities: research, analysis, design, implementation, test, transition and assessment
Bartleet et al. (2014)	Based on existing literature case study of indigenous art	Relationship, reciprocity, reflection, representation, implementation

Table 2.1 continued

	based service learning	
Julie (2014)	Based on elements of intervention theory	Assess readiness for service learning institutionalization, develop contextual definition, develop service learning capacity and scholarship, monitoring and evaluation, reflection.
Whitley and Walsh. (2014)	Based on existing literature but detailed with student context.	design, implementation, reflection, outcomes
Voss et al. (2015)	Own invention	Feasibility, assess, implementation and consistency
Hart (2015)	Based on Kolb's experiential learning cycle	Assessment, engagement, planning, implementation, flexible, reflection, collaboration and celebration
Musa et al. (2017)	Based on Kolb's experiential learning cycle	A methodology framework includes planning, design, analysis, service delivery, reflection , evaluation and monitoring
Bartleet et al.(2019)	Based on practice	Focused on respectfulness and reciprocal learning in service experience with ways of learning and engagement
Langlois (2019)	Self-Determination Theory (SDT)	A conceptual framework developed relationship between SDT and service learning, findings shows how the SDSL pedagogy changed in students self-efficacy
Halberstadt et al. (2019)	Sustainable entrepreneurship capability	Includes personal and institutional factors e.g., learning format, environment and aptitude

This study presents the common phases of service learning, which were derived from literature, through critical review of existing service learning frameworks. The information presented in Table 2.1 provides evidence that the phases outlined in this section are

frequently found in previous service learning frameworks. Each of the framework discussed in previous section has been investigated for the five main phases of service learning (see Table 2.2). In this study, the researcher derived common phases from literature, based on Kolb's theory and re-arranged them in the form of one framework with technology support layer, which shows the effective use of ICT's in different phases and sub-activities of these phases (see Chapter 4). According to Kolb's experiential learning theory discussed in Section 2.3 there are four steps for a complete experiential learning cycle. Therefore, these common phases are in line with Kolb's theory of experiential learning (Hart, 2015; Petkus, 2000). The detailed design of technology integration framework and its evaluation is presented in Chapter 4.

Table 2.2: Mapping of Common Phases of Service-Learning

Study	Planning and Preparation	Implementation	Reflection	Assessment and Evaluation	Management/ Administration
Bringle and Hatcher (1996)	✓	✓	✗	✓	✓
Petkus (2000)	✓	✓	✓	✓	✗
Roakes and Norris-Tirrell (2000)	✓	✓	✓	✓	✗
Yoder (2006)	✓	✗	✓	✓	✓
Zhang et al.(2011)	✓	✓	✗	✓	✗
Cecil (2012)	✗	✓	✗	✗	✓
Ali et al. (2012)	✓	✓	✗	✓	✓
Nejmeh (2012)	✓	✓	✗	✓	✓
Bartleet et al. (2014)	✗	✓	✓	✗	✗

Table 2.2 continued

Julie (2014)	✓	✓	✓	✓	✗
Whitley and walsh. (2014)	✗	✓	✓	✓	✓
Voss et al. (2015)	✓	✓	✗	✓	✗
Hart (2015)	✓	✓	✓	✓	✓
Musa et al. (2017)	✓	✓	✓	✓	✓
Bartleet et al.(2019)	✓	✓	✓	✗	✓
Langlois (2019)	✓	✓	✓	✓	✗
Halberstadt et al. (2019)	✓	✓	✓	✓	✓

Note: Evidence of presence of particular phase = ✓ Evidence implicit: not stated directly but reader understand = ✓ Phase not present = ✗

2.7 Existing Technology Integration Frameworks

Two technology integration frameworks were found in literature, which have been widely used by academicians for technology integration in education process named as; Technological, Pedagogical and Content Knowledge (TPACK) framework (Mishra & Koehler, 2006) and Substitution, Augmentation, Modification and Redefinition (SAMR) framework (Puentedura, 2009). Nevertheless, these frameworks present valued contribution to understand the phenomenon of technology integration in education process; but various scholars have criticised on the efficiency of these frameworks for technology integration in experiential learning pedagogies (e.g. service learning pedagogy in this study) (Crompton, 2017; Rutti et al., 2016).

Turnley (2007) and Rutti et al. (2016) argued that these frameworks were designed according to the requirements of technology integration in traditional education system, which is

different from other learning pedagogies e.g., service learning. In relation to this, Meyer et al. (2016) have also noted that implementation process of service learning pedagogy is different from traditional education system; as it includes variety of experiential learning activities along with active involvement in the community service, which is theoretically explained by Kolb's (1984) experiential learning theory.

Crompton (2017) proposed a technology integration framework for mobile learning, which consists of four main components: 1) beliefs, 2) resources, 3) methods and 4) purpose. He claimed that, along with these four components, there are several sub-components, which can help in determining technology integration. However, this framework also has its limitations. It has mainly focused on the personal and environmental factors without considering the pedagogical styles and nature of learning outcomes. Therefore, the current service-learning frameworks and technology integration frameworks do not explain how technologies can be effectively used in service learning to transform this pedagogy for learners.

2.8 Reflection

The term "reflection" is widely used in our daily lives and it has many meanings. For example, it can refer to the collection of ideas or general thoughts about something. Sometimes, it is also used to refer to thinking about a particular problem. Reflection is an important component of service learning as defined in service learning definition also as *"reflect on the service activity in such a way as to gain further understanding of course content"* (Hatcher & Bringle, 1997, p. 153). Most cited definition of reflection is *"active, persistent and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends"* (1938, p. 9).

In service learning, reflection is generally stated as purposeful learning activity to assist students to think back to re-evaluate their experience and identify new perspectives by transforming experience into applicable knowledge (Bloomquist, 2015; Bringle & Hatcher, 1999; Hatcher & Bringle, 1997). Moon (1999) has stated that reflection is more than just a thinking process, it involves internal mental processing, with clear purpose, or an expected outcome which is applied to unstructured or comparatively complex ideas, which do not have obvious solutions.

Various scholars have noted that reflection is also a way of assessing students' learning from their overall service experience (Ash & Clayton, 2009; Harvey et al., 2017; Molee et al., 2010; Ryan & Ryan, 2013). The critical review of literature showed that, there are two types of research studies, one type of studies described the process of reflection and other type emphasized on assessment of reflective writing. This dissertation focuses on first type of studies about the reflection process, particularly in the context of service learning.

2.8.1 Theoretical Foundation of Reflection

There are three schools of thoughts (behaviourism, cognitivism and constructivism), which are mainly used by scholars in reflective learning context. The behaviorist paradigm was popular during the first half of the 20th century, which mainly focused only on observable behaviors, and there was little relevance with the mental processing. In the context of education behaviorists believed that *"learning is accomplished when a proper response is demonstrated following the presentation of a specific environmental stimulus"* (Ertmer & Newby, 1993, p. 55). Learning in behaviorist paradigm is associated with the development of lower order mental skills, such as knowledge acquisition and memorization of facts (Birney, 2012).

Second school of thought is known as cognitivism, which became popular in 1960's. Cognitivists were more interested in mental level processes and they emphasized on internal thoughts of individuals, where they developed representations of information gained from external environment. According to Ertmer and Newby (2013) cognitivists believed that *"learning is associated with discrete changes between states of knowledge rather than with changes in the probability of response"* (Ertmer & Newby, 2013, p. 51). Birney (2012) has acknowledged that learning involves internal mental processes, instead of considering only external visible changes, which might be carried out by the virtue of a learning process. Further, Ertmer and Newby (1993) have noted that one main difference between these two theoretical paradigms is that, in behaviorist learning students are positioned as a passive recipient of knowledge; whereas, in cognitivism students are viewed as an active participant in their overall learning process.

Third school of thought is known as constructivism, which has emerged very recently, and has been well-documented in literature as a learning theory. Constructivism is also known as a branch of cognitivism, as both theories considered learning as a mind process and they view students' position as an active participant in a learning process (Ertmer & Newby, 2013). Whereas, both cognitivism and behaviourism approaches are teacher-centered, but the constructivism approach is student-centered (Birney, 2012; Ertmer & Newby, 2013). Besides that, constructivist have recognized that, the way students identify new knowledge is mainly affected by their previous understanding and experiences (Baharom, 2013). Constructivist asserted that learning is not only taking in knowledge or memorizing it, learning occurs when students can transform their acquired knowledge to their practical life (Jonassen et al., 1995). Furthermore, the mental processing helps students to interpret their experiences and transforms it in the shape of applicable knowledge.

Another perspective on learning, which needs to be considered is social constructivism. The theorists in social constructivism have proposed that the students' ability to learn can be greatly enhanced when providing 'scaffolding' through mentors or peers (Birney, 2012; Vygotsky, 1980). Social constructivism supports the social context of learning and believes that learning can be enhanced when students interact with experts in communities or learn in a collaborative learning environment (Garrison, 1995; Le et al., 2015). The principle of Vygotsky's theory is, that people first develop their cognitive abilities in a social context, which may be supported by mentors or other cognitive phenomenon, then later they are capable to individually processing these cognitive capabilities (Stahl, 2013). However, he focused on individual cognition as a unit of analysis and described how cultural factors affect individual cognition in the form of a group work. For example: his renowned concept 'zone of proximal development' has focused on measuring individuals' cognitive abilities, when they are working in a group, but not considering their group's ability as whole. In this sense most of Vygotsky's followers have investigated various individual abilities used in collaboration and group work.

In addition to this, collaborative knowledge-building theories from learning science (Scardamalia & Bereiter, 1991; Stahl, 2002, 2005) were also known as the elaboration of Vygotsky's 'social theory of minds or social constructivism'. Here, this study elaborates collaborative knowledge-building theory, to determine its applicability and importance for this study. The collaborative knowledge-building is defined as the process of "*collective creation and improvement of ideas*" where learners work collaboratively on identified problems to develop understanding, articulate personal ideas, discuss, and criticize them to refine, relate and synthesize these ideas (Bereiter, 2005). Various studies have been conducted on collaborative knowledge-building through collaborative learning activities,

and they generally show that this approach is favorable to develop knowledge-building practices among students (Scardamalia, 2002; Scardamalia & Bereiter, 2006). This study adapts the concept of social constructivism theory (Vygotsky, 1980). and collaborative knowledge-building theory (Stahl, 2000; Stahl et al., 2006) to propose a conceptual model of collaborative knowledge-building through co-operative reflection activities (see Chapter 5).

2.8.2 Existing Reflection Models

Several reflection models have been proposed in previous studies, this study discusses only those existing reflection models, which describe reflection process particularly in the context of service learning (Ash & Clayton, 2009; Boud et al., 1985; Gibbs, 1988). Therefore, models that describe the reflection process, were selected as being relevant to this thesis.

Reflection model proposed by Boud et al. (1985) consists of three stages which are 1) returning to an experience through assimilating information about events that occurred during experience 2) thinking back to experience, utilizing positive feelings that includes identification of what has been gained and what can be gained from an experience and avoiding destructing feelings 3) final stage describes the outcomes as a result of whole reflection process, which contains new perspectives about an experience, future directions and change in behavior.

Gibb's reflection cycle presents a structured debriefing approach, which directly supports reflection on ones' experience (Gibbs, 1988). This model is comprised of multiple stages, the first point is description of experience. Next stage is describing feelings that are followed by the evaluation stage, where learner looks back to the particular event, to find out what was good and bad about that experience. During analyses stage of the Gibb's cycle learners are encouraged to relate to their experience of the course contents and their own

understanding of the concepts (Gibbs, 1988). Then the learner draws conclusions on what they learnt in experience and how it relates to or is different from their existing knowledge with a new perspective. Finally, they develop their future action plans based on their new knowledge. However, like other cyclical models, Gibb's reflection cycle also has one drawback, of being overly prescriptive and narrow for individual learner's reflective practice.

Rolfe reflection model is a simplest model, which consists of three basic questions: 'what', 'so what' and 'now what' (Rolfe et al., 2001). It is widely used for professional education for instance, in health sciences nursing staff used this model for their daily reflection practices. The first question of this model provides description about experience. The next question helps to evaluate experience by critical thinking about events or activities performed in their experience. Final question of this model helps to draw a conclusion on experience and produces new perspectives, which further suggests how to improve an experience. One drawback of this model is, being overly simplified with limited number of questions, which presents the concept of reflection at a very abstract level.

Ash and Clayton (2009) developed a DEAL reflection model particularly for service learning. They claimed that critical reflection practice is necessary for developing new insights from service learning experience. DEAL model considers the effective reflective principles, which often integrate assessment with reflection (Ash & Clayton, 2009). With respect to the unique qualities of service learning, this model aims to investigate students' learning at academic, civic and personal level. Therefore, DEAL model consists of three sequential stages: first stage is description of experience with objectives, second the evaluation of experience in the light of proposed objectives and last stage is the articulation of learning with the future directions of new experiences.

However, in all models discussed above, they have considered reflection as an individual learning process. As described by Yukawa (2006) and Prilla (2014), reflection is not only an individual critical thinking process, but it can also be a social or collaborative learning process. Scholars acknowledged there are two methods used to conduct reflection, individually or collaboratively in a group, which positively affect the reflection process and its' outcomes (Gungor & Gungor, 2019; Prilla & Renner, 2014; Smit & Tremethick, 2017; Yukawa, 2006). The next section presents the concept of reflection as collaborative learning activity.

2.8.3 Co-operative Reflection

The use of reflection in service learning is purposeful to reflect on community service experience to gain better understanding of theories, to encourage reflective learning and critical thinking. Scholars described reflection as collective learning activity, controlled by learners and elaborates cognitive and affective learning in a unified way, they defined it as a joint effort to explore learning experiences to gain new intersubjective understanding (Clara et al., 2019; Smit & Tremethick, 2017; Veen & dela-Croix, 2016; Yukawa, 2006). In the context of collective reflective learning, different scholars have used different terminologies such as: group reflection (Smit & Tremethick, 2017), collective reflection (Foong et al., 2018), collaborative reflection (Prilla et al., 2012) and co-operative reflection (Harvey et al., 2010; Hong et al., 2019; Huggard et al., 2014; Leino, 1995); however, the concept of co-operative reflection stresses on structured reflective learning activity that includes collaborative critical thinking process through effective communication and collaboration to explore experiences to make decision collectively (Erdogan, 2019). Co-operative reflection is defined as structured collective critical thinking process, which involves both cognitive and affective interactions among two or more individuals to achieve

shared understanding by working and learning together in small groups (Huggard et al., 2014; Leino, 1995; Yukawa, 2006).

The nature of co-operative reflection is different from individual reflection as individual reflection is the process of one person's cognitive or mental activity, while in the co-operative reflection two or more than two persons involve in a dialogical interaction to share their reciprocal experiences (Degeling & Prilla, 2011). Smit and Tremethick (2017) have noted that for successful co-operative reflection in group based service learning experience, student must learn a process to communicate, share their experiences with each other to exchange their personal thoughts, generate new perspectives and common meanings from their experiences.

With reference to the social constructivism learning theory and knowledge-building theory, the outcomes of a co-operative learning activity should be in the form of collective knowledge or group cognition (Aguirre Garzón, 2018; Clara et al., 2019). Various scholars (Biasutti & Frate, 2018; Veen & dela-Croix, 2016), have claimed that, the goal of any co-operative learning activity is to develop a shared understanding and creation of knowledge through cooperation and interaction e.g., problem or project based learning. Additionally, Foong et al. (2018) described that collective reflection requires scaffolding and guidance as proper facilitation from supervisors, to allow students to think deeper together, with teachers to improve reflective thinking and to develop collective knowledge.

Most of the existing reflection models are based on the concept of individual reflection and they have considered reflection as an individual learning activity (Foong et al., 2018; Smit & Tremethick, 2017). In order to achieve collective understanding of group based service learning experience co-operative reflection can be effective to assess students' level of reflective thinking and knowledge-building abilities (Adelopo et al., 2017; Erdogan, 2019).

This study modifies the concept of group reflection and focuses on the co-operative reflection to design and develop a new model to understand actual outcomes of structured co-operative reflection activity from students' overall learning perspective.

2.9 Application of Information and Communication Technologies in Service

Learning

The use of Information and Communication Technology (ICT) in education sector both in traditional and online classrooms, plays a significant role in delivering education, and to foster teaching and learning processes (Price & Kirkwood, 2014). Internationally the use of ICT in education sector also is recognized by various academicians and scholars. As described in latest technology use report, faculty is more motivated to use ICT for their teaching practices and to buy personal computing devices (Jeffrey & Brooks, 2017). One recent example is the widespread use of Learning Management Systems (LMS) in institutions for course management, and instruction delivery functions.

Another survey by Brooks and Jeffrey (2017) reports that, the students' perspective towards technology use for education is also positive and they are pleased to use more advance technologies. Majority of students believed that, the use of technology enhances their learning and encourages them to use more computer supported collaborative learning tools. Particularly, in Malaysian context there are many ICT related initiatives, which have been taken by the Ministry of Education (MOE), to promote the advance technology usage for education. For instance, Malaysian Higher education blueprint 2015-2025 (2015) aims to promote and advance ICT to foster *“quality learning across all educational institutes by leveraging advance technology enabled models to enable more personalized learning”* (2015, p. 20). There are various technologies, which can be effectively used in education. Becker et al. (2017), categorised them as 1) Internet technologies 2) visualization

technologies, 3) consumer technologies, 4) learning technologies, 5) social media technologies and 6) enabling technologies .

According to Crompton (2017); Tracey and Kacin (2014); and Turnley (2007), it is not necessary that the technologies which are effective for traditional classroom education system, can also be effectively used for other types of pedagogies such as experiential learning (e.g. service learning) and other student-centered learning models. For technology integration Graham et al. (2012) claims that it is important to understand the nature of technology and the characteristics, required of these pedagogies and other factors which can influence technology integration process.

With respect to the technology use in service learning projects, various studies have reported the use of technologies for different purposes for instance: Turnley (2007) have focused on the effective use of communication technologies for students' collaboration with clients during technical communication course, Montgomery et al. (2017) have reported the use of data collection tools, community and service delivery in online service learning projects (Bourelle, 2014; Helms et al., 2015). Furthermore, some recent studies (Bourelle, 2014; Nielsen, 2016; Sun & Yang, 2015; Tracey & Kacin, 2014) have reported the use of communication technologies (e.g. e-mail, instant messaging, and skype) and Web 2.0 tools (e.g. Google applications, social media etc.) for effective communication and collaboration between participants in service learning projects. Sun and Yang (2015) have examined the use of web 2.0 tools (e.g. Facebook and YouTube) for service learning projects in their language learning class. Furthermore, some researchers have used the course management systems (e.g. Blackboard) for instruction delivery, data collection and as a analysis tool (e.g. Google applications and voice recorder) in their service learning projects (Helms et al., 2015;

Montgomery et al., 2017). In addition to these tools, online diaries, e-portfolio and Blogs are also used for reflection.

Researcher found that most of the studies also indicated the frequent use of communication technologies (e.g. e-mail, Skype, instant messages, Google application) for communication and collaboration purposes (Bourelle, 2014; Nielsen, 2016; Soria & Weiner, 2013; Tracey & Kacin, 2014). In addition, several studies suggested the use of instructional and web 2.0 technologies (e.g. Blackboard, Facebook, YouTube) (Montgomery et al., 2017; Sun & Yang, 2015). However, the use of technology is not limited to facilitating communication and collaboration during service learning projects. Although, there are variety of technologies, which can be used in service learning projects; however, the selection of technology depends on their effective use in specific phases and depends on different situations. Therefore, there is a need of a standard technology integration framework to understand the whole process with technology support layer (see Chapter 4 for more detail).

With reference to the use of technology for reflective learning, various studies have reported the use of technology for data capturing and storing information, which can be used for reflection (Fleck & Fitzpatrick, 2010; Isaacs et al., 2013; Krogstie et al., 2012). Lin et al. (1999) have suggested some important factors to design technology support for reflection such as preparation of model, process display, prompts facility and social discourse. Literature review has revealed the use of web 2.0 applications (Churchill, 2011), personal online diaries (Chirema, 2007), mobile applications (Bohoj et al., 2011) and online journal writing, particularly for assessing individuals' reflection (Cheng, 2017). Majority of these tools are used for recording and capturing data during service learning experience, which can be later used for assessing reflection (Prilla et al., 2012).

In addition to this, some researchers (Driessen et al., 2005; Lim et al., 2016; Pianpeng & Koraneekij, 2016) have also suggested the use of electronic portfolios for reflection, that can be used for storing and maintaining learning materials, taking notes to reflect on personal learning and sharing. It provides a personal learning environment to monitor personal growth. Fleck and Fitzpatrick (2009) have reported the use of Microsoft SenseCam for reflection which helps to take pictures of experience, which later can be used as data presented in the form pictures for reflection purpose. Some scholars have reported the use of social networking sites for example Blogs (Novakovich, 2016), Microblogs (Krutka et al., 2014) and Twitter (Wright, 2010) for assessing collaborative reflection.

In previous literature there is limited research on specific tools, which are designed for structured co-operative reflection. Though, the usage of technology for individual reflection is often mentioned by various studies such as journal writing, online diaries and electronic portfolios. Prilla et al.(2012) and Zheng (2017a) have stated that, current tools can be effective for individual reflection only. Therefore, they have developed a mobile application for collaborative reflection at workplace, which helps to capture, store and maintain experience based data. However, they particularly designed this mobile application to capture data in different episodes during working hours in a hospital and later used that data for collaborative reflection and self-assessment. As a conclusion, it can be said that current tools offer limited functionalities for instance data capturing, maintaining records and sharing material with others only.

With respect to the co-operative reflection in service learning as discussed above, students need to cooperate with each other to share personal thoughts on experience, document collaborative reflective thinking and enhance whole learning process. In addition, a controlled environment with proper level of privacy is also required for inter-group

communication to monitor students' progress in group based projects through their reflection activities. Scaffolding is required to support students in co-operative reflection to achieve a higher level of reflective thinking and shared understanding (Coulson & Harvey, 2013; Fessler et al., 2017; Prilla et al., 2013; Ryan & Ryan, 2013). Table 2.3 outlines the comparison of current technologies, which can be used for reflection.

Table 2.3: Comparison of Current Technology Support for Reflective Learning

Technologies used in current studies	Reflection type	System modules
SenseCam Fleck and Fitzpatrick (2009)	N/A	SenseCam capturing experience moments in images form that latter helps to return to experience, providing evidence
Mobile Application Bohoj et al. (2011)	N/A	A mobile application particularly designed for sharing geospatial information: support for sharing multimedia information, store contextual and geographic information, support for integrating geospatial information to create customized maps, Support for visualizing and analysing geospatial information
Talk Reflection App Prilla et al. (2012)	Collaborative reflection on workplace	Support for documenting experience in different episodes, support for view, discussion and share data
Echo Isaacs et al. (2013)	Individual reflection	Mobile application 'Echo' to record daily experiences in form of writing, pictures, and rating emotions.
Blog, Twitter and discussion forum (social networking sites) (Krutka et al., 2014; Novakovich, 2016; Smit and Tremethick, 2017; Wright, 2010)	Used for both individual and group reflection	Basically, these applications were used for social networking; however, some academicians used them for reflection too. Helps to share material, discussion.
E-Portfolio Lim et al. (2016) Pianpeng & Koraneekij (2016)	Individual reflection	E-portfolio: A showcase to present data in form of text, image, video, sharing, recording and tracking learning, plan and evaluate a course. Recording evidence

Table 2.3 continued

		and reflect on stored data manage references.
Web-folio Turkey (2016)	Individual reflection	Web-folio: content management, storing evidence, web-folio is collection of web pages linked with other web 2.0 application to maintain record of scholars

Based on the above discussion, few tools were identified, which can be used for individual and collaborative reflection. However, to the best of researcher's knowledge, there is no dedicated tool for co-operative reflection, which provides support for 1) effective communication and collaboration, 2) allow for promising co-operative reflection with different time intervals, 3) proper documentation of individual and collaborative understanding or learning, 4) scaffolding co-operative reflection activities to monitor students' progress in service learning projects, 5) controlled collaborative learning environment to maintain proper privacy level and 6) monitors students' collaborative critical thinking and knowledge-building through structured co-operative reflection activity. Developing from the previous discussion, the following limitations and challenges of existing ICT technologies are derived from previous literature on the subject matter:

- 1 Lack of participants' cooperation specifically in the case of group reflection
- 2 Lack of integrated view of participants' individual and collaborative reflection
- 3 Lack of scaffolding and guidance for co-operative reflection
- 4 Lack of transparency and awareness regarding the collaborative knowledge-building through co-operative reflection activity.
- 5 Lack of controlled environment for inter-group collaboration, to ensure proper level of privacy and monitor students' progress in group based projects

2.10 Design Science Research Methodology in Information Systems

The use of Design Science Research Methodology (DSRM) in the discipline of Information Systems (IS) and Computer Science has been described by Peffers et al. (2007, 2012) and Laylavi (2017). DSRM is considered more flexible for these disciplines, as it offers three major advantages, which are scope, artefact development and solving real-world problems (March & Smith, 1995; Sam, 2016). The development of ‘artefact’ is a common idea in this methodology, which can be constructs, models, frameworks, methods, or even informational resources (Hevner et al., 2004; March & Smith, 1995). Hevner et al. (2004) and Geerts (2011) have described two characteristics of an artefact which are rigor and relevance. Rigor shows the novelty of artefacts, it should be based on existing knowledge, and must be ensured as a viable contribution to the overall body of knowledge. On the other hand, relevance indicates the application of proposed artefact in solving the identified problems. The DSRM consists of six sequential phases that are 1) problem identification and motivation, 2) definition of the objectives of the solution, 3) design and development, 4) demonstration, 5) evaluation, and 6) communication (see Figure 2.1). The DSRM starts with ‘problem identification’ which describes the identified research problem, motivation and the understanding of underlying concepts. In this phase, a detailed research proposal should be prepared, which includes problem statement, justification for research importance and its relevance to, determine the capabilities of proposed solution. Second phase is about defining ‘objectives of a solution’. This phase aims to answer “*How should the problem be solved*” (2007, p. 55) and specifies the parameters and criteria for the evaluation of proposed solutions to meet the desired objectives of a study (Peffers et al., 2007).

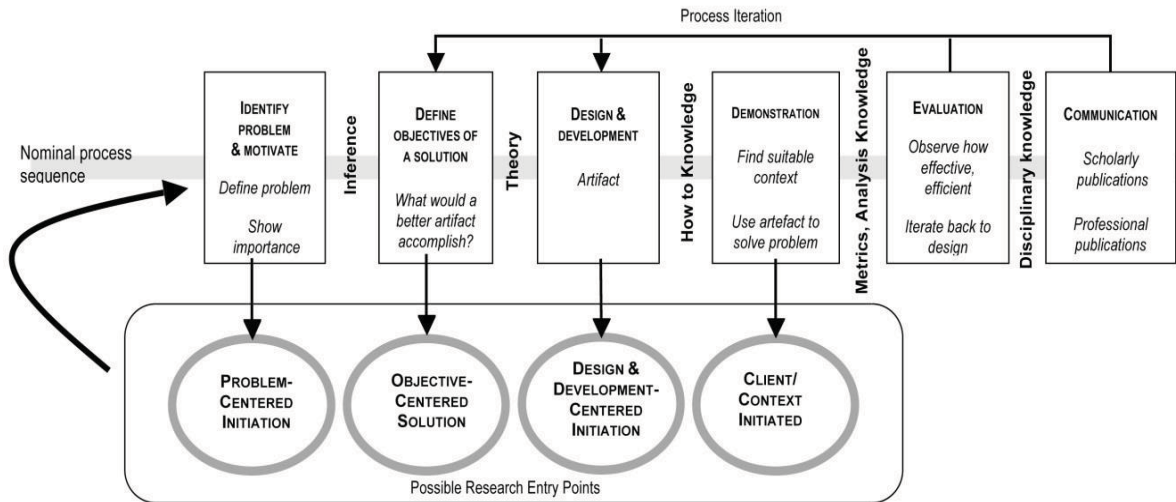


Figure 2.1: Design science research methodology (Peppers et al., 2007)

The third phase of DSRM is ‘design and development’ which includes the design, development and implementation of proposed solutions in the form of artefacts. In this phase, the architecture of the artefact, with its main functionalities and essential steps is provided (Peppers et al., 2007). Following the design and development phase, the demonstration of artefact to assess its ability to solve identified problem is verified in ‘demonstration’ phase of DSRM. This phase involves variety of activities for artefact demonstration which are case study, experimentation, simulation, and real-world testing for validating the basic underlying design principles of an artefact.

The fifth phase is referred as ‘Evaluation’ of artefact. This phase focuses on “*How well does artefact works?*”. Evaluation phase deals with the validation of artefact, by examining its’ behaviour, performance and effectiveness for solving the targeted problems in a particular environment (Hevner et al., 2004; Peppers et al., 2007). If the findings of evaluation phase are contrary to the expected results, the researchers can always return to the preceding phase (e.g. design and development phase), to modify the design of their artefact.

The last phase of DSRM is ‘communication phase’ which enables the researchers to document their research findings, importance of research problem and effectiveness of their proposed solutions. Researchers can also share their research findings, artefact with its utility, novelty and effectiveness for solving their identified problems in a particular field. Although, DSRM is well documented in previous literature; however, Laylavi (2017) claimed that there is no fixed starting point; hence, it can be modified according to the nature and type of identified research problem and research objectives.

This study has employed the modified DSRM approach, which is presented by Laylavi (2017). He has made some modifications in original DSRM to accommodate the research activities of DSRM in accordance with the context of Information System (IS) research. Laylavi’s (2017) modified DSRM has two initial phases (which are problem identification and objectives of the solution) merged into one phase named as ‘conceptual phase’. Then, the ‘design and development phase’ of DSRM divided into two phases which are ‘design phase’ and ‘development phase’. As similar to first phase ‘evaluation phase’ is also constructed by combining the two phases which are ‘demonstration and evaluation’ of the DSRM. The last phase of DSRM is ‘communication’ which is aimed to highlight the importance of documentation in the design science research (Laylavi, 2017; Peffers et al., 2012; Sam, 2016). Figure 2.2 illustrates the modified DSRM.

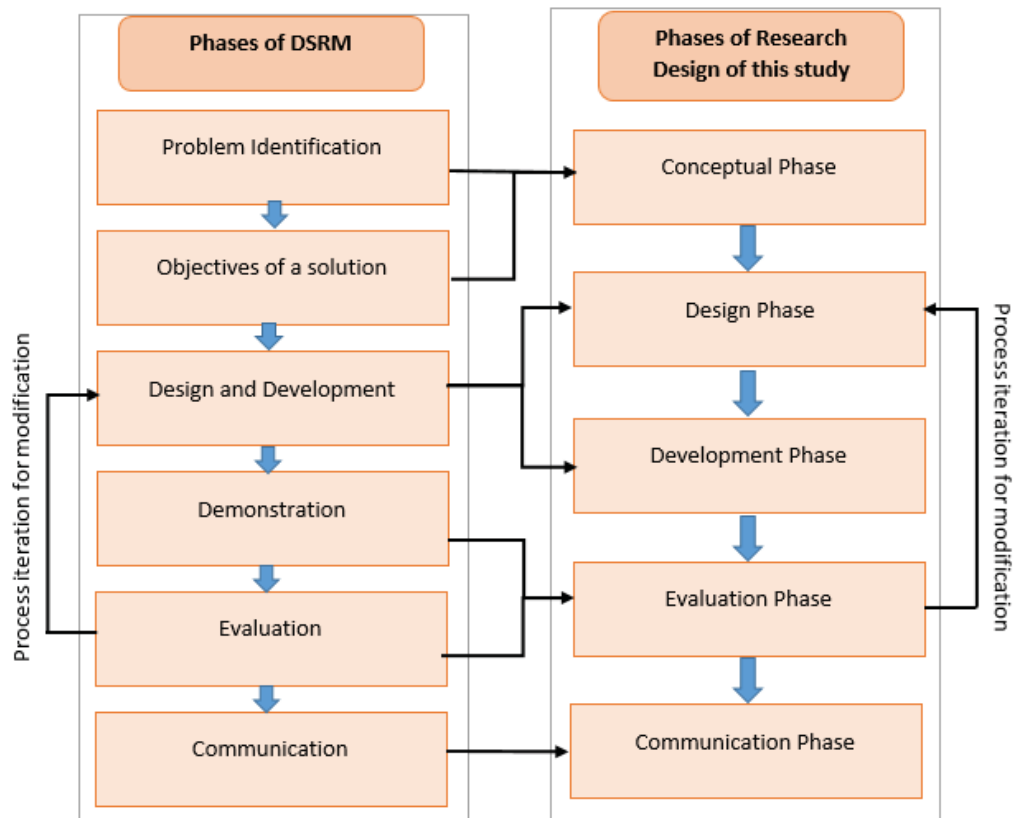


Figure 2.2: Adaptation of Design Science Research Methodology (Laylavi, 2017)

2.11 Evaluation Approaches

Literature review has revealed that design science research in information systems is generally performed for evaluating and validating the resulting artefact's performance, according to its' intended objectives (Gregor & Hevner, 2013; Peffers et al., 2012). Henver et al. (2004) have described that evaluation is an important phase in design science research, and researcher should strictly evaluate their artefact for its 'utility', 'quality' and 'efficacy'. For this purpose variety of evaluation methods and techniques are documented by various scholars e.g. Hevner et al. (2004); Venable et al. (2012); Peffers et al. (2012); and Myers and Venable (2014). Table 2.4 presents the list of evaluation methods from Hevner et al.(2004, p. 86).

Table 2.4: Evaluation Methods for Design Science Research (Hevner et al., 2004)

Evaluation Type	Methods and Techniques
Observational	Case Study: In-depth analysis of artefact in real environment Field Study: Monitoring the use of artefact in multiple real projects
Analytical	Static Analysis: Examine the structure of artefact for static qualities e.g., complexity Architecture Analysis: Check the fitness of an artefact into technical IS architecture Optimization: Demonstrate the inherent properties of artefact or provide optimality bounds on artefact behaviour Dynamic Analysis: Study the dynamic qualities of artefact such as performance
Experimental	Controlled Experiment: the study of an artefact in controlled environment such as usability Simulation: Execution of artefact with artificial data
Testing	Functional Testing: Execute artefact interface to determine failures and identify defects Structural Testing: Execute coverage testing of some metric (e.g., execution paths) in the artefact implementation
Descriptive	Informed Argument: Usage of base knowledge information (e.g., relevant research) to make a convincing argument for artefact's utility Scenarios: Construct scenarios around the artefact to demonstrate its utility

Different evaluation methods were selected to use in this study for instance: case study evaluation method is used for proposed framework evaluation; face validity evaluation method is used for proposed model which consists of two steps verification and validation. Verification is performed by using statistical measurements e.g., interrater reliability by using Cohen's Kappa, Chi square (χ^2) test of independence and goodness of fit for nominal variables' analysis. In Chi square (χ^2) test of independence, sample data is organized in a contingency table, where each column represents the categories of one nominal variable, and rows represent the categories of other nominal variables. Then the frequencies of each category of one nominal variable is compared with the categories of other nominal variable. For the evaluation of prototype system to validate its usability and effectiveness Partial Least Squares-Structural Equation Modelling (PLS-SEM) approach was used. The evaluation of

information system is performed by measuring its use, acceptance and success. However, “*acceptance is not equivalent to success*” (2008, p. 237) although, users’ acceptance of an information system is necessary for the prediction of its’ success (Petter et al., 2008). There are two types of theories found in literature 1) technology acceptance and use; and 2) information system success. The first kind of theories which are Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT) were used to measure beliefs and attitudes, which are concerned with the usage behavior of a specific technology, but not concerning with the beliefs and attitudes about particular object (e.g. the quality of an information system) (Wixom & Todd, 2005). On the other hand, information system success theory is proposed by DeLone and McLean (1992) to measure the success dimensions of information system which are based on the characteristics of an information system itself.

The technology acceptance and use theories (i.e. TAM and UTAUT) are often questioned, for scale reliability and validity especially when system is at experimental stage, as UTAUT scale is designed for ex-post facto research type, rather than experiential research type (Hellmuth, 2015). Therefore, this study employed information system success theory for the evaluation of prototype system. The following sub-section describes the information system success and social interaction theories, which were employed for the evaluation of prototype system developed in this study.

2.11.1 Information System Success Theory

DeLone and McLean developed the first information system success model in 1992, which consists of six variables that are system quality, information quality, user satisfaction, use, individual impact and organization impact (DeLone & McLean, 1992). They suggested that, these IS success dimensions are interrelated and have a casual interdependencies between

them. Later, after ten years DeLone and McLean (2003) revised their IS success model, based on various recommendations from research community. They proposed an extension of old IS success model, with 'service quality' in the context of e-commerce, they added intention to use, along with use variable. They argued that, sometime it is appropriate to measure users' attitude that is 'intention to use', instead of measuring users' behavior that is 'use' (DeLone & McLean, 2003). They also combined individual and organizational impact into one variable named as 'net benefits' (DeLone & McLean, 2003). Various scholars have validated this model; however, some have argued about the measurement issues and beneficiaries of the 'net benefit'. However, to date, this is widely accepted model to measure information system success in the field of IS research.

There are so many types of information systems and can be used in different contexts. IS success model has been widely adopted to measure IS success in specific environment. There are some studies, which have proposed IS success measurement of e-learning systems (Balaban et al., 2013; Lin, 2007), open source systems (Lee & Lee, 2012), e-government systems (Wang & Liao, 2008), internet banking systems (Koo et al., 2013) etc. However, all of them have generally adapted their measures and constructs from previous studies or they have integrated different concepts from other theories, based on the purpose of their study, but they have not considered the system type, core/novel functionality and scope of their information system (Gable et al., 2008; Petter et al., 2008).

In addition to this, because of rapid development of innovative technological solutions and changing technological environment it is important to revalidate the revised IS success model, to assess the success dimensions of a specific system, while considering the system type and scope as well. Although, there are several studies that used IS success model to assess the success of e-learning system however, none of them could be applied to

collaborative learning information system. These studies demonstrate significant level of correlation between all constructs of model have been established which shows that interrelationship of all constructs is crucial for measuring the success of online learning systems. As the purpose of using updated IS success model in this study is the evaluation of prototype system which is a type of computer supported co-operative reflection system. In this context, assessing the impact of functional and social functionalities of collaborative learning system on system use and user satisfaction is necessary.

2.11.2 Social Interaction Theory

In order to have effective learning experience in computer supported collaborative learning (CSCL) environments, Kreijns and Kirschner (2004) have highlighted the need of sociable CSCL systems, which encompasses its both educational and social functionalities. There are three important factors, which influence the development of social interaction in CSCL system that are sociability, social presence and pedagogical techniques (Kreijns et al., 2007). Sociability is defined as the ability of the CSCL system to enable the emergence of a social space, which can support meaningful social interaction for collaborative learning in groups (Kreijns et al., 2007).

Sociability is considered as an important attribute of CSCL system as it represents various social aspects (Kreijns & Kirschner, 2004). Sociability is defined as the extent to which CSCL system facilitates effective social interaction to support socioemotional aspect of group learning, which leads to the emergence of a sound social space; which is characterized by robust interpersonal relationships, sense of online community and trustworthiness (Kreijns et al., 2007). The sociability is also determined by the social affordance, which is often regarded as a noticeable characteristic of system (tool), which facilitates social interaction. According to Kreijns et al. (2013), the CSCL system can be more sociable, if it

can facilitate better social interactions, which in turn influences overall group learning outcomes. It can be said that some technologies such as social network sites are more sociable, than learning management systems, such as Moodle and Blackboard. Therefore, academicians and developers should design CSCL systems with both educational and social functionalities to perform as a sociable collaborative learning environment.

The second component is social presence which is also considered important for a sociable CSCL system. Social presence is defined by Kreijns et al. (2003) as a quality of communication medium, with its' capability to transfer verbal and non-verbal cues for communicating socio-emotional information, and which is perceived by users as a real mode of communication. According to Brown et al. (2010) different technologies offer different levels of social presence (e.g. video conferencing offers high level of social presence, as compare to computer mediated text communication/chat).

Various scholars (Gunawardena & Zittle, 1997; Kreijns et al., 2014; Tu & McIsaac, 2002) have asserted that social presence is not only about quality of communication medium (tool) only, but it also refers to the users' perception of medium as well. In this context Kreijns *et al* (2007) and Yamada and Goda (2012) have claimed that, providing interactivity support through tools does not means that social presence will occur. They stated that it is also important to give attention to other factors (e.g. learners, instructors and content etc.) of role and needs of people who are involved in a collaborative learning environment for social interaction. Although, technological affordance in CSCL system is also essential for building connectivity and interaction, since social interaction is impossible without it but not sufficient for affective learning alone.

Various researchers have suggested the development of sociable collaborative learning system and sense of learning community are key factors to supporting collaborative learning

and knowledge-building process (Brown et al., 2010; Kreijns et al., 2003). They also determined that ‘users’ perception of the communication medium’ can be cultured by the construction of a conducive collaborative learning systems. According to Brown et al. (2010) collaborative learning technologies have socially derived characteristics e.g. “*social presence and immediacy of feedback*” (2010, p. 19) and these characteristics may influence the user adoption and use behaviors. Although, perceptions of these characteristics are different from user to user, but still these perceptions are based on their knowledge and skills. Various scholars have emphasized on the quality of sociability in a CSCL system, which enriches its overall social interaction and might have impact on system usage behavior (Gao et al., 2010; Junglas et al., 2013; Kreijns et al., 2007; Kreijns & Kirschner, 2018; Yamada et al., 2016). They have defined interactivity as the capability of a technology to establish a two way connection between participants for exchanging text, audio, video and graphical information etc.

Based on the above discussion, the concept of sociability has been identified as a technological quality of the computer supported collaborative learning (CSCL) system and it is therefore, also termed as socio-technological system (Gao et al., 2010). In this context, sociability quality of a CSCL system can be enriched, by carefully designing and implementing CSCL system, with the tangible technological components, which can facilitate the overall effective social interaction process. The computer supported collaborative learning system can stimulate a socioemotional interaction in the group learning, by assessing the extent, to which a technological component offers a meaningful and satisfactory social interaction (Kreijns et al., 2013). Therefore, this study argues that sociability is an important component in CSCL system, and it has a growing influence on the technology use and users’ satisfaction. In addition, on the base of aforementioned

discussion, this study is righteous to claim that, the concept of sociability and effective social interaction, which is also influenced by technology use in CSCL system needs to be explored in more details.

2.12 Summary

This chapter reviewed the concept of service learning with its theoretical frameworks. A critical review of previous service learning frameworks and important role of ICT in service learning pedagogy and in traditional education system is also presented in this chapter. The potential role of experiential learning (e.g. service learning) in higher education, along with the reference of Malaysia's higher education context is also presented. This chapter also presented the concept of reflection, which is one of the important components of service learning. Particularly, collaborative reflection and review of technology support for service learning is also presented in this chapter. A critical review of current reflection models is also provided to assess their limitations and gap for further research, which relates with the overall co-operative reflection process.

In order to understand the potential role of ICT in service learning, major gap is the lack of a standard framework, which shows the technology support layer for different phases of service learning. In addition to this, no previous (collaborative reflection) model was found, which could describe the process of knowledge-building through collaborative reflection.

Furthermore, existing technologies offer limited functionalities to conduct co-operative reflection in a controlled environment, to assess students' learning from their overall service learning experience. Then, the introduction of design science research with its theoretical foundation and its applicability for information system research was presented.

This chapter has reviewed the technology acceptance and success theories, which can be used for the evaluation of information system. In addition, the theoretical foundation of new

success dimension was also presented in this chapter which is explored to contribute to the IS success model, for computer supported collaborative learning systems. The adapted IS success model determines the success dimensions of computer supported collaborative learning systems, which is used to examine the success of information systems in real environment.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

The extant literature on the subject matter, background of identified research problem and critical review of existing approaches were presented in the previous chapter. In order to address the research problem and to achieve research objectives, design science research methodology (DSRM) is employed in this study, because it offers a practical approach for investigating the adoption of ICT in service learning programs.

This chapter intends to explain the research framework and process used for conducting this study. One of the main objectives of this chapter is to describe the suitability of modified design science research methodology for this study. This is followed by, overall research design of this study, along with discussion of adopted data collection and evaluation methods. Finally, this chapter presents detailed justification for the selection of design science research methodology for this study to achieve the research objectives and to address the research questions stated in Chapter 1. The assessment of adopted research methodology in terms of how this research work meets the requirements of good design science research in information systems is also discussed in this chapter.

3.2 Research Framework

In order to achieve the objectives of this study, a research framework was designed which presents a broader picture of research methods used in this study. The proposed research framework is presented in Figure 3.1, which was developed on the base of research problem's context, questions and objectives which are already discussed in the Chapter 1.

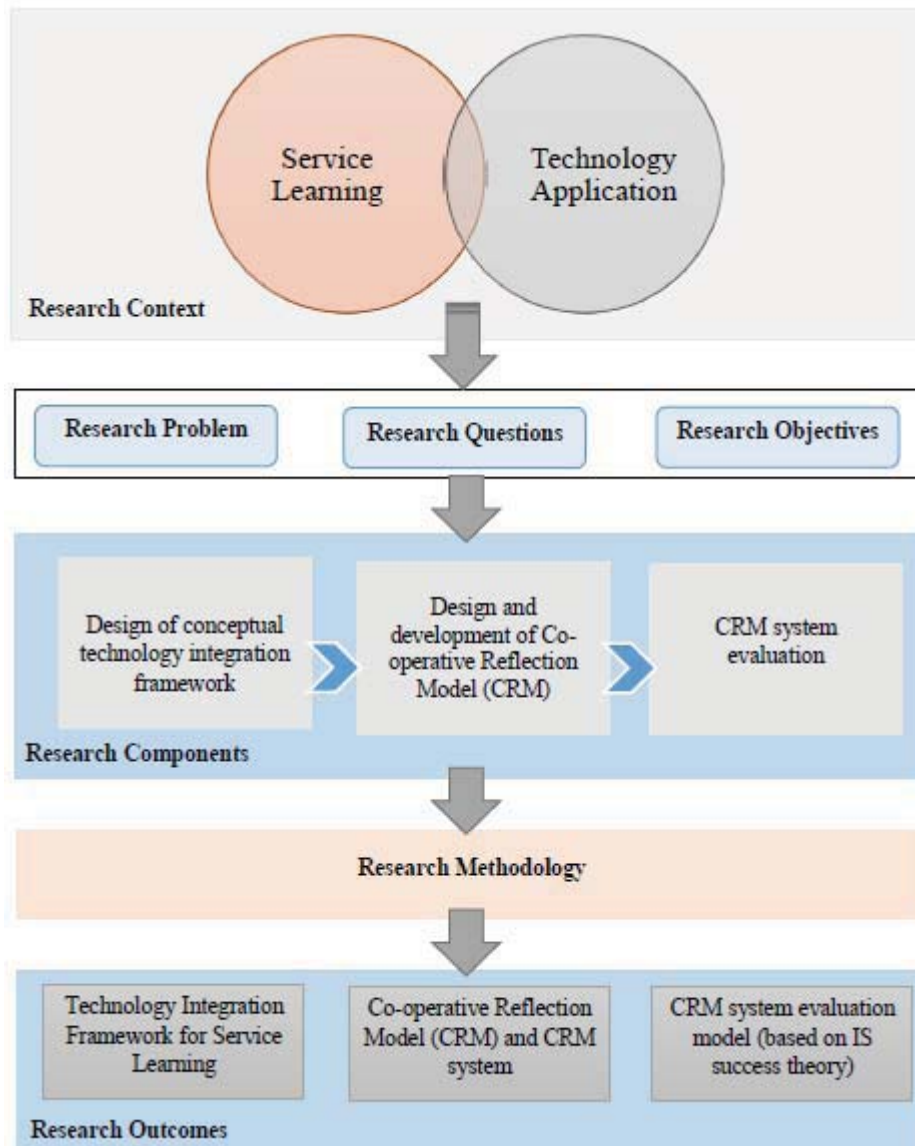


Figure 3.1: Research Framework

3.3 Research Process for this Study

Research methodology provides a fundamental structure for any scientific work. It is pertinent to note that developing a clear research methodology is a vital pre-requisite for achieving any research objectives. According to Checkland (1981), a research design is a collection of research methods, which are governed by a set of principles, with underpinning philosophy for finding solutions of identified research problems. According to Hevner and Chatterjee (2010) research methodology precisely explains how to design a research process

for achieving particular objectives of a research study, and it also provides justification for the selection of a specific research method. Design Science Research Methodology (DSRM) was adopted for this study, which is an extensively used methodology in Information Systems (IS) research (Arora, 2009; Md-Ali, 2013; Mokko Ahonen, 2011; Peacock, 2012; Samardzija, 2016). The main objective of this design science research methodology is to create new knowledge from research by designing new and innovative artefacts (Hevner et al., 2004; Hevner & Chatterjee, 2010). The introduction of the design science research methodology, its theoretical basis and its applicability in information systems research is outlined in previous chapter.

This study has employed the modified Design Science Research Methodology (DSRM), proposed by Laylavi (2017) as depicted in previous chapter (see Figure 2.2), which includes five major phases. This study has synthesized these five phases to fit with the research context of this study. The research process used for this study and its logical relationship with research objectives of this study is demonstrated in Figure 3.2. This research process, beginning with the conceptualization phase for collection of research requirements and thorough review of previous studies to ensure theoretical gap. After confirmation of theoretical gap next phase is the design of a proposed solution for earlier identified problems, in the form of artefacts, followed by the development phase, evaluation phase, and communication phase. Next section continues with the description of all phases in detail, along with the methods and techniques selected to be employed in this study.

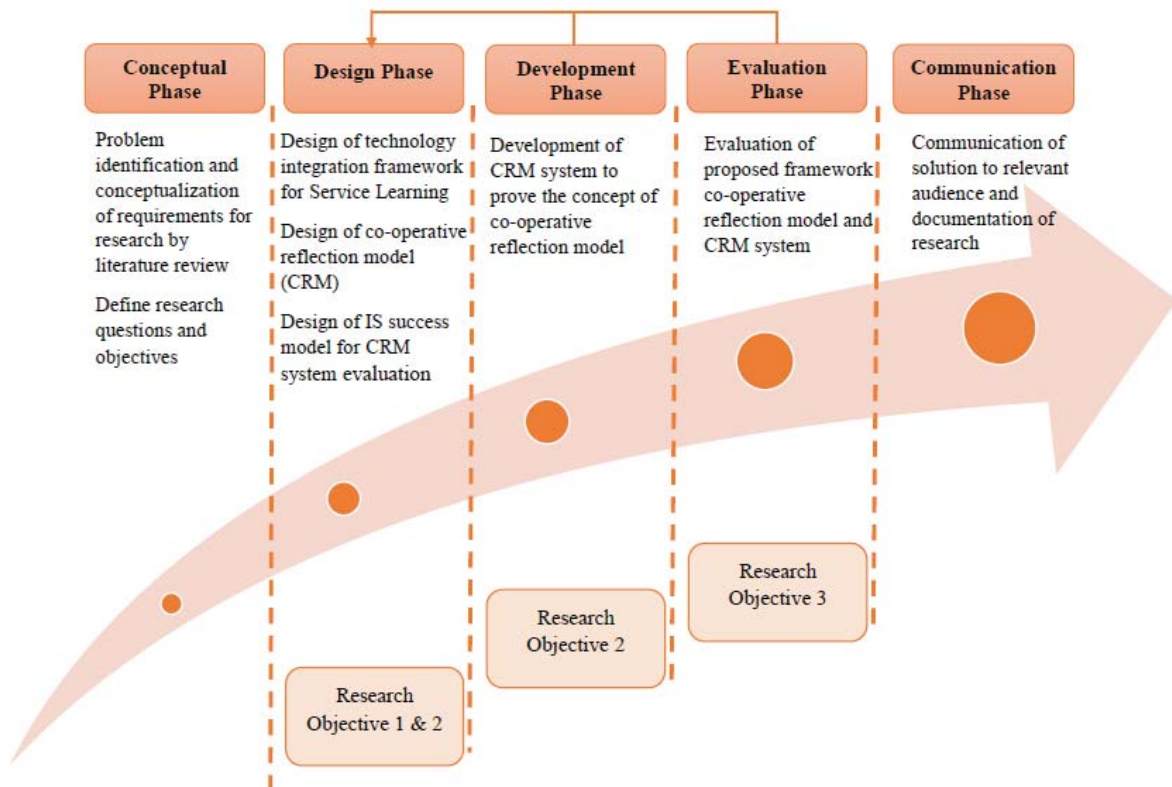


Figure 3.2: Research Process and its Connection with Research Objectives

3.3.1 Conceptual Phase

First phase of this research design is conceptual phase, which investigates the fundamental theories and the requirements for the integration of Information and Communication Technology (ICT) in the of context service learning pedagogy. Several activities are performed by researcher to establish a knowledge base for this research, these activities are as follows:

- An extensive review of literature has been carried out to establish the knowledge base and to identify the research problems in the domain of service learning and technology support. The critical review of literature has highlighted the potential role of ICT for experiential learning in general, and for service learning in particular. Literature review is performed to investigate the current service learning frameworks, reflection models and their limitations. The effective utilization of ICT

in traditional education system and online education system is also well documented. However, there is a lack of research in the field of service learning from its' technological perspective. A wide variety of information resources was utilized e.g. journals, books, conference proceedings, university material, governmental publications, and other internet resources for conducting a comprehensive literature review in the identified research domain.

- The investigation of the important factors, which can affect the technology integration in service learning and underlying theories for developing a technology integration framework (which is the major objective of this study). The critical analysis of previous service learning frameworks and ICT utilization in different phases of service learning projects, is expected to help in the development of knowledge base for designing an artifact of this study. By identifying the potential use of current technologies in service learning, and by highlighting the limited technology support for particular phases of service learning, this study is expected to help in implementing the possible IT solutions for information system research.
- The identification and verification of theoretical gap, the output of conceptual phase recognizes two major challenges regarding adoption and use of ICT in service learning pedagogy by determining the capabilities of current tools and technologies. First problem is referred as the lack of knowledge of technology integration in service learning and possible factors, which can influence technology integration process. A recent study by Doyle (2016) have reported the effective use of advanced technologies for teaching and learning in higher education. In this context, various scholars have agreed that, advance technologies have positive impact on experiential

learning pedagogies, such as service learning in the context of this study (Donnelly, 2006; Md-Ali, 2013; Rutti et al., 2016; Turnley, 2007).

In addition to this, another research gap is related to reflection, it is about the design of structured co-operative reflection model, which is aimed to view its' outcomes from students' overall learning perspective. Technology support for co-operative reflection is assessed in a research setting, where a large number of students are enrolled in service learning course. Besides that, the literature review has also informed that previous reflection models are only suitable for assessing individual reflection, particularly in the context of service learning, as outlined in the Chapter 2.

3.3.2 Design Phase

The design phase of this study elaborates the overall design of proposed artefacts, which is based on the knowledge synthesized during the conceptualization phase. Previous theories, concepts and methods were adapted, or new methods were developed (if not existed earlier) to create a newly proposed design of artefacts to accomplish the previously outlines research objectives of this study. Through logical integration and linkage of existing theories and methods, three artefacts were designed in this research which are 1) technology integration framework for service learning, 2) co-operative reflection model along with a prototype system, for validating the concept of proposed model, 3) IS Success model is extended to assess the usability and success of prototype system developed for this study.

- The first artefact of this study is technology integration framework, which comprises of three components which are 1) common phases along with sub-activities for service learning implementation, 2) technology integration layer for all these phases and 3) service learning stakeholders' (which are administration, faculty, students and

community) involvement patterns. Chapter 4 presents a detailed overview of technology integration framework to address the first and major research objective of this study (see Figure 3.2).

- As discussed in Chapter 2, the existing reflection models, specifically in the domain of service learning are not sound enough to support the structured co-operative reflection. Furthermore, very limited technological resources are available to facilitate a structured co-operative reflection. Therefore, second artifact of this study is co-operative reflection model (CRM) for supporting collaborative critical thinking and knowledge-building process. A prototype system was also developed to prove and validate the concepts CRM. The detailed description of co-operative reflection model and implementation of prototype system is presented in Chapter 5, which addresses the second research objective of this study.
- An extended IS success model was also proposed for the evaluation of prototype system, which directly addresses the third objective of this study. Next section outlines the development phase of the prototype developed for this study.

3.3.3 Development Phase

In this phase, CRM system (that is a computer supported co-operative reflection system) was developed for validating the proposed concept of CRM (see Chapter 5 for proposed model). The development of prototype system is also associated with the second major objective of this study. Development phase is crucial part of design science research methodology, which is used to validate and communicate the design and its' fundamental concepts through a prototype development (Peffer et al., 2012). In this regard, Sommerville (2011) claims that prototyping of designed artefact helps researchers, to see how well system is performing in the context of a specific problem. Additionally, prototyping of designed artefact is also

useful for assessing its strengths and weaknesses. This approach can help researchers to explore new system requirements for imparting improvements in their proposed models.

In the field of tools and technology development, there are some other methodologies such as system development model, and prototyping process model etc. which can be used as sub-processes in the development phase of design science research (Sam, 2016). As Olfat (2013, p. 102) describes a prototyping methodology which includes, system design according to the proposed artefact, development of system architecture, analysis of system design, and finally implementation of prototype by utilizing appropriate technologies. In this context, prototype development starts with the identification of the system objectives and determination of its' type. As mentioned earlier, the main objective of prototype implementation is to validate the concept of CRM. After the clarification of systems' objectives, its' functionalities are specified according to the users' requirements. The identification of system functionalities leads to the formation of system architecture, which demonstrates the system modularization.

3.3.3.1 System Functionalities

The implementation of CRM system has offered various functionalities, which are considered essential for conducting the structured co-operative reflection. Also, the CRM system is also aimed to help students in the implication of interaction process to ensure the element of transparency in their collaborative critical thinking and knowledge-building process. This prototype is particularly designed and developed for reflective learning. Furthermore, it offers three-fold environment for collaborative reflection, which ensures inter-group communication and project progress monitoring as well to monitor students' progress while working on remote places. The following functionalities are determined to validate the fundamental concepts of CRM, through the implementation of CRM system:

1. The Prototype should have the option of creating (service learning) projects on teacher side, and on the other side users (students) can select the projects, based on their interest in any specific domain. It should also have the option of managing and processing the students' requests, based on their project requirements.
2. The prototype should have the option of preparing the reflection outcomes, according to desired reflection type (that is co-operative or individual) and it should provide scaffolding for students by arranging reflection prompt questions.
3. The prototype should provide a self-regulated reflection window, where students can keep the record of updates about their project progress, and later they can reflect on it collaboratively. On the other hand, teachers can monitor each project's progress by following participants' activities and reflective learning simultaneously.
4. The prototype should provide inter-group communication environment, for each group, which is being monitored by the course instructors. It should provide support for teacher/student initiated reflection activities.
5. The prototype should allow teachers to conduct both collaborative and individual reflection activities for service learning projects
6. The prototype should provide structured co-operative reflection environment, where students reflect individually first and can share with other group members. However, at a later stage prototype should integrate all responses and should present them in the form of a single integrated window for facilitating overall co-operative reflection process. This option allows for the dialogical interaction to perform collaborative reflection. The idea of structured co-operative reflection is developed on the base of reflection prompt questions, which are specifically designed to support the process

and the practice of drawing conclusions on co-operative reflection activity for building collective knowledge regarding the selected projects.

7. The current version of prototype system presents results for individual reflection only; however, the assessment of co-operative reflection is performed manually, because it requires detailed content analysis, which is performed by using various coding schemes.

In information system design research, the design of proposed artefact is validated through its prototype implementation (Doyle, 2016; Peffers et al., 2012, p. 403). However, sometimes it is not feasible to implement a prototype, for instance in this study the development and demonstration of one prototype for evaluating whole technology integration framework was not possible, because of strict time constraints, limited financial and technological resources. Therefore, a prototype was developed for only one part of the proposed framework, along with the implementation of the concepts presented in the proposed co-operative reflection model.

Next section presents a detailed description of evaluation methods adopted for the validation of the artefacts proposed in this study. It is important to note that, in design science research the evaluation of one artefact is done on the base of development and implementation of other artefacts. For example, the CRM is validated with the development and demonstration of a prototype, and the prototype system is itself validated by assessing its utility and effectiveness in the context of a specific scenario, which was conducted by employing extended IS Success model.

3.3.4 Evaluation Phase

As discussed earlier, the evaluation phase encompasses demonstration and evaluation of artefacts. Demonstration of an artefact is essential for assessing its utility (through case

study, simulation, experiments or other suitable methods), and for analyzing whether the proposed solution actually works to solve the identified problems (Peppers et al., 2007). Although demonstration phase is considered an independent phase in DSRM; however, in this study these two phases (demonstration and evaluation) are merged together for evaluating the performance and feasibility of proposed artefacts (see Figure 3.2). Hence, the evaluation phase of this study first performs the demonstration to assess the proposed solution's utility in the real life environment (which is prototype system testing with real-world users). Secondly, formal validation and verification of proposed artefacts was performed to assess its performance and success. As discussed earlier in the design phase, this study contains three design artefacts; therefore, evaluation of each artefact was performed individually:

1. The viability and feasibility of proposed technology integration framework is verified by employing case study method approach. Case study is an observational evaluation method (Hevner et al., 2004) and it is considered an appropriate approach for computer science and information technology research to explore complex problems in the natural context (Dresch et al., 2015).
2. The second artefact of this study (that is CRM) is assessed by using face validity method, which involves experts' opinion, and through a prototype development for assessing the validity of fundamental concepts of proposed model.
3. Then, the overall effectiveness and utility of prototype is also demonstrated in real scenario, which is evaluated by employing an extended IS success model for assessing the success (that is actual use of prototype by users) of proposed prototype system. Following sub-section presents the details of evaluation methods used for each design artifact of this study.

3.3.4.1 Evaluation of Proposed Technology Integration Framework

As discussed earlier in the evaluation techniques outlined in Chapter 2, Table 2.4, the evaluation of technology integration framework is performed by using case study method. The main objective for the selection of case study method is the demonstration and in-depth validation of technology integration framework in a real-world context. In a recent study, Runeson and Host (2009) have reported that, the case study method is more suitable for design science research, primarily in the context of information system and software engineering research, because such studies are developed on the base of contemporary phenomenon and artefacts. It is pertinent to mention that technology related objects and artefacts are quite difficult to assess in isolation. Furthermore, Runeson and Host (2009) have also described five steps for case study method which are design case study, preparation of data collection, gather evidence, analysis of data and reporting. Hevner et al. (2004) also stated that, case study is one of the most effective approaches for the demonstration and evaluation of frameworks in a real-world environment. Considering the guidelines of case study research method by Runeson and Host (2009) this study was started with the selection and design of a case study, details of which are presented in the Chapter 4. Data collected during framework evaluation was then analyzed for its reliability, feasibility and validity for intended purpose (see Chapter 4). Further details of data collection procedure and questionnaire design for the evaluation of proposed framework are as following:

3.3.4.1.1 Data Collection Procedures

For the evaluation of proposed framework mixed method explanatory case study design was employed. For this purpose, two types of data collection methods were used which are 1) online questionnaire and 2) semi-structured interviews. Yin (2003) has reported that interviews in case study method are a good tool for assessing participant's individual

experience in the real-world scenario. Semi-structured interviews also offer an in-depth understanding about a specific situation. On the other hand, self-reported survey instrument was used to gain broader insights of the subject matter under study.

Therefore, as a part of case study research design, an online self-reported survey based questionnaire was designed for collecting data from selected respondents (see Appendix-1). The questionnaire used in this study contained three main sections. The first section was about demographic information and also asked some questions about the participants' involvement and nature of their role in the service learning program. The second section consisted of questions regarding to the first component of our proposed framework (that is identification of common phases for service learning implementation) of this study. These questions were adapted from standard service learning toolkit proposed by Billig (2011) and comprehensive action plan for service learning, which was developed by Bringle and Hatcher (1996, 1995b). The third section of questionnaire comprised of questions related to ICT use in different phases of service learning. This section was organized separately for each phase of service learning, and its' items were adapted from a recent study by Ghavifekr et al. (2015). The main reason behind grouping questions according to each phase is highlighting the role of ICT in different phases of service learning. A five-point Likert type scale was used for assessing the participants' level of agreement for every statement involved in the questionnaire. The selection of this scale is justified by its nature of generalizability and applicability, which is also reported in most of the previous studies from where questionnaire items were adapted for developing our survey instrument. Initially our survey instrument (questionnaire) was internally evaluated, against the objectives of this study (which is evaluation of proposed framework) with the help of senior academicians and experts (service learning team) in the field of service learning. The purpose of this activity

was to determine the suitability of questionnaire, and to avoid ambiguity of words and sentences, which may lead to misunderstanding of participants, if not dealt with prior care and caution.

In addition to this, semi-structured interviews were also conducted with eleven service learning experts, to learn about their personal experiences and for the clarification of service learning implementation process and technology integration. The interview instrument was designed with the help of specific pre-decided questions, which were relevant to the basic components of proposed framework. This activity helped researcher to understand the role of each participant involved in the service learning project (e.g. service learning program coordinator is responsible for activities included in planning and preparation phase). Likewise, course instructor is responsible for course design, reflection and assessment phase. The selected method supports researcher to collect data from each participant (service learning team and students) individually, regarding their views about the application and success of ICT, according to their role and participation in each phase of service learning project.

3.3.4.1.2 Data Analysis Method for Framework

Yin (2003), Marshall and Rossman (2014) define data analysis process as examining, structuring, clarifying and interpreting the huge amount of collected data. Furthermore, Aaker and Jacobson (2001) have noted that the incorrect conversion of raw data in the form of statistical coding effects the quality of results and interpretation of these results.

Therefore, two types of data collection methods (which are self-administered survey and semi-structured interviews) were employed for the evaluation of our proposed framework, which was analyzed independently. The data was collected through self-administered survey based questionnaire, and findings were assessed separately in each section of questionnaire,

for an in-depth descriptive analysis. In addition to this, qualitative data (which was collected as a result of semi-structured interviews) was analyzed by using a thematic analysis method. These steps were deemed necessary for achieving the overarching objective of this study, to evaluate the proposed framework, which consist of three major and distinct components. Therefore, data analysis was organized accordingly.

3.3.4.2 Evaluation of Proposed Co-operative Reflection Model (CRM)

In order to evaluate proposed CRM (that is second design artefact of this study) face validity evaluation method is adopted (Sam, 2016). It involves two steps, which are 1) demonstration of prototype system in real-world environment for verification and 2) validation of proposed model. Model verification through experts' opinion confirms its usefulness, credibility for defining the degree to which model reasonably presents real-world scenario for co-operative reflection, completeness and correctness for intended purposes. Whereas, validation ensures model success, effectiveness and usability in real-world environment with actual users, which is discussed in Section 3.3.4.3.

There are different verification strategies, which are proposed in previous literature for evaluating the performance of a selected artefact e.g. 1) simulation, 2) parameters analysis, 3) analytical modeling 3) empirical evaluation etc. (Laylavi, 2017; Sam, 2016). For the purpose of this study, content analysis method is selected for analyzing the co-operative reflection tasks performed by the participants. Content analysis method is also useful for understanding the output of collaborative critical thinking and knowledge-building process. According to Prilla et al. (2015) content analysis is an effective and common method, which is often employed for understanding group learning behaviors and communication patterns in computer supported collaborative work. Furthermore, predefined parameters and coding schemes for performing content analysis of this study were adapted from various previous

studies from relevant literature (Prilla et al., 2015). The main reason for the selection of this method is inability of previous models to provide comparable data, which can match the logical connections proposed in this study. Therefore, face validity method employs experts' opinion, which offers a suitable and thorough way of verifying the logical connections and usefulness for intended objectives.

3.3.4.2.1 Data Collection Procedures

The verification of CRM consists of three steps, which are 1) coding scheme selection, 2) experts' selection and 3) case selection (data collection). For content analysis, there is a need of coding scheme or model for which contents are to be analyzed. In a recent study, Prilla et al. (2015) have proposed a coding scheme for assessing the collaborative/co-operative reflection, which includes describing experience, referring to experiences, sharing thoughts and creating results. Besides that, Hou and Wu (2011) and Rodriguez (2014) have described a three stage model for the analysis of collaborative knowledge-building in online communication projects, which includes academic related, task coordination and social interaction activities. This study has adapted, these two coding schemes for content analysis, which will fulfil the requirements of proposed co-operative reflection model in a suitable manner. Based on the core steps involved in our proposed model, we have adapted above mentioned coding schemes, which contain four levels of activities for collaborative reflection, and three levels for collaborative knowledge-building process (see Appendix-2). Second step is experts' selection, for content analysis, which is important for validating our proposed model. For this purpose, national (Universiti Teknologi Malaysia) and international (Cornell University USA) service learning experts were selected, on the base of their overall experience in the field of service learning pedagogy. Face to face meetings were conducted with each expert. Purpose of these meetings was to explore their personal

views, beliefs and real life experiences regarding their service learning courses and reflection activities.

Finally, the data collection process was performed with much care. For this purpose, data were carefully retrieved from the database, which recorded users' data through experiments in real life, while implementation of our prototype system. These data serve as an output for group reflection assignments, which were performed during the testing phase of our prototype system, where participants were voluntarily invited to participate in various activities and workshops. For this purpose, three cases from group reflection activities were selected to assess the collaborative critical thinking and knowledge-building process of students. It is important to mention, that three main reasons for the selection of only three cases are as following: 1) we have selected each case from two types of projects (which are product development and training) to avoid redundancy in the data and to examine student collaborative reflective thinking and knowledge-building process in a distinct way, 2) completeness of co-operative reflection activity, where users followed all steps involved in a service learning project, and 3) insufficient human resources (expertise) to assist in data coding process, which is important for assessing the co-operative reflection data for achieving the intended objectives of this study.

3.3.4.2.2 Data Analysis Methods for CRM

The data analysis process begins with inter-rater reliability check, which is performed for calculating percentage agreement between two raters for a given coding scheme. Cohen's Kappa is also used for this purpose, which is one of the most widely used statistical method for calculating inter-rater reliability (Rodriguez, 2014). It is helpful in identifying any outliers or if any agreement has occurred by chance (Rodriguez, 2014). According to Hennessy et al. (2016) inter-rater reliability is considered an important element for content

analysis, and it also presents an indication of the stability and reproducibility of a study. In this study, whole message is considered as a unit of analysis, instead of a single sentence or paragraph. Although, there is a possibility that, one complete message may contain more than one indicator. Therefore, this issue was addressed by coding the messages according to the dominance of their evidence in any particular message.

Literature review has offered different interpretations regarding the acceptance level of Cohen's Kappa value for inter-rater reliability. According to Landis and Koch (1977), the threshold value of Cohen's Kappa coefficient is "*0-.20 slight, .21-.40 fair, .41-.60 moderate, .61-.80 substantial, and .81-1.00 perfect*" (1977, p. 165). A study by Prilla et al. (2015) has assessed the presence of collaborative reflection in online discussion forums, they have reported an average of 0.91 as a value of inter-rater reliability. They have argued that, a higher inter-rater reliability value can be achieved, by improving the skills of coders through proper training and guidance sessions.

Furthermore, data was analyzed to determine the levels of reflective thinking and evidence of knowledge-building by using descriptive statistics. In order, to determine whether the sub-categories of each code level are equally distributed, and to assess the significant difference between observed and expected values, Chi square (χ^2) Goodness of fit test was also conducted. It is a non-parametric test, aimed to explain, how well theoretical distribution fits with the empirical distribution.

In order to assess the significance of association between co-operative reflection and knowledge-building, crosstab Chi square (χ^2) test of independence was also employed. This statistical measure was used to determine the relationship or association between two nominal variables. Along with this, the strength of association was also determined by using Phi and Cramer's V coefficients. The Phi and Cramer's V were assessed by adjusting the chi

square significance to factor out sample size. As per the rule of thumb, Phi and Cramer's V value close to 1 determines a strong relationship and close to 0 determines a weak relationship between two nominal variables. In both types of Chi Square tests, the process begins by setting up hypothesis, and then results are reported according to the hypothesis testing. In order to perform hypothesis testing, Chi Square test of independence is computed and compared with critical value, and this value is determined through level of significance and degrees of freedom. If the observed χ^2 value is higher than the critical value, the null hypothesis will be rejected. In this study, SPSS statistical software is used to perform above mentioned statistical assessments.

3.3.4.3 Evaluation of CRM System

This section presents CRM system's validation, which is performed through various experiments in real environment, with actual users, to assess its usability and effectiveness for intended purposes, for which this CRM system was developed. For this purpose, a well-known information system success theory was used to assess the success of proposed system, in a real world scenario. For this purpose, updated information system success model was adapted to measure the usability, effectiveness and success of CRM system.

As stated earlier, the demonstration and evaluation, both are regarded as interconnected activities in DSRM; however, the demonstration of an artefact informs 'it works or not' on the other hand evaluation determines the performance and effectiveness of artefact, and helps in assessing that 'how well it works' in a particular context. The testing of CRM system is done in workshop, with actual users, which is also referred as the demonstration of an artifact. However, evaluation of the system is done by forming the analysis of data, which is collected through self-administered questionnaires, during the workshop. For this purpose,

a questionnaire was designed using IS success dimensions proposed by DeLone and McLean (2003).

The evaluation criteria for CRM system is its usability and effectiveness in a real world environment with its' target users. The performance and efficiency of prototype for its intended objectives, for which it was developed (for example in this study prototype is developed for structured co-operative reflection) is also critical. According to Hevner et al. (2004) and Peffers et al. (2012) validation of prototype system is determined on the base of its utility, quality and efficacy to achieve the intended objectives, for which a system was developed initially.

3.3.4.3.1 Research Evaluation Setting

As mentioned earlier, CRM system was implemented to assess and validate the fundamental underlying concepts of our proposed co-operative reflection model. However, the main aim of CRM system evaluation is to assess its efficiency, utility and effectiveness in a real environment for proposed purposes. In this context, participants of service learning program in the Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak (UNIMAS), are the target population for this study. For the purpose of CRM system evaluation, workshops were conducted, where participants who participated in at least one service learning course were voluntarily invited. These workshops were particularly organized to assess the usability and effectiveness of CRM system for co-operative reflection activities, for which it was implemented. Here, it is pertinent to highlight that, convenience sampling method was employed, which is suitable for this research. This convenience sampling method was employed, because the researcher required particular segment of population who had service learning experience, and that they could be easily available for system testing and giving responses through self-administered questionnaire, which were

distributed at the time of data collection for this study. Pertaining to this, Aaker and Jacobson (2001) and Kothari (2004) have recommended the use of convenience sampling approach for conducting exploratory studies. Besides that, they have acknowledged that, various scholars prefer to use convenience sampling approach, because it is less expensive, and it is comparatively less difficult. According to Hellmuth (2015), convenience sampling technique can be employed for experimental research design, where newly implemented prototype system's testing and evaluation are performed.

3.3.4.3.2 Sample Size and Data Collection Procedure

In quantitative research, the selection of right sample size is a very crucial task. According to Bryman and Bell (2011) the determination of sample size depends on several factors, such as: time, cost, heterogeneity of population, distinction among complete and relative sample sizes and the nature of study. When using the Partial Least Square method, Hair et al. (2017, p. 20) have suggested the use of the "ten times rule" where the minimum sample size must be ten times larger than the number of pointing arrows towards any endogenous (dependent) variable in a structural model. They argued that Partial Least Square-Structural Equation Modelling (PLS-SEM) have ability of high efficiency, when sample size is comparatively low; hence, this ten-time rule is more sufficient for PLS-SEM method.

This study aims at selecting the sample size which signifies the complete target population. Here it is important to note that, in this study the selection of sample is also influenced by maturity of prototype system, as it is not feasible to test first version of the system at commercial level. According to the guidelines of Chin and Newsted (1999), and Hair et al. (2014, 2017) a sample size of 80 participants was determined by using the aforementioned 'ten times rule' with PLS-SEM method. As mentioned earlier, in this study a self-administered questionnaire is used for the purpose of data collection for this phase (CRM

system evaluation). The questionnaire items were adapted from previous studies, detail of measurement instrument (items) and scales is presented in next section.

3.3.4.3.3 Measurement Instrument and Scale

Measurement instrument items were adapted from previous studies. A total of 49 items were used in the questionnaire to measure seven variables (system quality, information quality, service quality, sociability quality, system use, user satisfaction and net benefits) of the proposed conceptual model of this study (that is proposed for CRM system evaluation). Specifically, system quality construct was measured with 9 items scale adapted from Balaban et al. (2013), Mohammadi (2015), DeLone and McLean (2003). Information quality and service quality constructs were measured with 5 items scale for each, adapted from Martins et al. (2018) and DeLone and McLean (2003). Furthermore, sociability quality was measured with the help of 8 items scale, adapted from Kreijns et al. (2007), Junglas et al. (2013) and Yamada et al. (2016). The second order constructs of structural model for example use and user satisfaction were individually measured with 4 and 5 items scale, which was also adapted from (Alzahrani et al., 2017; Balaban et al., 2013). Finally, net benefit was operationalized by adapting a 13 items scale, adapted from Balaban et al. (2013) and Martins et al. (2018) (see Appendix-3).

These scales were adapted after conducting a comprehensive and in-depth literature review of each construct involved in our proposed conceptual model. Considering the reliability and validity of these scales, which is already established through previously published studies (Alzahrani et al., 2017; Balaban et al., 2013; Brown et al., 2010; DeLone & McLean, 2003; Gao et al., 2010; Junglas et al., 2013; Kreijns et al., 2007; Mohammadi, 2015; Venkatesh et al., 2003; Yamada et al., 2016); these scales were adapted in the context of this study. Various other scholars (Al-Samarraie et al., 2017; Cidral et al., 2018; Martins et al., 2018;

Mohammadi, 2015) have also employed these scales in the context of their studies. In order to achieve the overarching objectives of this study, these scales deemed best fit for the creed and context of this study.

This study has employed a seven point Likert type scale (1 = Strongly disagree to 7 = Strongly agree also added 0 = don't know) for data collection purpose. Researcher decided to use this scale to measure the subjective concepts of information system success factors, which are system quality, information quality, service quality, sociability quality, system use, user satisfaction and net benefits. All aforementioned studies have used and suggested the seven point Likert type scale, because of its high reliability and validity.

3.3.4.3.4 Reliability and Validity of Scales

As mentioned in the previous section, measurement items of this thesis were adapted from previous studies; however, the selection of measurement scale and variables is conditional to their reliability in a particular context of this study. For this purpose various scholars have recommended the use of Cronbach's Alpha to measure the scale reliability (Bryman & Bell, 2011; Hair et al., 2011; Pallant, 2011). It is defined as the degree to which scale indicators (items) are used to create a scale 'collectively' (Pallant, 2011). As per rule of thumb, a scale is considered reliable and stable, only when its Cronbach's Alpha value is 0.70 or larger than 0.70. If the Cronbach's Alpha is lower than threshold value of 0.70 it indicates that, items in the scale are not consistent with each other (Hair et al., 2014). In that case, the reliability of measurement scale is doubtful and needs a careful reconsideration and modification. Cronbach's Alpha has few limitations for instance the number of indicators in scale are sensitive and consider that all indicators are reliable. Hence, Hair et al. (2014) recommended the procedure of composite reliability as it is better measure than Cronbach's alpha, and it is interpreted in the same way as the Cronbach's alpha.

Furthermore, according to Aaker and Jacobson (2001) the concept of validity can be defined in three main components which are face validity, construct validity and criterion validity. Face validity is a commonly used criteria for assessing the validity of scales, which provides a subjective judgment and initial impression about the significance of measurement scales for their inherent underlying constructs. As stipulated by Bryman and Bell (2011) the use of proper wording and related contents for constructing items of scale confirms its face validity. Similarly, Pallant (2011) stated that a scale contains face validity when its components demonstrate the importance of items (scale questions) for the major variable of scale. The concept of construct validity is described as a measure, which differentiates one item of the scale from other items of the same scale (Bryman & Bell, 2011). It is achieved only by testing the outcomes of scales with pre-established theories (Bryman & Bell, 2011; Devaus, 2002). For constructs' validity there are two statistical measures namely discriminant validity and convergent validity, which are usually used by researchers. Discriminant validity measure represents the level to which an indicator of a measurement scale is dissimilar from other indicators included in the creation of specific measurement model (Hair et al., 2014). In order to achieve discriminant validity each indicator in measurement scale should represent a distinct phenomenon that is not characterized by any other indicator of reflective measurement model (Henseler et al., 2009). The convergent validity measure represents the extent to which a reflective indicator (item) correlates positively with other indicators of the same construct (Hair et al., 2014). In this thesis, considering these guidelines researcher has ensured that, the consistency and validity of measurement scales is assessed properly.

3.3.4.3.5 Questionnaire Design and Pre-Testing

The proper design and interactive layout of questionnaire helps to increase the survey completion rate, obtain accurate data, maximize and maintain respondent's interest in completing a survey. In this case, Creswell (2014) has stated that questionnaire design should be attractive, clear, precise, brief, easy to read with proper follow and sequence. As suggested by Dillman et al. (2009), questionnaire design should be self-explanatory, with a simple format, easy to understand and should consist of multiple sections, which can help the respondents to easily navigate through the whole document. In this study, the researcher has observed all these suggestions for preparing a questionnaire, which was used for the evaluation of proposed prototype system. Considering the guidelines from previous studies, the questionnaire used for the assessment of proposed prototype comprises of following sections: 1) cover page which describes the nature of the survey and purpose of this study, 2) synchronized layout for questions 3) provides separate sections for the questions of each construct. The detailed questionnaire is presented in Appendix-3.

After the questionnaire was designed, the next step is its pre-testing in the context of this study. For this purpose, a pilot study was conducted to assess the survey instrument's usability, before its use for real data collection. Several researchers (Bryman & Bell, 2011; Hair et al., 2011; Pallant, 2011) have recommended that, it is necessary to conduct a pilot study to collect feedback about survey instrument, particularly for the main constructs of the model, which needs more clarity. They also argue that pre-testing of survey instrument helps to minimize the chances of error, and also enhances researcher's confidence about the usability of survey instrument. In this study, for the purpose of instrument pre-testing, researcher have selected the respondents from UNIMAS service learning program. Preference was given to the participants of service learning program based on their

availability, at the time of data collection. Besides that, the questionnaire used for prototype evaluation was proofread by professional language experts and academic supervisors for initial screening of potential errors which are un-clear wording, dual meaning and vagueness of the sentences etc.

Once data were collected from respondents for the pre-testing of questionnaire, an empirical analysis was performed for checking the reliability and validity of measurement instrument. Data collected through pre-testing was evaluated using PLS software. The measurement scales for constructs were carefully tested for the internal reliability. For this purpose, it was ensured that all constructs of the model have obtained an acceptable level of Cronbach's Alpha and composite reliability and that these values should be higher than the threshold level recommended by previous studies. In order to assure the integrity of data, only those items were selected for final version of questionnaire, which had fulfilled these criteria of reliability and validity for achieving the overarching objectives of this study.

3.3.4.3.6 Data Analysis Methods for CRM System

This section presents the overview of data analysis, which was collected for CRM system evaluation. As mentioned earlier, Partial Least Square-Structural Equation Modelling (PLS-SEM) approach was used for the validation of proposed theoretical model, which is proposed for assessing the CRM system. PLS-SEM is an advanced second generation method of data analysis, which is widely used in social science because of its higher capability of prediction. According to Chin (2010) and Hair et al. (2014), Structural Equation Modelling (SEM) is an advanced tool for data analysis, which can be used for both covariance based and variance based statistical component analysis. They have claimed that these second generation PLS-SEM techniques are more advanced, and that it can easily handle complex structural models,

with more variables and also works well with the small sample size as compared to other techniques (e.g. CB-SEM).

In addition to this, the decision of choosing PLS-SEM approach for this study was also influenced by following compelling reasons (Hair et al., 2014; Henseler et al., 2009):

1. This method is suitable when research objective is to identify a new variable and study involves predicting its relationship with other variables in any existing model
2. When structural model includes reflective and formative variables
3. When study sample is small
4. When model is complex and includes various variables and indicators for determining an endogenous construct
5. When data is not distributed normally

For the purpose of this study, in this phase the advanced level of data analysis involves: 1) complete testing of measurement model (analyzing the relationship between measurement scale items, and latent constructs, which was also named as outer model), 2) comprehensive testing of structural model (analyzing the relationship between independent and dependent variables, which was also named as inner model) and 3) bootstrapping, which was used for the testing of significance level of path coefficient values. All these steps include further sub-components for the evaluation of theoretical model, such as assessment of the measurement model (e.g. internal consistency, indicator reliability, convergent validity and discriminant validity) was used to assess the reliability and validity of measurement scale. Furthermore, for the assessment of structural model, collinearity assessment, path coefficient analysis (beta value), bootstrapping, R^2 value of dependent latent constructs, effect size (f^2), and Stone-Geisser's Q^2 values were employed for assessing the significance of relationship and overall model fit.

3.3.5 Communication Phase

The documentation and communication phase is the final phase of this study, which covers the documentation of synthesized findings in the form of journal articles and dissertation, as well as this phase involves presenting these findings to the intended audience. The limitations and implications of this research study along with future recommendation are also provided in this phase. In addition, the alignment of all chapters involved in this study, along with research questions and objectives of this study is illustrated in Figure 3.3.

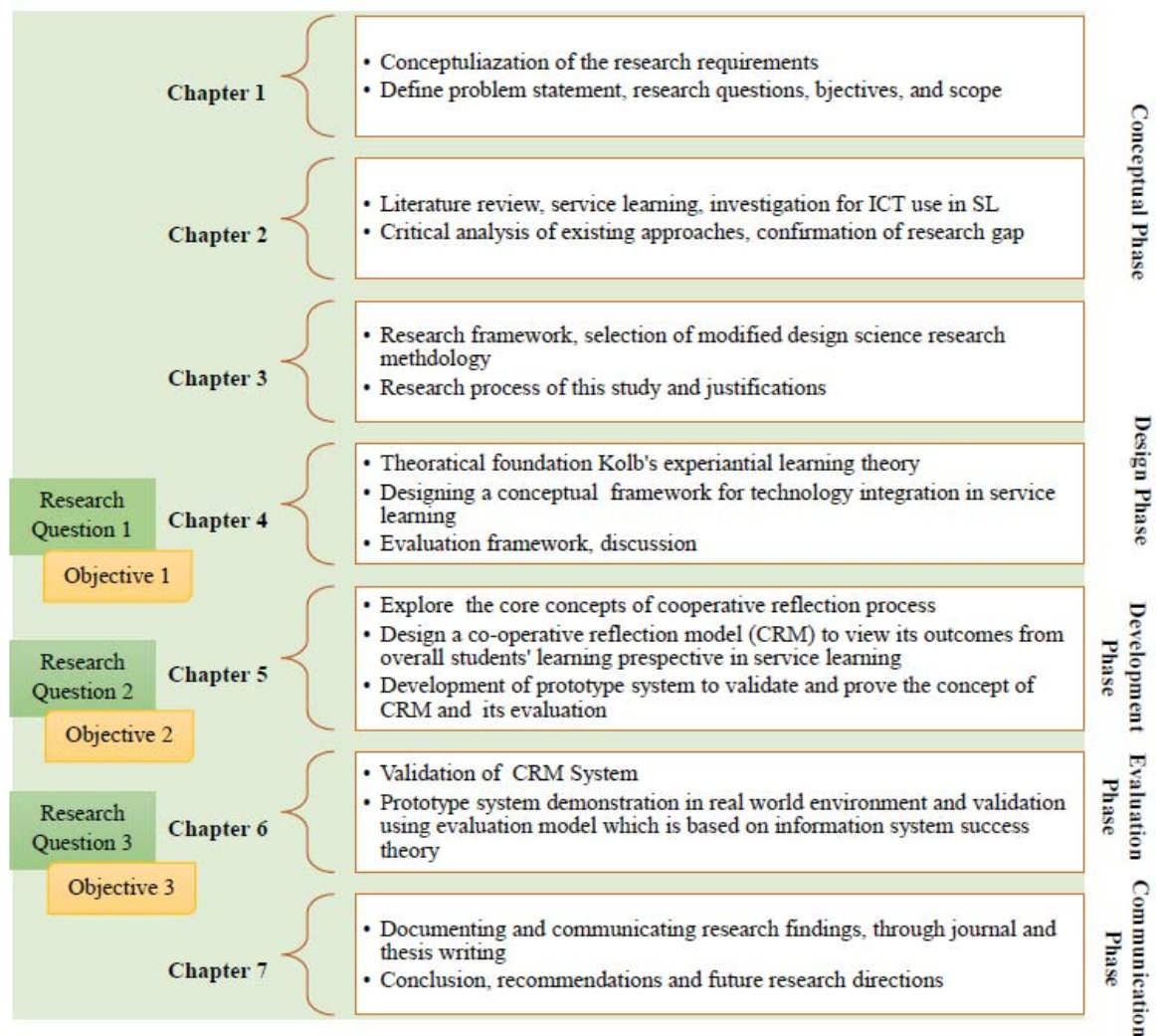


Figure 3.3: Connection of Thesis Chapters with Research Questions, Objectives and Methodology

3.4 Justifications for Selection of DSRM

This study attempts to investigate the utilization of ICTs in service learning and intends to explore an appropriate design of technology integration framework for service learning. Moreover, the co-operative reflection model and system implementation to validate the concept of this model are also part of this study. The nature of our identified problem is considered as an ‘applied research’. Therefore, the use of design science research methodology is more suitable for this study. In this regard, Hevner et al. (2004) have reported that, the design science research method has been increasingly recognized in information system’s domain, as opposed to behavioral science research only. Venable et al. (2006; 2016) have also described behavioral science as the development and verification of theories, which can predict the human behaviour, whereas the design science research extends these theories and human capabilities, through generating new and innovative artefacts.

Generally, the purpose of design science research is to propose, design and evaluate artefacts, as IT based tools for solving some real life problems; in contrast to traditional natural science, which only focuses on the formulation and testing of hypotheses in the conceptual framework (March & Smith, 1995). Although in this study, researcher has also proposed a theoretical model (that is extended IS success model) to evaluate the effectiveness of our CRM system.

The design science research combines the traditional science methods (e.g. descriptive) and practical problem solving knowledge related to real world (Dresch et al., 2015). Therefore, various PhD dissertations have also previously employed and recommended the use of design science research methodology in the domain of computer sciences and information systems (Abbasi, 2008; Al-Buhairan, 2012; Arora, 2009; Delano, 2011; Laylavi, 2017; Peacock, 2012; Richardson, 2006; Samardzija, 2016; Stale, 2012).

Design science research methodology is highly congruent with the research objectives of this study (as already stated in Chapter 1); therefore, it was selected to extend the knowledge about technology integration in service learning and to contribute to the limited body of knowledge by designing new artefacts. In this regard, the formulated research process of this study is mainly based on the guidelines of design science research methodology, as proposed by Peffers et al. (2007).

In any study, a question which is very important to answer, is always regarding the quality of research, and the way research was conducted. In design science research paradigm, to answer this question, Hevner et al. (2004) have suggested a number of guidelines for the assessment and validation of studies which have employed DSRM. These guidelines are also applied in this research to assess its quality. All guidelines are presented in Table 3.1. with detailed discussion about how this research meets the Hevner et al.'s (2004) criteria for design science research approach. Based on this discussion presented in Table 3.1, it can be concluded that, this study has successfully fulfilled all the criterions, described by Hevner et al. (2004); therefore, it can be said that, this offers a unique and effective piece of scientific work by employing design science research methodology in the domain of information systems.

Table 3.1: Guidelines for the Assessment of Design Science Research in IS

Guideline	Discussion with respect to this study
Design as an artefact	Artefacts of this study, technology integration framework and co-operative reflection model (CRM) for service learning proposed during the design phase of this study, moreover, a prototype (that is CRM system) developed to prove the concept of CRM. Additionally, evaluation model also proposed to assess the effectiveness and usability of CRM system in real-world situation. These proposed artefacts meet the criteria of this guideline
Problem relevance	As discussed in Chapter 1, the design of framework and co-operative reflection model (CRM) bridges the identified research gap (evidence from literature review and practical examples from case study UNIMAS with service learning experts). This highlighted the needs for technology integration framework as none of the current frameworks support the concept of technology integration in service learning. Moreover, CRM and technology support for it, is also required as none of the current reflection models provide support for co-operative reflection to understand its outcomes from service learning perspective.
Design evaluation	The framework was evaluated by employing case study method using real data in real situation. For the evaluation and validation of CRM face validity method with expert's opinion is used and prototype system is implemented for the proof of concept of this CRM. A prototype system is evaluated within real environment using IS success measures and data analyzed through PLS-SEM method.
Research contribution	This research study is a response to a clearly identified research problem (see Chapter 1), to fill this gap, propose a technology integration framework for service learning that advance the experiential learning theory with technology perspective, A co-operative reflection model (CRM) is proposed and prototype system is implemented to proof the concept of this model, which advance the concept of collaborative reflection with knowledge-building perspective in the context of service learning. The information system success model is extended for the evaluation of CRM system which also contributes in the theory of IS success.
Research rigor	This study well founded by the current literature in several domains such as: existing service learning frameworks, reflective learning theories, existing reflection models and technology support. Kolb's experiential learning theory provides a theoretical base to propose a conceptual technology integration framework for service learning. The group reflection concept from previous studies and social constructivism and knowledge-building theories are used to extend the concept in form of co-operative reflection model to view the

Table 3.1 continued

	process of reflective thinking and knowledge-building. Along with this a prototype system is implemented to proof the concept of CRM. This study extended new horizons for appropriate technology use in service learning and developed innovative system for co-operative reflection that were never considered earlier. Extended IS success model for evaluation of prototype system success expands new applications which is not discussed earlier.
Design as a search process	The artefacts designed and implemented in this study aims to meet the research objectives described in Chapter 1, one of the objectives is to implement technology support for proposed model. The prototype system provides a proof of concept and fills research objectives however, it leads to future improvements for instance automated assessment of co-operative reflection and analytical tool with this system.
Communication of research	The findings of this study are communicated through journal publications, conference papers and dissertation. Also, the application of this study also formally discussed with actual users e.g., with service learning team and students

3.5 Summary

The details of research process and research methodology employed for this study is presented in this chapter. Firstly, this chapter described the research framework for this study to address the research problems outlined in Chapter 1. Furthermore, based on the design science research methodology, a new research process, particularly for the context of this study was arranged and described. According to the research process of this study, there are five phases; e.g. conceptual, design, development, evaluation and documentation & communication phase, which were adopted from modified design science research methodology (Laylavi, 2017).

In addition to this, details of each phase and methods employed for the completion of each phase were also discussed. As part of design and development phase, the data collection methods (questionnaires and semi-structured interviews) and evaluation methods

(explanatory case study design, face validity with expert's opinion and evaluation model with quantitative approach) were also discussed and justified according to the context of this study. The selected research methodology and research process of this study was also further elaborated for its suitability in the context of this study. The design science research guidelines, which are proposed by Hevner et al. (2004) were also elaborated in detail and applied to this study for ensuring the sanctity of assessment and research quality of this study. After the clarification of research methodology in this chapter, the next chapter presents the design, development and evaluation of technology integration framework for service learning, which is the first research component of this study.

CHAPTER 4

DESIGN OF TECHNOLOGY INTEGRATION FRAMEWORK FOR SERVICE LEARNING

4.1 Introduction

Continuing from the research methodology, which is discussed in the previous chapter, this chapter explains the design of the conceptual framework, one of the artefacts of this study. This is a first research component of the study. In order to complete the requirement of Information and Communication Technology (ICT) integration in service learning pedagogy, a holistic technology integration framework is designed to address the limitations of existing frameworks, as mentioned in Section 2.6. The design phase of this study involves the understanding of problem domain and applying related scientific and technical knowledge from knowledge base, while development phase refers to the construction of an artefact based on that knowledge.

The first part of this chapter provides a conceptual framework for technology integration in service learning, which comprises of three major components 1) identification of common phases for service learning implementation, which draws on Kolb's experiential learning theory 2) technology support layer 3) and stakeholder's involvements patterns. The second part of this chapter discusses the assessment of proposed framework, using a case study method. Findings of our evaluation provide insights on the important phases of service learning and current technological support for these phases. In addition, these results also show the limitations of existing tools and technologies for some phases of service learning, for instance reflection (specifically co-operative reflection) and assessment. Finally, this chapter is summarized with the discussion of results, which will offer a base for next chapter.

4.2 Theoretical Foundation for Proposed Conceptual Framework

Kolb's (1984) experiential learning theory provides a fundamental theoretical framework for service-learning implementation. Kolb's (1984) has defined experiential learning as a process which comprises four phases 1) Concrete Experience, 2) Reflective Observation, 3) Abstract Conceptualization and 4) Active Experimentation. Several scholars have often accredited, that service learning involves all these phases of Kolb's (1984) experiential learning theory (Bowie & Cassim, 2016; Carver, 1997; Giles et al., 1994; Kolb, 2014; Le Grange, 2007; Petkus, 2000). In service learning students go-through all four phases of this experiential learning process by ascertaining potential problems in their local community, suggesting and implementing unique solutions, reflecting back on their experience and testing their understandings and new knowledge in the real-world scenario (Durbin & Marchel, 2015; Hart, 2015; Petkus, 2000).

In this study, we have employed Kolb's experiential learning theory (1984) as theoretical framework for designing and developing a new technology integration framework for service learning. Service learning experience include all phases of the Kolb's experiential learning process, these phases aligned with service learning and applied during its implementation. In the active experimentation phase, the teacher plans the service learning projects, objectives of the projects are recognized, and target community site and their problems are identified and aligned with objectives. The concrete experience phase is actual implementation, when students engage in service learning project, working time with the community members to address their problems. The reflection observation phase, when students integrate their actual experience with their own understanding of problem and its connection with theories or course concepts. In service learning reflection can perform using two methods, informally student can reflect on personal experience on his own, or formally

student participate in organized reflection activity with course instructor or other students. Finally, in abstract conceptualization, overall evaluation of service learning project is performed. The understanding developed during reflection phase gives a chance of assessing the students' performance in service experience. Evaluating overall outcomes of service learning experience from learning and service perspective. In this case, various academicians have claimed that service learning provides an innovative and distinctive pedagogical process, which offers new prospects for students to play a productive role in their course related community projects, to inculcate a deep awareness of theoretical knowledge, while improving their critical thinking skills also at the same time.

Here it is pertinent to mention that, the reason for employing Kolb's experiential learning theory is its best fit with the research objectives of this study. Additionally, its generalizability and its acceptability among acclaimed academicians in the field of service learning make it a suitable and right choice for this study (Durbin & Marchel, 2015; Kolb, 2014; Petkus, 2000; Roakes & Norris-Tirrell, 2000). In this context, it is righteous to claim that, our technology integration framework advances the concept of experiential learning theory, with a technological perspective, specifically in the field of service learning pedagogy.

4.3 Design of a Holistic Technology Integration Framework for Service Learning

This section presents the structural view of conceptual Technology Integration Framework for Service Learning (TIFSL), which is aimed to address the first research objective of this study. There are three important components in technology integration framework, which are (1) identification of common phases for service learning implementation along with sub-activities which are draws on Kolb's experiential learning theory, (2) ICT support layer for service learning which shows the application of technology for each phase and (3)

stakeholder's involvement patterns in service learning, to understanding their role in each phase of service learning pedagogy. In this context, these three components (factors) affect the technology integration in service learning.

In order to design and develop a holistic technology integration framework for service learning, the researcher used Kolb's experiential learning theory as an underpinning theory to serve as a guideline for selecting generic phases, which have frequently appeared in the previous service learning frameworks. The detailed arguments on the operationalization of each component included in the proposed framework of this study are provided in following sections:

4.3.1 Identification of Common Phases of Service Learning

In order to design and develop a holistic technology integration framework, it is important to understand the whole process of service learning incorporation in academic disciplines (Billig, 2011; Durbin & Marchel, 2015). The integration of service learning in any academic discipline requires a mutual partnership between two parties, which are academic institutions and community members, who are involved in a variety of its phases and sub-activities for its successful integration (Cupelli, 2016; Kohlbry & Daugherty, 2013). Therefore, for the purpose of this study researcher have identified five important phases of service learning, which are developed based on Kolb's experiential learning theory (see Figure 4.1). These phases are 1) planning and preparation, 2) implementation, 3) reflection, 4) assessment and evaluation and 5) administration and management.

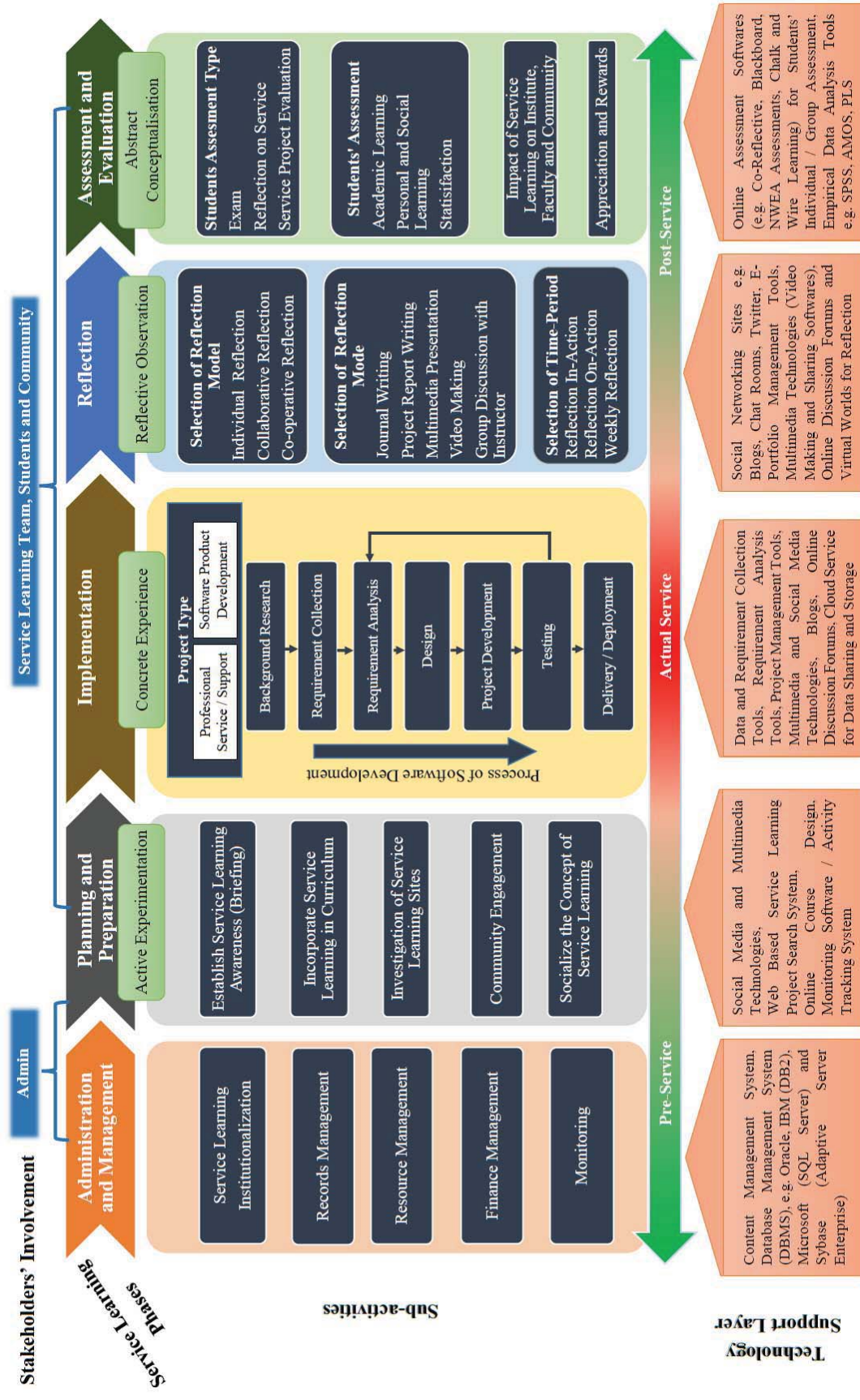


Figure 4.1: Proposed Technology Integration Framework for Service Learning

As discussed in Chapter 2, Section 2.5, previous subject-oriented service learning frameworks have primarily emphasized on the institutionalizing and technical aspects of service learning, according to the requirements of their discipline. Table 2.2 presents those phases, which are identified from previously proposed service learning frameworks. For the purpose of this study, researcher has selected these phases for three reasons: 1) these phases are aligned with the Kolb's experiential learning theory, which is the underpinning theory of this study, 2) identified phases appear frequently in previous subject-oriented service learning frameworks, 3) another justification is this study aims to propose a generic technology integration framework for service learning pedagogy, that can be used for all academic disciplines. Therefore, researcher have carefully reviewed all necessary phases required for service learning implementation from existing literature, which are aligned with the Kolb's experiential learning theory.

Based on previous studies, Kolb's (1984) experiential learning theory offers an appropriate theoretical framework for understanding and defining important aspects of service learning pedagogy. Therefore, researcher has employed it for designing a technology integration framework with technology support layer for each phase. In the next section researcher describes each phase in detail, with its theoretical foundation and sub-activities. Here, it is vital to notice that, only common phases were selected for the development of technology integration framework, to maintain its generalization and application in all academic disciplines. The details of each phase is as follows:

4.3.1.1 Planning and Preparation

The first phase is planning and preparation, which is also referred as introducing service learning pedagogy in institution, by incorporating service learning component in the curriculum. The purpose of this phase is to perform some peripheral important initiatives

(assessment of institutional resources, financial support and target communities), which are considered important for the success of service learning program. The planning and preparation phase includes numerous sub-activities, which are establishing participant's awareness regarding service learning, redesigning course for incorporating service learning component, searching target communities or service sites, and developing partnership with community. This phase is considered very important; therefore, Bringle and Hatcher (2009) have described that, at this early stage there is also need to identify a governing or administrative body, who is responsible for the subsequent operations, management of data and monitoring of resources for whole service learning program. With reference to current studies, planning and preparation phase is found common in all service learning frameworks.

4.3.1.2 Implementation

The implementation phase holds a central position in whole service learning program, as it is the actual starting point of service delivery to the communities. The design of overall implementation phase is based on the course requirements and types of service learning projects, that are intended to support community problems. For example in the discipline of computer science and information technology, most of the service learning projects are technology based; therefore, students need to follow the process of software development to complete these types of service learning projects (Nejmeh, 2012). The sub-activities performed in this phase are dependent on the academic discipline and types of service learning projects. However, there are some general activities, such as: searching background of problem, data collection and analysis, designing solution and delivery of services etc. The service learning team and faculty can also contribute in this phase by managing students and community engagement. With respect to the prior research work, it is noted that, the implementation phase is common in all service learning frameworks. However, it includes

a variety of sub-activities, which can vary according to the nature of each academic disciplines' requirements, or according to the distinct type of any service learning project.

4.3.1.3 Reflection

Reflection is an important phase in service learning, it is also defined as the re-evaluation of service experience, in such a way, which helps to gain deeper understanding of theories and concepts, which were applied during any service learning experience. The main purpose of this phase is to provide an opportunity for the participants, to critically think about their overall service experience, and develop new knowledge or understanding of particular problem. Reflection is not only limited to students, yet other participants (e.g. faculty, community) can also perform reflection to re-evaluate their own service learning experience. Mostly, reflection is designed for evaluating students' learning from community service experience. There are some important points, which need to be considered when designing reflection for students' evaluation, first is selecting the mode of reflection (written, oral, formal or informal), second is the selection of reflection model (individual, collaborative/co-operative, guided or unguided) and third is selection of time period (that is recording reflection before, during or after service learning experience). The use of reflection model assists participants in two ways, one is providing a structure or framework to guide how to conduct reflection and second it is also helpful in the overall assessment of actual learning. After selecting the model, mode and time period for reflection, there are several methods e.g. journal writing, oral discussion, multimedia presentations, video development, informal discussion etc. which can be utilized for reflection in assessing student learning from experience.

4.3.1.4 Assessment and Evaluation

The assessment and evaluation phase encompasses the evaluation of whole service learning project, along with comprehensive assessment of the learning outcomes of all participants involved in the service learning project. The assessment and evaluation phase is aimed to design a comprehensive evaluation method, which can cater all the participants involved in a service learning project (which are students, faculty members and communities). More precisely assessment and evaluation methods are designed for assessing the service learning outcomes in an academic perspective, which are focused on overall students' learning and faculty members' satisfaction with regard to their career orientation. Nonetheless, the assessment and evaluation phase also caters the 'service' perspective of a service learning project by assessing the participants' satisfaction, with regard to services rendered to the community members, during a service learning project. Likewise, assessment and evaluation phase also focuses on the students reflection assessment, which is one of the methods for assessing the overall learning outcomes of a service learning project. However, it is pertinent to mention that the selection of assessment methods is the discretion of faculty members, which is done by considering the nature and requirements of a service learning projects.

4.3.1.5 Administration and Management

The administration and management phase is necessary for the management of all records and arrangement of subsequent program activities. In this context Bringle and Hatcher (2000, 2009) have argued that, without establishing a strong and effective administrative body (that is establishing a dedicated administrative and management unit for service learning projects) higher education institutions cannot reap the long term and meaningful benefits from their service learning projects. It is the core responsibility of administrative and management body to ensure the steady supply of finances and other resources during

the course of whole service learning project. During a service learning project, administrative unit is also responsible for ensuring the record keeping of all the participants involved in a service learning project. Furthermore, resource allocation and optimum utilization of available resources is also not possible without establishing a separate administration and management unit. Therefore, building on these aforementioned logical arguments, this study argues that administration and management of service learning projects is a separate phase for exploring the overall technology integration process in service learning projects.

4.3.2 Technology Support Layer for Service Learning

Although technology integration is much appreciated in academic sectors around the globe; however, extant literature have not documented sufficient proofs of technology integration in service learning pedagogy. Previous studies on service learning projects have overlooked the role of technology integration component, which is either absent or not very well documented in the past. It is pertinent to mention that, service learning offers a multidimensional pedagogical structure, which is different from other traditional old education systems. Hence, service learning can be helpful for transforming the ways in which technology is used for education and learning purposes. Existing literature shows that, researchers and academicians have often stated the use of ICT for communication and collaboration. However, it is vital that academicians should recognize the effective use of technology for other activities involved in their service learning projects. For this reason, in order to highlight the application of technology for important phases of service learning, this study has designed a technology support layer in our proposed technology integration framework.

Technology support layer for each phase is the second component of proposed technology integration framework, where technologies are categorized according to their potential to be used in any specific phase of service learning. Thus, proposed framework contributes to develop a deeper understanding about what type of technologies one can select to use efficiently for specific sub-activities to achieve intended objectives. Furthermore, effective use of technology is essential to engage the students of this modern digital era, who heavily depend on the use of computers, tablets, smart phones, video games, internet other advance technologies for their learning throughout their career. Subsequent section presents the technology integration details for different phases according to their characteristics.

4.3.2.1 Technology Support for Planning and Preparation

When considering first phase ‘planning and preparation’ the use of technology depends on sub-activities involved in this phase. With this respect, for searching suitable communities for intended course objectives, the online web based systems can be effective for searching and establishing connection with communities. Additionally, when we are looking for developing partnership between academic institutes and communities or students and communities, online service searching systems can be effective for matching course objectives and opportunities available on community sites. It will also help to arrange initial meetings with communities to understand their requirements. For example, Portland State University have a web based searching system particularly designed for service learning projects.

In the context for course management, content design and instruction delivery e-learning portals can be effectively used for service learning. Some researchers (Helms et al., 2015; Montgomery et al., 2017) have reported the use of Blackboard system for their service learning course. Furthermore, for developing awareness among participants and promotion

of the service learning concept variety of technologies can be used such as Web 2.0 tools, multimedia and social media technologies.

4.3.2.2 Technology Support for Implementation

The implementation phase and sub-activities of this phase generally depend on the subjects' requirements and types of service learning projects, which are designed to provide community service. Therefore, the use of technology in this phase is also determined by the project types and subject requirements (e.g. in technology based service learning projects, students mostly used those technologies, which are considered effective for design and development of technological solutions for already identified problems in their community). There are a variety of technologies and applications, which can be used for general activities (e.g. data collection and analysis, solution design and content delivery), as referred in Section 2.9. For example, Google applications and other smart phone applications such as: voice recorder, note pad, iMovie, simpleminded etc. can be efficiently used for data collection and analysis.

4.3.2.3 Technology Support for Reflection

Reflection is an essential component of service learning. In this phase faculty is responsible for designing reflection activities to assess students' learning and ensures that learning objectives of service learning course are achieved as desired. As mentioned above, it is necessary to design reflection activities through the selection of an appropriate reflection model, mode and time period. In terms of technology use in reflection, there are some technologies e.g. e-portfolio, blogs, twitter, screencast etc. which can be successfully used for individual reflection. However, the concept of co-operative reflection is less documented in previous literature; particularly, structured co-operative reflection and technology support for co-operative reflection is seriously undermined.

A guided reflection is also considered very important, because reflection itself is a complex learning process, specifically for undergraduate students, who are still new in reflective learning practices. The use of reflection for students' assessment throughout their service learning project can also be effective to monitor students' learning process as well as to provide necessary support when it is required. Therefore, technology support for structured co-operative reflection is required to provide a platform for students to think deeper collectively and generate collaborative knowledge through group reflection activity. During critical review of previous service learning studies, very limited use of technologies for reflection phase was observed; however, following section (that is framework evaluation) provides insights of technologies used in a real time service learning project, with a case study of UNIMAS.

4.3.2.4 Technology Support for Assessment and Evaluation

In the evaluation and assessment phase, the selection of technologies depends on evaluation methods and the target population for which evaluation is designed. For example, evaluation of the impact of service learning program on communities' can be conducted through different methods, e.g. online questionnaires, interview recording with voice recorders and variety of other data analysis methods (e.g. SPSS, AMOSS etc.) can be used effectively. As students' assessment, reflection is one of the best activities to assess students' actual learning from their service learning experience. In addition to this, online data collection and analysis tools can also be utilized to assess their behavior and satisfaction towards service learning program.

However, when students are working in a group project, then it is quite challenging to assess their collaborative learning. Furthermore, it is hard to conduct co-operative reflection for a large number of students, without any technological support. In this context, students'

assessment through collaborative reflection, during service learning projects is quite challenging for instructors. Likewise, automatic assessment of reflection is also quite challenging, specifically when considering co-operative reflection and actual collaborative learning.

4.3.2.5 Technology Support for Administration and Management

The use of technologies for managing data and maintaining records is common in all organizations including academic institutes. Database management system is a very prominent example for managing and maintaining all types of data. In this regard, database management systems can be designed for service learning to maintain the records of participants (e.g. faculty, students and communities), types of projects, course contents related data, information about service sites and records of financial support.

4.3.2.6 Technology Support for Communication and Collaboration

As described in the previous sections service learning is a mutual learning process of three main participants. It can be said, that all participants support each other during whole service learning program, to achieve the learning objectives, and also contribute to economic development of a country, by providing effective services to local communities. Communication and collaboration throughout service learning projects, is very important, to achieve the desired objectives. This is a three way relationship, between participants as students, who have to communicate and collaborate with communities, while serving them, as well as with faculty, for getting necessary support, guidance and reflection. Similarly, faculty also needs to communicate and collaborate with students, throughout the service learning projects, to get feedbacks and assessing their learning outcomes, according to their course objectives. There are several technologies, which can be used for communication and collaboration, e.g. social media technologies, e-mail, Skype, instant messaging etc.

4.3.3 Stakeholder's Involvement Patterns in Service Learning

Service learning comprises of three types of participants which are faculty members, students and community members (Rutti et al., 2016). Service learning provides a mutual learning experience for all members, where academic institutes serve as an administrator of the partnership among faculty members, students and community members (Bringle & Hatcher, 2009; Hart, 2015). Generally, in conceptual framework of service learning, academic institutes are considered as an administrative body and the faculty and students, are considered as active participants who are involved in the whole service learning program. Longart et al. (2017) argued that all stakeholders should collaborate with each other for maximizing the outcomes of service learning, which will ultimately enhance their overall learning experience. Therefore, in this context, this study asserts that effective technology integration is not possible without having a comprehensive in-depth understanding of all potential stakeholders and their involvement. Therefore, this study suggests that, stakeholders are an integral part of whole service learning project, and their involvement can significantly affect overall technology integration process and whole service learning project.

Considering these aforementioned notions, proposed technology integration framework of this study considers stakeholders' involvement patterns as a third important component, which deals with the overall involvement pattern of all stakeholders in a service learning project. On the base of previous discussion, this study argues that a better understanding of overall stakeholders' involvement patterns is very crucial for recognizing our participants' potential and capabilities for ensuring an effective utilization of technological resources available to them. Furthermore, stakeholders' technological capabilities and usage pattern is also integral for developing a preliminary understanding of all available technological

resources, which are required on ground, during different phases of service learning projects. Building on these logical arguments, this study continues to the next section, which elaborates the assessment of our proposed framework.

4.4 Evaluation of Proposed Framework a Case Study of UNIMAS

This section provides the details of evaluation methods used for the assessment of the proposed framework, which is the first research component of this study (see Figure 3.1). The proposed technology integration framework for service learning is evaluated using case study method. For this purpose we have carefully observed the guidelines of case study research method, proposed by Runeson and Host (2009) as mentioned in Chapter 3. Based on those guidelines, in order to demonstrate and evaluate technology integration framework, first step is case study selection and design.

While selecting a case study, it is always important to ensure the availability of data, particularly in the context of this study, where it is important to assess the proposed framework in real-world environment. Therefore, we have selected Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak (UNIMAS), who have introduced service learning in their curriculum since 2016. The overall structure of service learning program in Faculty of Computer Science and Information Technology is similar to the real-world problem solving, where faculty and students are engaged in community service to explore the application of what they teach and learn in traditional classrooms.

In Faculty of Computer Science and Information Technology UNIMAS, service learning program is started with the establishment of service learning team, which consists of coordinators, course instructors and site supervisors and they have been assigned some responsibilities according to their role in service learning program. One of the major course named Technopreneurship and Product Development (TMC3034) was redesigned to

incorporate service learning component in their curriculum. There are two types of service learning projects such as custom system development projects and IT training projects, which best reflects the objectives of course and expose students to the real-world ICT related problems. The service learning projects selected for this course is related to the technological solutions which were requested by communities, as some members of service learning team have directly asked target communities for their requirements during planning and preparation phase. After that this information were used for matching course objectives and communities requirements. While selecting service learning projects it should be necessary to ensure that the nature of projects must reflect the course contents and community needs. Considering the communities requirements, total 41 focused projects were designed and approved by faculty. For the purpose of service learning program, local communities surrounding Universiti Malaysia Sarawak (UNIMAS) were elected as target service sites, which are known as Kuching and Kota Samarahan.

In Faculty of Computer Science and Information Technology, service learning course was offered during first semester of 2016/2017 academic session for Bachelor of Computer Science (BSc) majoring in 5 programs. In this study, for the evaluation of proposed framework, our target respondents were service learning team and students who enrolled in service learning course and for the selection of respondents convenience sampling technique was employed in this study as discussed in Chapter 3. In total, we approached 393 respondents, including 14 service-learning team members, and 378 students. However, we received 223 (59%) responses from students and 13 (92%) responses were received from service-learning team members.

In order to evaluate proposed framework, it is compulsory to determine the overall service learning implementation process that has been utilized by service learning team in selected

case study as well as expose the application of ICT in all phases of service learning implementation process. As outlined in Figure 4.1, the proposed framework presents the general phases with sub-activities for service learning implementation and ICT support layer for each phase. Therefore, to explore the application of ICT in different phases of service learning it is required that directly contact participants (service learning team and students) to identify the use of ICT according to their role in service learning. The detail of data collection procedure and questionnaire design was presented in Section 3.3.4.1. Next, the discussion proceeds with findings of framework evaluation.

4.5 Findings

This section presents the two types of results; first part presents the quantitative results of survey and second part deliberate the qualitative results of semi-structured interviews. Data analysis process started with the investigation of data completeness and correctness. Therefore, in first screening of data we have removed incomplete and identical responses. The demographic information of respondents is presented in Table 4.1.

Table 4.1: Demographic Information

Demographic information of service learning Students	
Gender	N = 207
Male	64
Female	143
Age	
18-20	0
20-22	174
22-25	33
Degree Program Major	
Computational Science	35
Software Engineering	52
Information System	41
Multimedia Computing	37

Table 4.1 continued

Network Computing	42
Demographic Information of Service Learning Team	
Gender	N = 13
Male	3
Female	10
Age	
30-40	8
40-50	5
Role in Service Learning Team	
Course Instructor	5
Service Learning Supervisor	6
Service Learning Coordinator	2

4.5.1 Survey Results

For the purpose of framework evaluation, a self-administered online questionnaire was used for data collection from both respondents which are service learning team and students individually. The collected data was calculated separately for descriptive analysis. In order to identify five important phases for service learning implementation, which was proposed in our framework, we have used five statements (which were adapted from previous studies) in questionnaire. Through this part of questionnaire, we asked service learning team about their opinion regarding the significance and importance of different service learning implementation phases based on their real time work experience, while employing service learning component in their curriculum. The results from this section of questionnaire help to evaluate the first component (that is identification of common phases of service learning implementation) of our proposed framework. Considering the recommendations of Pallant (2011), responses were recorded on the five-point Likert scale, where all responses were assigned different values; “Strongly disagree” as 1, “Disagree” as 2, “Neutral” as 3, “Agree” as 4 and “Strongly agree” was assigned as 5. In order to compare the obtain results of each

phase of service learning implementation each set of value was compiled against the respective phases. A brief overview of responses regarding the respondent's level of agreement for important phases of service learning is presented in Table 4.2.

Table 4.2: Service-Learning Team's Level of Agreement for Implementation Phases

Service Learning Phases	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree	Obtained score	Maximum Score
Planning & Preparation	0	0	0	16	45	61	65
Implementation	0	0	6	20	30	56	65
Reflection	0	0	3	16	40	59	65
Assessment & Evaluation	1	2	9	20	20	52	65
Administration & Management	0	2	15	20	10	47	65

The survey responses corresponding to the first component (that is identification of common phases of service learning) of proposed framework indicates that Planning & preparation, implementation and reflection obtained higher score as compared to assessment and management & administration phase. Figure 4.2 shows that all phases achieved more than 70% value, which indicate higher level of agreement level for proposed phases, and importance of these phases in service learning implementation. These findings indicate that planning & preparation, implementation, reflection, assessment and administration are important phases for service learning implementation in academic discipline.

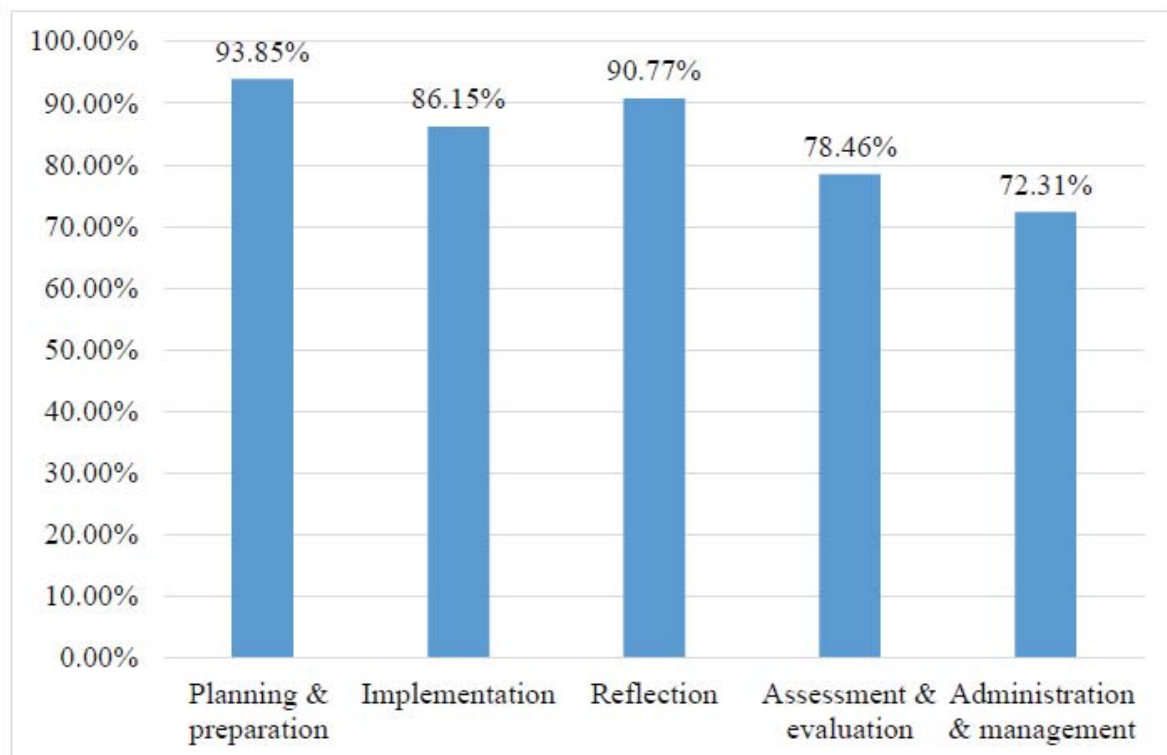


Figure 4.2: Comparative Importance of Service-Learning Implementation Phases

After the confirmation of first component of proposed framework, next question in the questionnaire was about the use and effectiveness of existing technologies, which includes ten statements, two statements for each phase (see Appendix 1). Service learning team was asked to reflect about the application of current technology in different phases and sub-activities throughout their service learning program. The responses for this question were recorded on five point Likert scale to measure the respondents' opinion and behaviour regarding the use and effectiveness of current technologies in their service learning projects. At this point, we assume that each respondent presents his/her behaviour regarding technologies use and effectiveness based on their individual experience in the fieldwork. We believe that they response to this question based on their personal experience about the use of technologies and their effectiveness in real time service learning project. This question was directly used to inquire the second component of proposed framework, which specifies

the service learning teams' feedback about the application and effectiveness of current technologies in different phases of service learning. Responses for this question showed that service learning teams' behaviour and level of agreement towards integration of technology in their service learning program. Table 4.3 presents detailed results.

Table 4.3: Technology Integration in Different Phases of Service Learning (Service-Learning Team's Perspective)

Service learning phases	Strongly Disagree or Disagree	Neutral	Agree or Strongly Agree	Average	Std. dev.
Planning & Preparation	0.00	0.23	0.77	4.00	0.69
Implementation	0.12	0.19	0.69	3.65	0.80
Reflection	0.65	0.23	0.12	2.50	0.91
Assessment & Evaluation	0.46	0.46	0.08	2.54	0.76
Administration & Management	0.00	0.15	0.85	4.08	0.63

Findings of this question indicated the use of current technologies for all phases of service learning however, it is important to note here the level of effective use of technology for particular phase depends on the respondents need and situation. The technology use and effectiveness based on the sub-activities involved in the specific phase of service learning. The results of survey shows that respondents were less satisfied with the use of current technologies for reflection and assessment phase, while other phases (which are planning & preparation, implementation and administration) achieved significant value, that indicates higher level of respondents' agreement towards the effective use of certain technologies for these phases.

Figure 4.3 shows the comparison of ICT use in identified common phases of service learning; more than 75% users were satisfied with the effective use of current technologies for planning and preparation phase. For the implementation phase, 69% users were satisfied

with the usefulness of current technologies based on their personal experience in service learning project. Administration and management phase achieved the highest value, as 85% respondents reported the effective use of existing technologies for this phase. According to the findings of reflection and assessment phase, we can see that most of the respondents were disagree with the effective use of existing technologies for these phases. As result of these findings reflection and assessment phase needs more effective and robust technology support. With reference to literature review the findings of this study is in line with the results of current studies as discussed in Section 2.9. Further information about respondents' perspective for technology use for these phases is discussed in following section that entails the results of semi-structured interviews.

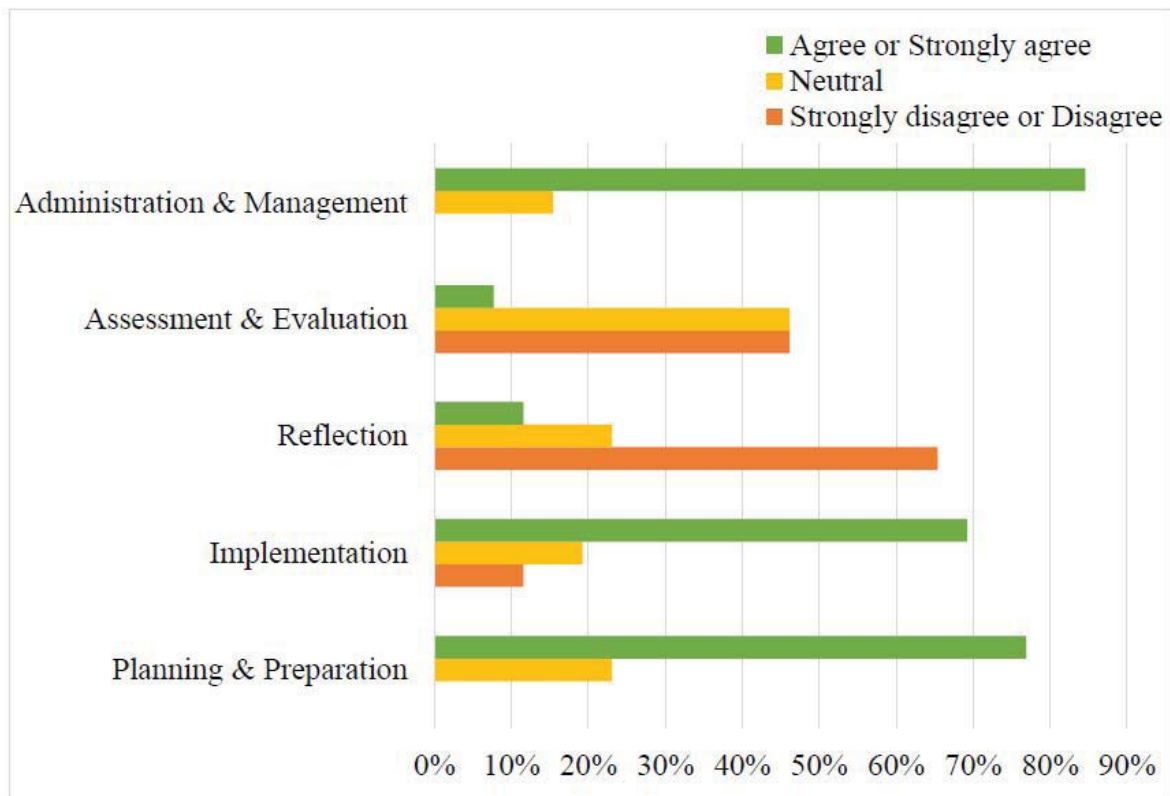


Figure 4.3: Comparison of Technology Use in Different Phases of Service Learning (Service Learning Teams' Perspective)

As mentioned earlier, data was also collected from students about their perspective on the application of ICT for those phases, where they involved directly such as implementation and reflection. After careful screening of students' data, incomplete questionnaires were removed, and 207 responses were used for further analysis. Based on students' direct involvement in implementation and reflection phase, as discussed in Chapter 3, questionnaire was adapted from Ghavifekr et al. (2015) which comprised of six statements, three for each phases (implementation and reflection). Table 4.4 shows a brief summary of responses obtained from implementation and reflection phase, which denotes students' satisfaction and level of agreement regarding the use of ICT.

Table 4.4: Technology Integration in Reflection and Implementation Phase (Student's Perspective)

Service Learning Phases	Strongly Disagree or Disagree	Neutral	Agree or Strongly Agree	Average	Std. dev.
Implementation	0.07	0.20	0.73	3.93	0.88
Reflection	0.52	0.28	0.20	2.36	0.96

Based on the results in Table 4.4, the implementation phase obtained higher value based on students' personal experience, which shows that students have used existing technologies during different activities of this phase. On the other hand, lower value for reflection phase indicates that the students are less satisfied and use limited technologies for this phase, as compared to implementation phase. This also indicate there is a technological constraint for this phase. Figure 4.4 illustrates that 73% students found current technologies effective and useful during implementation phase, and 20% lower values for reflection phase shows the limitations of current technologies for this phase, based on students' personal experience during their service learning project.

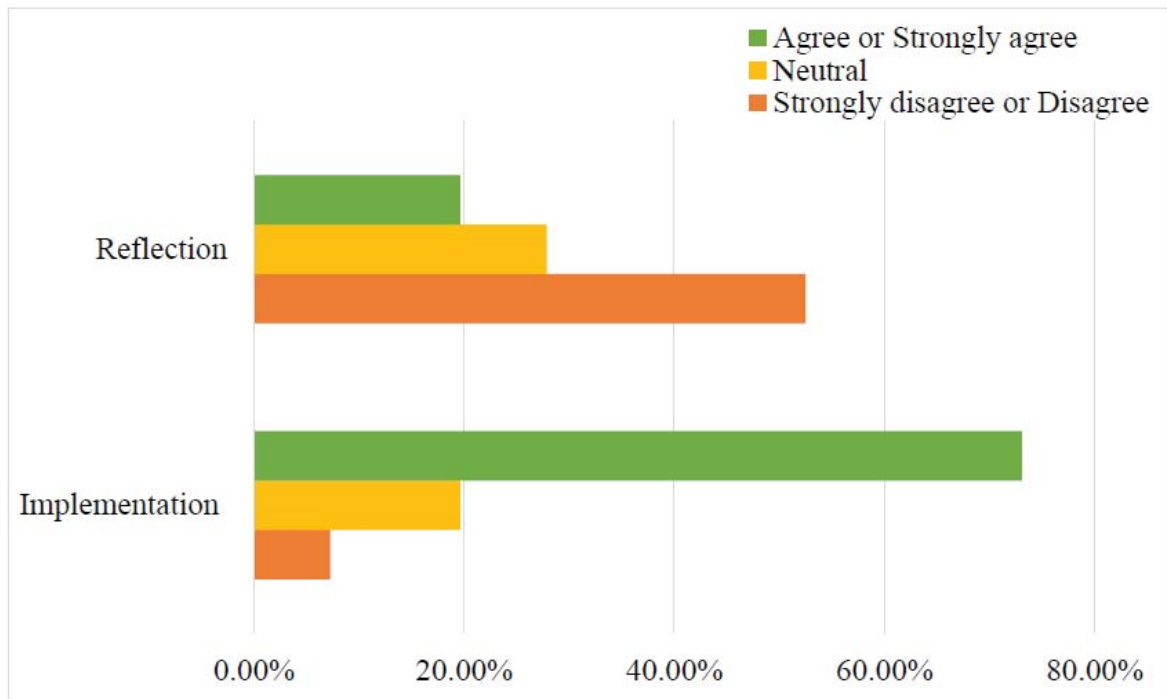


Figure 4.4: Comparison of Technology Use in Implementation and Reflection Phase (Students' Perspective)

As discussed above technology support is also required for communication and collaboration with all participants. For evaluating technology support for communication and collaboration, researcher asked both participants (service learning team and students) individually to reflect on the use of technologies for communication and collaboration, during their service learning projects. The survey results showed that most of the respondents strongly agree with the use of existing technologies for communication and collaboration as graphically depicted in Figure 4.5.

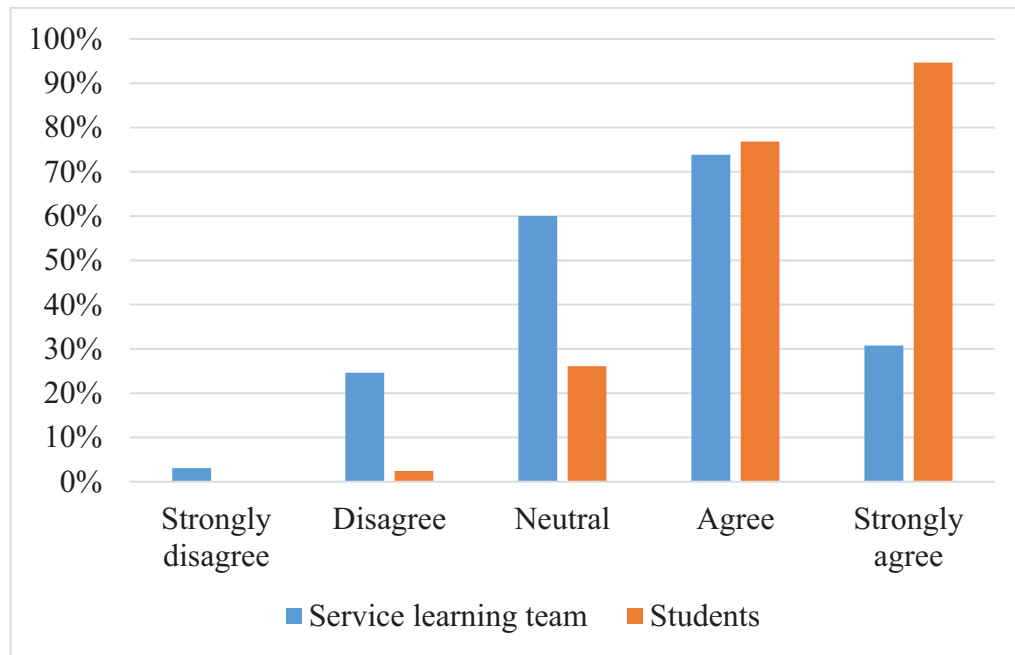


Figure 4.5: Comparison of Service-Learning Team and Students' Perspective Regarding Application of ICTs for Communication and Collaboration

Additionally, researcher have visited personally some service sites and also participated in several meetings and discussions with service learning team to understand the overall service learning process and participants involvements. As described in previous sections there are three main participants however, service learning team (faculty) in this case study was classified as course instructors, site supervisors and coordinators. We asked participants for their involvement and role throughout service learning project. The service learning team informed that currently they don't have any administrative body or service learning office therefore all activities related to administration and planning phase is performed by service learning coordinators. Other members of service learning team (which are site supervisors and course instructors) were directly or indirectly involved in other phases of service learning.

4.5.2 Semi-Structured Interviews Results

A comprehensive thematic data analysis methodology was employed for assessing the data collected during our focus group and semi-structured interviews. As mentioned earlier, one of the major objectives of this study is to assess the technology integration framework, which is proposed in this study. This study have proposed a technology integration framework which comprises for three major components. Those three major components were followed by service learning teams, during the implementation of whole service learning project. Among these phases, first phase includes project planning, design and analysis, second phase involves delivery of service to community, and final phase comprises of reflection, monitoring and evaluation (Musa et al., 2017). Furthermore, they reported that, the sub-activities involved in implementation phase depend on the project type, as described by one course instructor:

“During Technopreneurship and Product Development course, most of their students used the software development process to complete community requirements” (Course instructor-1).

In addition, one of the interviewees highlighted the importance of planning phase by stating that:

“Planning phase is necessary to fix all pre-service activities which are community selection, searching of financial resources, course redesign, partnership with community and training of participants” (Coordinator-2).

From learning perspective, another interviewee stated that:

“Course instructors focused on careful redesign of service learning course, selection and design of community service projects, to achieve learning objectives of service learning course” (Course instructor-2).

With respect to the technology used during service learning projects, interviewees informed us a ‘service learning database system’ was developed which is used to maintain all records related to students, course contents, projects, target communities and financial aids. Moreover, course instructors reported the use of UNIMAS e-learning portal (that is Morpheus) as well for their overall learning management, file sharing, instructions, communication and content management. Furthermore, individual reflection of participants was assessed through various oral discussion sessions, for that purpose, various applications from Google and Microsoft were also employed to ensure smooth conduction of individual reflection activities. One of the respondents stated that:

“As we noted for a large number of students, we need technology support, to conduct structured co-operative reflection, to monitor our students’ overall progress, to assess their learning outcomes, to assess their collaborative reflective learning and to assess their collaborative knowledge-building outcomes” (Supervisor-1).

Likewise, regarding group reflection, another interviewee stated that:

“It is important to ensure that our students achieve their course learning outcomes through group based service learning approach; however, designing a group level

reflection assessment tool requires deep involvement of instructors and students” (Course instructor-3).

Additionally, participants of service learning program, especially students also acknowledged the usage of different IT tools for implementing their tasks. For instance, one student stated that:

“Microsoft and Google applications (e.g. MS Word, Excel, project management, SimpleMind, Google doc, drive etc.) and specific software development tools (e.g. Java IDE, ASP.Net, PHP development frameworks and web development templates for agile development). Additionally, students reported the use of various mobile applications (e.g. WhatsApp group), social media and email for their communication” (Student-1).

Third major component of our proposed framework is stakeholders’ involvement patterns. Assessment of stakeholders’ involvement is one of the crucial elements of this study. For this purpose, in order to assess the stakeholders’ involvement pattern, all stakeholders were asked various questions regarding their role and contribution during the execution of whole service learning program. More precisely in our case, our service learning teams comprised of site supervisors, instructors, and team coordinators. Findings revealed that during the course of whole service learning program all participants were involved in the implementation of all phases of service learning project depending on the nature, role and significance of their responsibilities.

4.6 Discussion

Based on the above stated findings, we argue that for effective technology integration in service learning academicians should consider service learning implementation phases along with their sub-activities for the selection of any appropriate technology, before to its use. Service learning implementation process and the nature of implementation phases and their sub-activities significantly contribute to the selection of particular technology. Thus, it is crucial to recognize that how does technology integration can properly support given specific phases and their sub-activities to attain our desired objectives. Findings from case study method have established clear understanding regarding that, all components of proposed frameworks are essential, and academicians can achieve their benefits by using this framework according to their requirements.

Evaluation of proposed framework in case study revealed some interesting aspects regarding the application and integration of technology in different phases of service learning. It is important to note that different technologies have different potentials, properties, limitations and affordability levels, which effects their selection and suitability during certain phases or sub-activities of a service learning project. For instance, existing customized data management technologies efficiently support the administration and management phase of service learning. However, based on the above results low response rate for reflection and assessment phase shows less effectiveness of current tools and technologies.

As discussed above although, multiple technologies can be used for reflection but, in the case where large number of students are enrolled and they are working in group-based projects collaboratively, it is quit challenging for their course instructors to assess their co-operative reflection, collaborative learning and project based learning outcomes. Several researchers have acknowledged that reflection is a pivotal phase of service learning, which

assists to assess students learning from their experience, it also helps in developing problem solving and critical thinking skills in students. In this context, to the best of our knowledge current technologies (e.g. online discussion forums, Blogs, e-portfolios etc.) do not providing proper support to conduct structured co-operative reflection in a controlled environment, where course instructor can monitor student progress, and collaborative knowledge-building, through reflection or reflective learning assignments. In addition, assessment of reflective learning is also relatively challenging where technology support is limited.

Likewise, nature of service learning pedagogy, program structure, community service, practical working environment and involvement of multiple participants, also influences the level of technology integration in service learning projects. As the practical and unpredicted working environment, capabilities of involved participants to use technology and involvement patterns of multiple participants' can be influence the integration of technology in service learning projects.

Further, this study focus on the reflection, particularly co-operative reflection in order to propose and implement a new model. There are several reasons behind the selection of reflection, one of them is the importance of reflection in service learning to enhance critical thinking skills of students and assessing their learning from community service. Particularly in the context of selected case study the Malaysian higher education wants to leverage students with 21st century skills (4Cs critical thinking & problem solving, effective communication, collaboration & team building and creativity & innovation) that can be achieved through developing critical thinking skills, and promoting reflective learning among undergraduate students (MOEM, 2015). The lack of research in co-operative reflection specifically in the context of service learning is another reason, as discussed in

Chapter 2 existing reflection models only focus on individual reflection and cannot be used for co-operative reflection due to its unique characteristics.

As describes in results section reflection is an important method to assess student learning from service experience therefore the selection of reflection also covers the student's assessment part as well. In case study students performed in group based service learning projects where it is vital to assess their collaborative learning that can be achieved through co-operative reflection. Based on these reasons researcher further explores the concept of co-operative reflection and technology support for it. The results of case study identified conceptual gaps, which needs some important implications from researchers to explore co-operative reflection to understand its outcomes from learning perspective. In addition to this during project based work throughout students' progress monitoring and learning assessment is quite challenging in current research. Hence, this study will further focus on one part of framework which is co-operative reflection, to explore the concept of co-operative reflection in the context of service learning and identify the overall learning outcomes of co-operative reflection as shown in Figure 4.6.

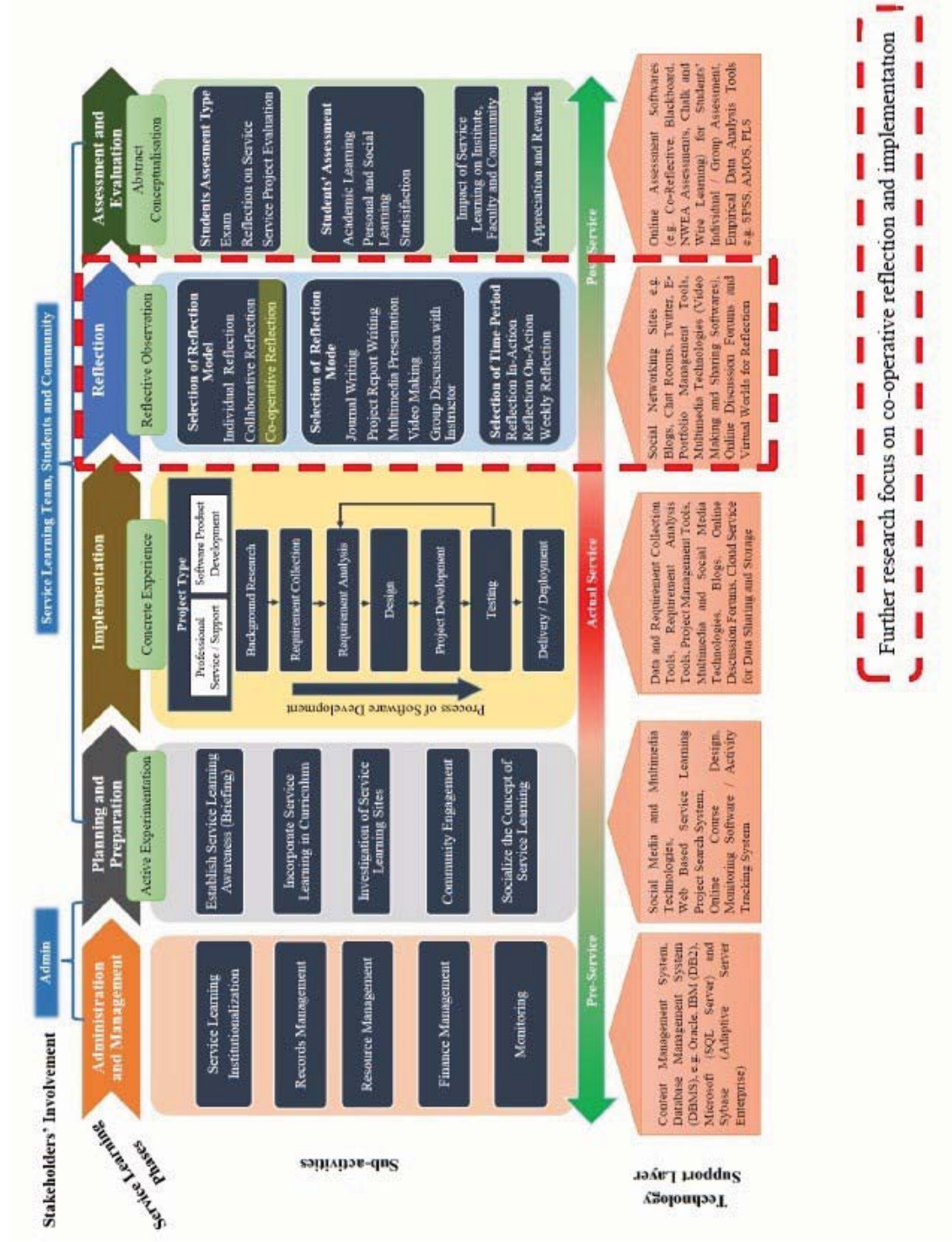


Figure 4.6: Further Research Focus on Co-operative Reflection and Implementation

In conclusion, this study presents a technology integration framework for service learning, drawing on Kolb's experiential learning theory, which consisted of three key components; identification of common phases for service learning implementation, technology support layer for these phase, and stakeholders' involvement patterns. From theoretical perspective, this study presents significant contribution by advancing Kolb's (1984) experiential learning theory, with a technology integration perspective in service learning. Moreover, through identification and elaboration of different service-learning phases with sub-activities can influence the academicians' intention to utilize specific technologies, based on the requirements and nature of phases, this study have advanced the overall body of knowledge in the field of ICT and service learning pedagogy.

In addition, practically our proposed technology integration framework can help academicians in more robust selection and assortment of suitable technologies, according to the requirements of their service learning projects, which will assist them to focus on all three components of service learning. Hence, this study provides a new direction and beginning of a deeper learning about the usage of widespread technologies for experiential learning pedagogy. This technology integration framework can be helpful to investigate the limitation of current technologies, for different phases of service learning, and it can serve as a guideline for effective use of technology in future service-learning projects.

4.7 Summary

This chapter has proposed a technology integration framework for service learning, in response to the first research objective of this study as outlined in Chapter 1. The proposed framework consists of three components, which are identification of common phases for service learning implementation; technology support layer for each phase and stakeholders' involvement patterns in these phases. The characteristics of the service learning phases with

their sub-activities were also discussed in detail. The proposed framework was conceptualized as a first design artifact of this study, and then case study method was employed for its evaluation. The overall architecture of the framework provided a conceptual view for technology integration in service learning, according to the characteristics and capabilities of tools and technologies. Moreover, it contributes in the theory of experiential learning with the technology integration perspective in service learning pedagogy.

The findings of framework evaluation inform us about the significance of identified phases for service learning implementation, which was also used by the Faculty of Computer Science and Information and Technology in Universiti Malaysia Sarawak (UNIMAS), while implementing service learning component in their curriculum. With regards to the technology support for each phase, the results of case study show that, existing ICT provides effective support for some phases of service learning, for example planning & preparation, administration & management and implementation. However, limited technology support is available for reflection and its assessment more specifically co-operative reflection. It is also revealed that, existing models for reflection cannot be used for the co-operative reflection, because of its unique nature. The next chapter provides the details of co-operative reflection and proposes a new co-operative reflection model to explore and understand the process of knowledge-building through group reflection activity.

CHAPTER 5

DESIGN AND DEVELOPMENT OF CO-OPERATIVE REFLECTION MODEL

5.1 Introduction

This chapter offers a detailed design and description of Co-operative Reflection Model (CRM), to address the second research objective of this thesis. The first part of this chapter described the main components of proposed CRM which are co-operative reflection process and synergy of co-operative reflection and knowledge-building. Then, the implementation of CRM is presented, which includes overall architecture of prototype system and workflow of CRM. Then, this chapter further deliberates on the evaluation results of CRM. The feasibility of proposed model is also assessed, with the help of a prototype system in a real-world environment. The results of the prototype testing were used to validate the CRM concept and to assess the overall performance of prototype system. Finally, the results of complete assessment process are discussed and summarized at the end of this chapter.

5.2 Theoretical Framework for Co-operative Reflection

This section focuses on reflective learning, which falls in the category of experiential learning experience. Theoretical foundation for reflective learning is already presented in Section 2.8.1, that is clustered in the form of three main paradigms, which are behaviorism, cognitivism and constructivism. Existing reflection models, are directly supported by these learning theories, for instance some models that used the Bloom's taxonomy of learning are influenced by cognitivist paradigm (Ash & Clayton, 2009; Gibbs, 1988; Molee et al., 2010). They asserted that, reflective learning has a strong connection with cognitivism learning theory, as they suggested that, reflection supports a type of learning which requires learner's

internal mental processing and encourage learner's active engagement in the whole learning process.

On the other hand the reflection models from Boud et al. (1985), Schon (1983), and Kolb (Kolb, 1984), have a constructivism influence, as these reflection models are based on the Dewey's research work about reflection. Constructivists asserted that, learner utilize mental models to interpret their experiences to construct new knowledge. The constructivist approach recognizes the existence of reality; however, reality is the interpretation and it is shaped by learner's individual experiences. It indicates that knowledge-building is an individual process. However, another variant of constructivism called social constructivism; in social constructivism, knowledge-building process is considered as social, rather than an individual experience (Schuh & Barab, 2008). Therefore, it is vital to note that, some type of reflective learning has connection with social constructivism e.g. co-operative reflection. The social constructivism considers learning process as a social learning process, where learner's ability can be greatly improved by getting support from experts, communities or from peers (Schuh & Barab, 2008; Vygotsky, 1980). In addition to this, another reason for the selection of social constructivism learning theory is it provides a solid base for computer supported collaborative learning (CSCL), which has been theorized by different perspectives such as activity learning, situated learning and distributed cognition. Only difference between these complementary theories is the unit of analysis, for example in activity theory 'activity' is a unit of analysis, in situated learning theory 'setting where persons performed activity' is the unit of analysis and in distributed cognition theory the unit of analysis is a larger cognitive system which consists of individuals and artefacts.

In the context of CSCL, Stahl (2002, 2013; 2009) has proposed that, the unit of analysis should be a small group. It is called group mediated learning where individuals can connect

their personal learning with each other, and knowledge is constructed at group level. In this concept, knowledge created at group level is distinct from knowledge gained at individual level. Therefore, in this study, researcher proposes that studying the concept of collaborative knowledge-building through co-operative reflection is theoretically supported by the social constructivism and knowledge-building theories, which defines the process of social construction of knowledge. It means that, social constructivism and knowledge-building theories are important, that contribute in the theory of co-operative reflection to explain the process of knowledge-building.

In this study, we propose a co-operative reflection model that describes how co-operative reflection leads to the overall collaborative knowledge-building. In this regard, our proposed conceptual model integrates two concepts, which are co-operative reflection and knowledge-building, which are strongly rooted in the computer supported collaborative learning theories (e.g. social constructivism and knowledge-building), where learners build collaborative knowledge, as a result of co-operative reflection practice. Next section describes the reflective practices, in a real time service learning program case study of Faculty of Computer Science and Information Technology, UNIMAS.

5.3 Service-Learning Projects and Reflection Practices

The literature review revealed that reflection can be performed as an individual or group reflection activity, and different methods can be used for this purpose, e.g. essay or report writing, e-portfolios and oral discussion. Similar to this, in our selected case study different methods have been used to conduct students' reflection in three consecutive semesters for assessing different situations. For instance, in the first semester when a large number of students are enrolled for service learning course, they usually use two methods for reflection, which are 1) informal oral discussion at the end of service visit with their site supervisor,

and 2) questionnaire based on open ended questions prepared for individual reflection. In the first case, during informal group discussion, students were asked about their service experience, feelings and difficulties; however, data was not documented properly. In second case course instructors reported that, it was difficult and time consuming to process questionnaires for students' assessment, because of large number of students. In this context current studies (Adelopo et al., 2017; Ash & Clayton, 2009; Molee et al., 2010) have also reported that, the proper design of reflection with assessment is important to assess students' learning and level of reflective thinking.

On the other hand, according to students, they had several group discussions with their group members, regarding their service learning project. However, during these discussions they specifically emphasized on how to design a solution for community needs instead of reflection on their experience. Students also agreed that in order to coordinate projects' work, multiple students worked parallel on different parts of the project to meet community's requirements in a limited time period. When considering reflection, most of the undergraduate students faced difficulties in the understanding of the actual meaning of reflection and co-operative reflection process in service learning. The main reason behind this is the lack of reflection practices in daily learning and lack of framework or structure particularly for co-operative reflection.

With respect to the co-operative reflection, in next two semesters students used a questionnaire, which was developed on the base of open ended questions, for their group reflection. According to the feedback received from service learning teams, both methods (oral discussion and written group reflection using open ended questions), which were used for co-operative reflection, were not successful to understand students' level of reflective thinking, collaborative learning and knowledge-building. There are several reasons, and one

of them is that, the co-operative reflection was not documented properly to understand each student contribution; therefore, it could not be used further for the assessment of the level of reflective thinking and co-construction of knowledge. Due to the large number of students and short time period they could not conduct co-operative reflection manually. In addition to this, lack of framework or structure for co-operative reflection to understand the process of collaborative reflective thinking and knowledge-building is also another hurdle in the process of conducting structured co-operative reflection in a proper way.

With reference to the existing research work, various scholars have highlighted the significance of group reflection, by identifying its benefits, e.g. collaborative meaning-making from experience (Siegel & Schraagen, 2017), development of deep critical thinking (Adelopo et al., 2017), exchanging ideas (Stokes et al., 2017), mutual support and feedback (Clara et al., 2017). However, Adelopo et al. (2017) have noted that, existing research has tended to focus on individual reflection rather than co-operative reflection. Also, in the context of service learning Adelopo et al. (2017) have suggested that, it is pertinent to understand the co-operative reflection structure and participants' interactions, which serves as a continues process to understand the collaborative reflective thinking process. Recent developments in the field of service learning have led to a renewed interest in promoting reflection, to develop critical thinking and problem solving skills among students.

In this study, we proposed a co-operative reflection model, which presents a modified concept of collaborative reflection, encompassing some stages of the knowledge-building. This model serves to understand the stages involved in a co-operative reflection process and shows that how collaborative knowledge-building takes place during this process of co-operative reflection, which is explained the next section.

5.4 The Proposed Co-operative Reflection Model (CRM)

The conceptual model of co-operative reflection entails 1) a co-operative reflection process to understand different stages and elaborates them in the light of existing studies 2) identification of the process of knowledge-building, to understand how these stages lead to the creation of knowledge. This conceptual model advances the concept of reflection and indicates the potential role of co-operative reflection as a core practice to understand the process of knowledge-building, in the domain of co-operative reflection.

5.4.1 Process of Co-operative Reflection

Co-operative reflection has its' own qualities involving collaborative critical thinking, exploring personal experiences by sharing, discussing and exchanging ideas to develop inter-subjective understanding. In service learning, reflection is the process of re-evaluating community service experience to assess students' learning from this experience according to the objectives of service learning course. The course instructors in the case study informed that, their aim was to provide real-life experience of developing a technological solution for identified community problems, as well as improving students' understanding of course contents/theories, enhancing practical knowledge, skills and preparing students for professional life. They emphasized on the importance of structured cooperation between students to develop collaborative reflective thinking and shared understanding.

As part of its major objectives, this study proposes a model which advances the concept of co-operative reflection with the perspective of collaborative knowledge-building in the context of service learning. In the light of existing work on co-operative/group reflection by Clara et al. (2019) and Prilla et al. (2012) and focusing on practical cases in service learning program (which are discussed in previous section); we have identified five important steps,

involved in co-operative reflection process (CRP), to attain the objectives of reflection in service learning. These five steps are as follows:

1. Group Experience

Firstly, it is required to participate in group based service learning project to attain community service experience. Students engaged in community service where they collect information that provides ground for reflection. Based on their service learning experience they reflect to develop a connection between community service and academic learning. Therefore, in proposed co-operative reflection process researcher consider 'group experience' as starting point or first step. As scholars acknowledged that experience and reflection are interconnected with each other; they argued experience provides basis for reflection to complete a reflective learning process (Ash & Clayton, 2009; Kolb, 1984; Mitchell et al., 2015).

2. Individual Reflection

The second step of this process is 'individual reflection' where students needs to reflect on their service experience individually and critically think about their personal understanding which provides a better way for self-evaluation. The cooperative reflection process actually starts from the individual thoughts and personal understanding of experience. Students need to individually reflect on service experience in order to develop better understanding of personal thoughts, attitude and behaviour towards experience. It allows students to critically think about service experience and apply their prior knowledge without any external help. Therefore, individual reflection is the sub-process or activity in co-operative reflection process. Here in order to trigger individual reflection, reflection prompt questions can be used to guide students (for further details, see Section 5.5).

3. Co-operative Reflection

After initial understanding of service experience the next step is ‘co-operative reflection’ which includes group discussion about the application of academic theories in real-world problem, critical analyses on service experience, evaluating service experience with respect to the performance and effectiveness of solution. The co-operative reflection takes place after sharing individual reflection with other’s and reflecting on the descriptions of others’ experiences to discuss, critically analyze and evaluate group service experience. According to Prilla et al. (2012) the sharing and discussion sessions on particular topic triggers co-operative reflection where individuals from different levels can communicate and discuss to generate a problem solution.

4. Recommendations

The fourth step of this process is ‘recommendations’ which encourages participants to produce new ideas and solutions, exchange and discuss new perspectives with each other. Researcher consider this phase important to encourage participants to raise their personal perspective and negotiate with other group members. With reference to the social constructivism theory (Lin, 2015) this step will help students to think of innovative ideas and the evaluation of own experience from different perspectives, peers will foster the development of problem solving and critical thinking skills.

5. Decision and Outcomes

The final step of this process is ‘decision and outcomes’ which includes shared understanding of all participants, documentation of outcomes and future action plans. This step allows students to draw conclusions on co-operative reflection to produce

shared understanding. Students will be able to interactively achieve new knowledge and improve their cognitive, affective learning and interaction skills. Building on the purpose of reflection in service learning we adapted this stage to ensure the outcome of co-operative reflection should be collective knowledge which is achieved through deep collaborative critical thinking and shared understanding (Yukawa, 2006).

We can see in Figure 5.1 all steps in co-operative reflection process connected with each other and presents a cyclic nature as in-line with experiential learning cycle. Moreover, description of each step is also provided to elucidate the concept and purpose of each stage. The description of each step presented in Figure 5.1 serves for different purposes such as: designing scaffolding for each step, explaining the overall process of co-operative reflection, developing critical thinking from descriptive to critical level and documenting multiple perspective of co-operative reflection.

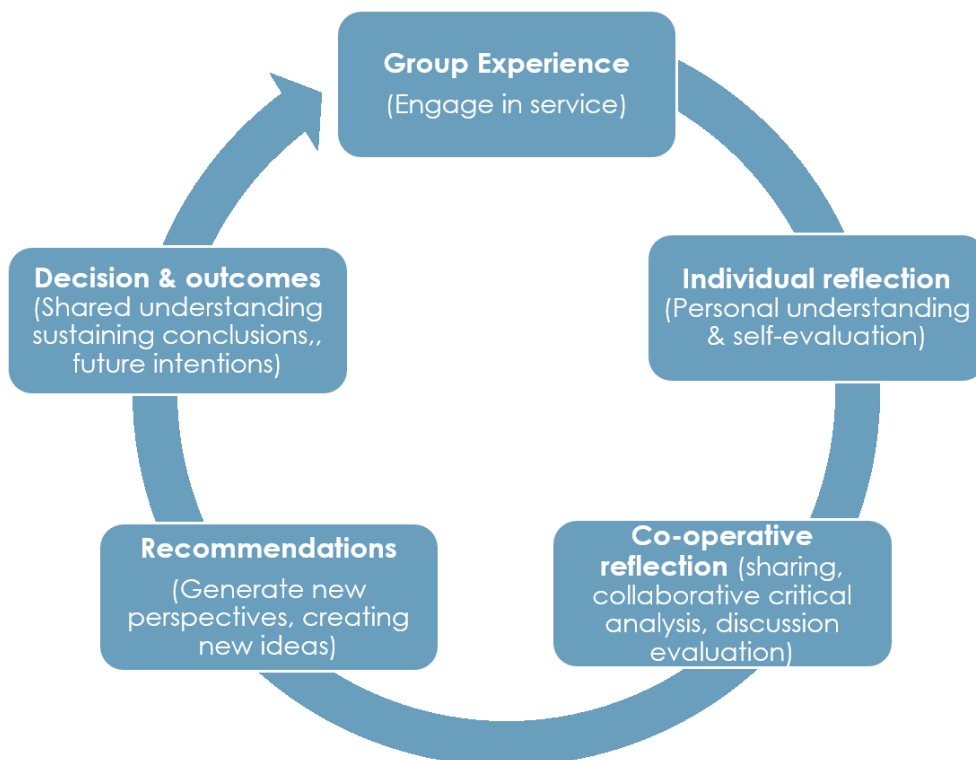


Figure 5.1: The Proposed Co-operative Reflection Process (CRP)

5.4.2 Synergy of Co-operative Reflection and Knowledge-Building

As discussed above, reflection can be performed as co-operative critical thinking process where learners explore their experiences and interactively achieve shared understanding. With this reference, we agreed that the purpose of co-operative reflection is to promote collaborative critical thinking and knowledge-building. On the other hand, it can be said that co-operative reflection is the process of social construction of knowledge where learners can share their own experiences and negotiation to elicit new knowledge. In this study, researcher attempts to prove it by identifying knowledge-building process in co-operative reflection which is adapted from current studies (Beers et al., 2005; Singh et al., 2009; Stahl, 2000) and explains how collaborative knowledge-building take place during co-operative reflection.

Despite the significance of co-operative reflection in service learning a logical understanding of how knowledge emerges during this process is remains largely unknown (Clara et al., 2019; Foong et al., 2018; Smit & Tremethick, 2017). In order to understand how knowledge emerges from the individual reflection to co-operative reflection is critical in the evolving research in group cognition (Phielix et al., 2011; Siegel & Schraagen, 2017). The main objective of this section is to develop a synergy between co-operative reflection and knowledge-building to understand the process of co-construction of knowledge during co-operative reflection practice. Researcher identifies the sub-processes of Knowledge-Building (KB) in co-operative reflection that explicitly defines how individual cognition and group cognition are shaped and linked with proposed co-operative reflection process. Figure 5.2 (combine with Figure 5.1) presents Co-operative Reflection Model (CRM) that explains the core mechanism and concepts through which collaborative knowledge develops during co-operative reflection, which advance the theory of reflection.

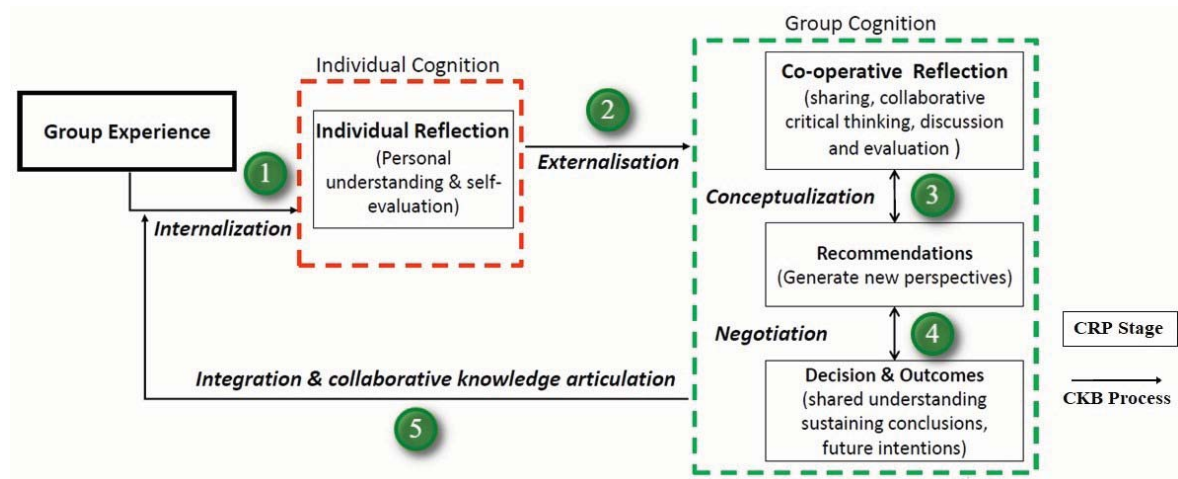


Figure 5.2: The Proposed Co-operative Reflection Model (CRM)

The original Collaborative Knowledge-building (CKB) model defined (Stahl, 2000) social construction of knowledge at two level: personal understanding which contains individual processes and group level processes which presents co-construction of knowledge. In order to determine collaborative knowledge-building from co-operative reflection we have utilized the same concept. Various studies reported that reflection mainly in service learning supported by transformative learning approach (Bartleet et al., 2014; Carrington et al., 2015; Hullender et al., 2015; Stover, 2016). Service learning promotes active participation of student's in experiential learning environment and reflection encourages them to develop new knowledge from experience by re-evaluating it (Adelopo et al., 2017). Therefore, service learning generally and reflection specifically are considered as process of knowledge transformation instead of knowledge transmission.

As widely accepted by scholars reflection is transformative learning process where participants develop critical level of thinking and enhance personal understanding of theories. In proposed co-operative reflection process (Figure 5.1), the individual reflection is the process of developing knowledge from personal understanding of service experience. Besides that, co-operative reflection allows the collaborative reflective thinking and

meaning-making which shows the emergence of collaborative knowledge at group level. As depicted in Figure 5.2, the co-operative reflection process supports knowledge-building at two levels during individual reflection where knowledge is created as individual cognition and co-operative reflection where knowledge is created at group cognition. We define our theory of knowledge-building through co-operative reflection into formal model which shows the processes of knowledge-building (see Figure 5.2). In CRM, the knowledge-building process during co-operative reflection consists of five sub-processes which is further discussed as follows with reference to the knowledge-building theory:

1. Internalization

The knowledge-building process starts when student internalize information collected during service experience, process it while reflecting individually using own prior knowledge. This sub-process named as ‘internalization’ where student critically think about personal service experience by presenting personal thoughts and feelings. The individual reflection provides opportunity for students to process information collected from service experience and assimilate it into their personal knowledge by interconnecting new and old knowledge. During internalization process students able to develop new individual knowledge for example students use the service experience’s information to expand their own knowledge about the application of theories in real life.

There are several prolific theories that suggest learning occurs through internalization of information (Piaget, 1977) more importantly information creation from social environment (Vygotsky, 1980). Individual knowledge creation take place through internalization when individuals process information and assimilate it into their personal knowledge. Internalization is an active process where learners accept

new information that make changes in their existing knowledge by improving understanding of concepts (Cress & Kimmerle, 2008; Kimmerle et al., 2015). In this sense, internalization process defines how individuals translate information which they perceived from service experience into new knowledge based on what they already know and remember. In our theory the internalization process captured as ‘learning from individual reflection’ that occurs when individuals process information obtained from service experience by utilizing their personal understanding/knowledge without coordination with other group members.

2. Externalization

Second sub-process is ‘Externalization’ where students sharing and explaining their personal understanding about service experience with others. In other words, externalization triggers the co-operative reflection by sharing individual reflection, which allows critical analysis and evaluation of personal understanding of group service experience from others perspective. The externalization process supports learners to clarify personal understanding and expand their knowledge (Beers et al., 2005; Cress & Kimmerle, 2008). In this context, when student externalize their personal experience with others it leads to individual knowledge creation process, while sharing own service experience students can expand their personal knowledge. The externalization defines as communication process when individuals share their own knowledge to others in a group. In this sense knowledge-building take place when individuals confronted with new information externalized by their group members that is based on their own thoughts and knowledge (Kimmerle et al., 2015). In our theory of knowledge-building through co-operative reflection, externalization characterizes ‘learning from communication and learning from others’ where

individuals learn while communicating their own knowledge (from their personal service experience) to others and individuals also learn when they obtain and interpret information (from others service experience) shared by other group members (Grand et al., 2016).

3. Conceptualization

Third sub-process is adapted from experiential learning theory named: 'conceptualization' which is defined as formation of new ideas and concepts. According to the Kolb's experiential learning theory (1984) learner can develop new concepts by reflecting on service experience/prior knowledge. In the proposed co-operative reflection process students can generate new concepts and ideas by critically analysing individual point of views on service experience. Conceptualization is an active process demonstrates a change in student's old knowledge that take place in two ways: first is assimilation which means learn new knowledge on the bases of existing knowledge (Cress & Kimmerle, 2008). Second is accommodation which means gain new knowledge in a way that make changes in existing knowledge in order to achieve better understanding of the concepts (Cress & Kimmerle, 2008).

In this context, the Piaget theory (1977) of cognitive conflict helps to understand this concept where scholar assumes that learners can experience a cognitive conflict when they observed information imbalance. They requires to rebalance their cognitive system by assimilating new information or by recreating on current knowledge in order to revise existing beliefs. However, he focused on the cognitive system only and more concerned with the internalization of information in individual's cognitive system. Kimmerle et al. (2015) have described cognitive conflict with respect to

social system where new information perceived from social environment cause for cognitive imbalance if do not meet their expectations. In this case the new information may accommodate by changing the existing beliefs of learners in social system or may assimilate after questioning its validity.

From this point of view in our theory, this concept is captured as ‘conceptualization’ process in which individuals must connects his intellectual understanding of service experience (internalization) with others service experiences (externalization) to grasp clear idea of group experience. During internalization and externalization process in co-operative reflection learner may accommodate or may assimilate new information if cognitive conflict occurred. The cognitive conflict appears during co-operative reflection as results of internalization and externalization process that encourage individuals to recommend new ideas and solutions that cause for collaborative knowledge-building. However, recommendations depends on the level of cognitive conflicts occurred between group members point of views.

4. Negotiation

The fourth process named as ‘negotiation’ which brings students into discussion and communication process where they agreed on one or more ideas. This process adopted from current knowledge-building theory (Stahl, 2000) and considered compulsory to achieve shared understanding of particular concept at group level. In this context, Zheng (2017b) has suggested that collaborative knowledge-building is a collaborative activity that can only be accomplished when participants engaged into negotiation process to achieve an agreement level. This is an iterative learning process, before moving to shared understanding or final decision students moved

back to preceding stage and negotiate on possible recommendation in the light of service learning experience.

At this stage, individuals refer to their existing knowledge/service experience to compare whether the new information shared by group members shows any relationship or dependency to achieve collective understanding. In the context of our theory, relating and understanding the situation that is being reflected, it is important to question others' contributions for the validity of newly produced ideas or denying their relevance with respect to their group service experience.

5. Integration and Collaborative Knowledge Articulation

Last process named as 'integration and collaborative knowledge articulation' in our theory that aims formation and articulation of new collaborative knowledge. In this process students can draw conclusions on co-operative reflection where they interactively achieved new collaborative knowledge at group level. Stahl and Singh et al. (2009; 2005) have suggested that the knowledge created in group discussion at group level might not be in any individual's mind, but can be achieved interactively in group dialogue. This process generates new collaborative knowledge which individuals internalize to their cognitive system.

Based on above discussion, it can be said that conceptual model define processes that leads to co-construction of knowledge through co-operative reflection which advance the existing reflection theory from knowledge-building perspective and contribute in the body of knowledge.

5.5 Scaffolding Co-operative Reflection

There are various studies that emphasized on reflection scaffolding as they considered that reflection is a complex learning activity and it is not always be in oral form (Coulson and

Harvey, 2013; Ryan, 2011; Ryan & Ryan, 2013). It is compulsory for students to understand the meaning of reflection and know about its important components. Therefore, scaffolding co-operative reflection by identifying its important components will be effective in two ways. Firstly, providing guidance and support students while performing co-operative reflection and secondly helping teachers in assessment of co-operative reflection.

With reference of existing studies Ryan (2013) asserted that reflection or reflective writing is complex. Particularly for undergraduate students it is difficult to master in reflection without necessary guidance and support. He discussed reflective writing in general context of academic learning and identified important components e.g. description, recount, explanation and discussion. In addition to this some scholars stated that reflective writing is not about the selections of appropriate vocabulary and grammar (Birney, 2012; Gibson et al., 2017; Ryan, 2011). However, there are some important contextual factors that make it different for instance ‘discipline’ for which reflective writing is taken. In every discipline knowledge is organized in specific way which is different than other disciplines. For example, reflection in service learning has its own characteristics, as reflection links community service with academic learning (i.e. theories & concepts).

In the context of service learning, some reflection models (see Chapter 2) were comprised of important elements for individual reflection such as description, feelings, analysis, articulation of learning and future plans. While these elements cannot fit in the context of co-operative reflection. The important components of co-operative reflection identified from existing literature (Adelopo et al., 2017; Prilla et al., 2015; Yukawa, 2006) such as: personal thoughts; self-evaluation; knowledge application; critical analysis and evaluation; sharing and referring to experience; discussion and argumentation; generating and exchanging new ideas; shared understanding; and outcomes with future intentions. This study will emphasize

on reflective writing with necessary guidance from teachers/peers. Scholars suggests that structuring reflection activity and providing guidance will be effective to encourage students to link their service experience (actions), personal thoughts, feelings and academic learning (Bentley-Williams, 2017; Clara et al., 2017; Prilla et al., 2012).

The development of a hierarchy for reflective writing from descriptive level to critical level and providing a framework for reflection assessment. In this study, researcher utilize the revised Bloom's taxonomy as a framework to design reflection prompt questions for co-operative reflection. These questions help students to trigger individual reflection and structure individual and collaborative thoughts in a specific context. These questions are used for the preparation of co-operative reflection assignments. Table 5.1 presents guided questions based on different learning perspectives adapted from (Ash et al., 2005; Molee et al., 2010; Plack et al., 2005; Ryan & Ryan, 2013).

Table 5.1: Reflection Prompt Questions Based on Revised Bloom's Taxonomy

Bloom's Taxonomy	Guided Questions for Academic Learning	Guided Questions for Civic Learning	Guided Questions for Personal Learning
Remember	Identify an academic concept/theories (course material) which relates to SL experience?	Identify social and ethical issues that emerged during your SL project?	List new skills (personal and professional) have you learnt during SL experience? Recognize a particular skill or set of skills that you need to develop further?
Understand	Describe academic concept/theories (course material) which relates to your SL experience?	Describe most difficult and most satisfying parts of the community service you had performed? why Describe how did SL experience help you to understand your responsibility as a citizen?	Describe why new skills important for you?
Apply	How does you apply your academic concept/theories (course material) in your SL experience to address community need?	How did you apply your prior knowledge to serve community in the context of specific objectives?	How will you apply your new skills in future?
Analyze	Compare and contrast your course material (concepts and theories) and SL experience, in what specific ways academic material and experience same or different?	Categories what are the possible reasons for social and ethical issues emerged during your SL project? Compare your current SL experience with you previous community service or volunteer work (if you have prior community work experience)	Investigate personal strengths and weakness that you have found during SL experience?

Table 5.1 continued

Evaluate	Evaluate the adequacy of course material (concept and theories) and your prior understanding of it?	Justify how your service impact your community how do you know?	Evaluate your performance and identify where you need additional guidance and learning in order to be more effective in SL project. Justify how does your learning (academic and personal) in SL experience matter for your career development?
Create	Construct new ideas how can we implement changes in our course material or improve concepts and theories? Compile your SL experience how does it helps you to better understand the course material or concepts/theories? Write what new knowledge you acquired about concepts and theories? Develop a plan, how will you apply what you have learnt (during SL experience) in future situations?	Propose suggestions how to avoid social and ethical issues that emerged during your SL project in future? Develop the steps necessary to make improvement in future SL programs? Create a list of other problems or community needs (which you recognized) to be address through future SL programs?	Create a plan for refining your skills and overcoming your weakness in future.

5.6 Implementation of CRM

As mentioned in Chapter 3, CRM system was implemented to prove the concept of CRM. Mainly, our purpose of developing CRM system is to provide co-operative reflective learning environment for students to foster collaborative critical thinking and knowledge-building. It provides necessary functionalities discussed in Section 3.3.3.1 which are required to conduct structured co-operative reflection based on proposed model (see Figure 5.2).

This system is designed to fill the requirements of promoting co-operative reflection, where large number of students enrolled in service learning class and they are working on group based service learning projects. It allows to keep track of student progress by providing four types of continues reflection activities for instance system presents: 1) structured co-operative reflection module which was designed to support structured co-operative reflection and foster high level reflective thinking and knowledge-building; 2) Self-regulated reflection module which was designed where students can update their daily project progress and reflect on it; 3) Teacher / student initiated reflection module which was designed where teacher / student can share their personal experience and project related material to reflect on mutual experiences; 4) individual reflection module which was designed to measure students individual behaviour and attitude towards service learning experience. In addition to this, system also includes project creation and reflection preparation modules which were used to support the core module (that is structured co-operative reflection module) of the system.

CRM system offers an inter-group networked platform that aims to facilitate real-time interaction and ensure continues co-operative reflection activities under course instructor supervision. Unlike other available technologies as discussed in Chapter 2, our system

provides a promising structured medium for co-operative reflection that ensures level of privacy required for fostering collaborative reflective thinking and knowledge-building.

More importantly it is a two layer system, where teacher have separate space to prepare reflection activities, monitor student progress throughout service learning project and assess student's attitude towards service learning project. According to proposed model (presented in Figure 5.2) , we need a controlled environment that facilitate teachers to design co-operative reflection tasks and support the practice of drawing conclusions on co-operative reflection to build collective knowledge. This promising idea of the system enhance transparency of collaborative knowledge-building through co-operative reflection and keep track of student's level of reflective thinking. System includes three user roles such as course instructor, students and admin or coordinator. Next section presents the overall architecture CRM system which intends to proof the concept of CRM.

5.6.1 CRM System Architecture

The implementation of CRM system follows the layered architecture. The use of layered architecture for software development is very famous technique to divide complex software development task into manageable parts (Chengjun, 2009). Moreover, each layer performs specific functions or services which offer separation of underlying logic, workflows and understanding of technologies used for each layer. In order to implement CRM system, layered architecture defined operational layers which is based on the logic of co-operative reflection model and divides the essential processes into executable modules. In this study, implementation of prototype is completely based on open-source software development tools such as: Laravel and Bootstrap (web development frameworks) by using high-level programing languages PHP, JavaScript, and Html which allows rapid application development. Both web development frameworks are open-source and cross-platform, with

a vast user community and wide range of freely available packages and libraries (Nguyen, 2015). The implementation layered architecture includes three layers named as: data layer, business (process) layer and presentation layer as outlines in Figure 5.3. Description of these three layers is as follows:

1. Data layer performs all activities required to maintain and store data for system processes. This system uses MariaDB which belongs to MySQL relational database family. The core feature of this layer is to deal with different events necessary to access, store and retrieve data. In the case of collaborative reflective learning environment which requires to access and manage a large amount of data, Laravel an open-source PHP framework used for this system implementation that makes database handling easy with incredible support for database migration. Moreover, it also provides core storage libraries to upload files, managing and transferring files.
2. Business layer is the core implementation layer of prototype system, it deals with all essential processes required to implement a computer supported co-operative reflection system. This layer presents all functionalities of prototype system as discussed in Chapter 3, Section 3.3.3.1. The implementation of prototype system consists of seven modules such as: 1) project creation module, 2) reflection preparation module, 3) structured co-operative reflection module, 4) individual reflection module, 5) teacher / student initiated reflection module, 6) self-regulated reflection module, and 7) result visualization and reporting module, which are associated with all system functionalities discussed in Section 3.3.3.1. Each module performs logical operations and processes to present a comprehensive computer supported co-operative reflection system. The core module of this prototype is structured co-operative reflection environment that executes with the help of other

modules such as: reflection preparation and project creation. Next section demonstrate the workflow of structured co-operative reflection module which is adopted from proposed Co-operative Reflection Model (CRM).

3. Presentation layer of the system architecture carries out user interfaces to deliver seven functionalities of prototype system. It presents user interface (for all modules) which is necessary to develop interaction between user and system such as: taking user input and presenting outcomes or outputs of the processes to the user. In this study we are not presenting the user interface for all modules however next section describes the core module (structured co-operative reflection) and its logical association with CRM for verification of underlying concept.

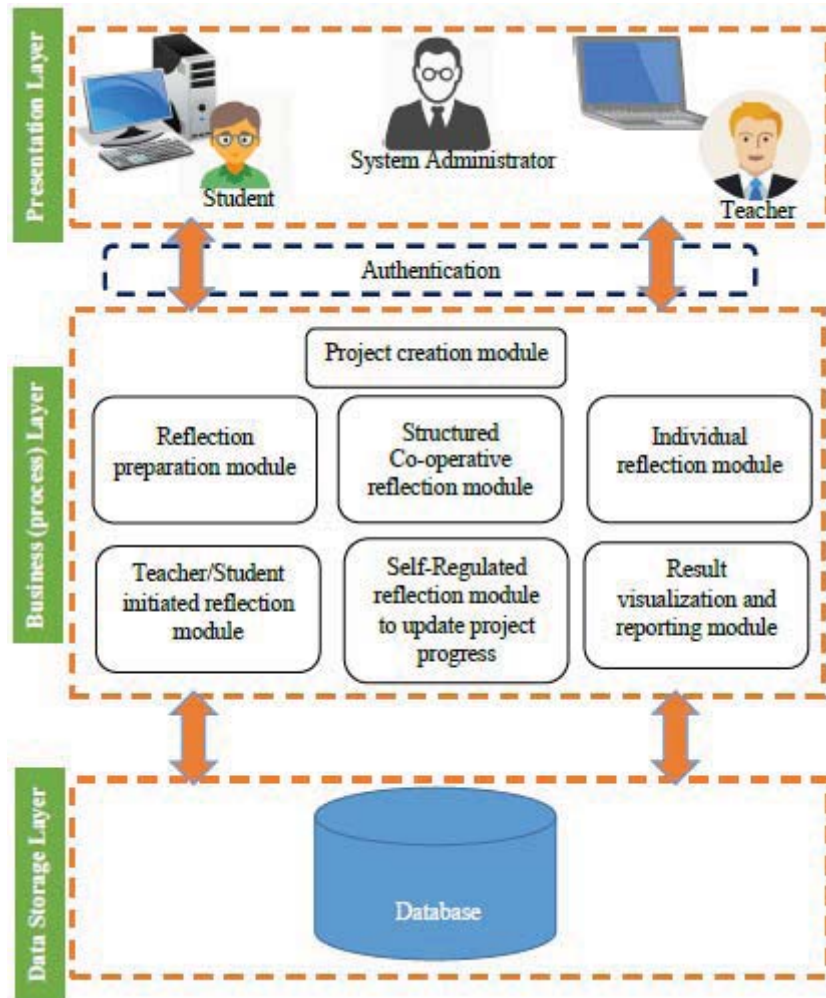


Figure 5.3: CRM System Architecture

5.6.2 Structured CRM Module

This section describes the design principles of CRM system to support the logic of co-operative reflection model (CRM) by providing structured co-operative reflection activities to promote collaborative reflective thinking and knowledge-building. Among the system modules mentioned above structured co-operative reflection module is the core module of this system which is implemented to provide support for every step identified in proposed model. Figure 5.4 illustrates the workflow of this module which is derived from CRM.

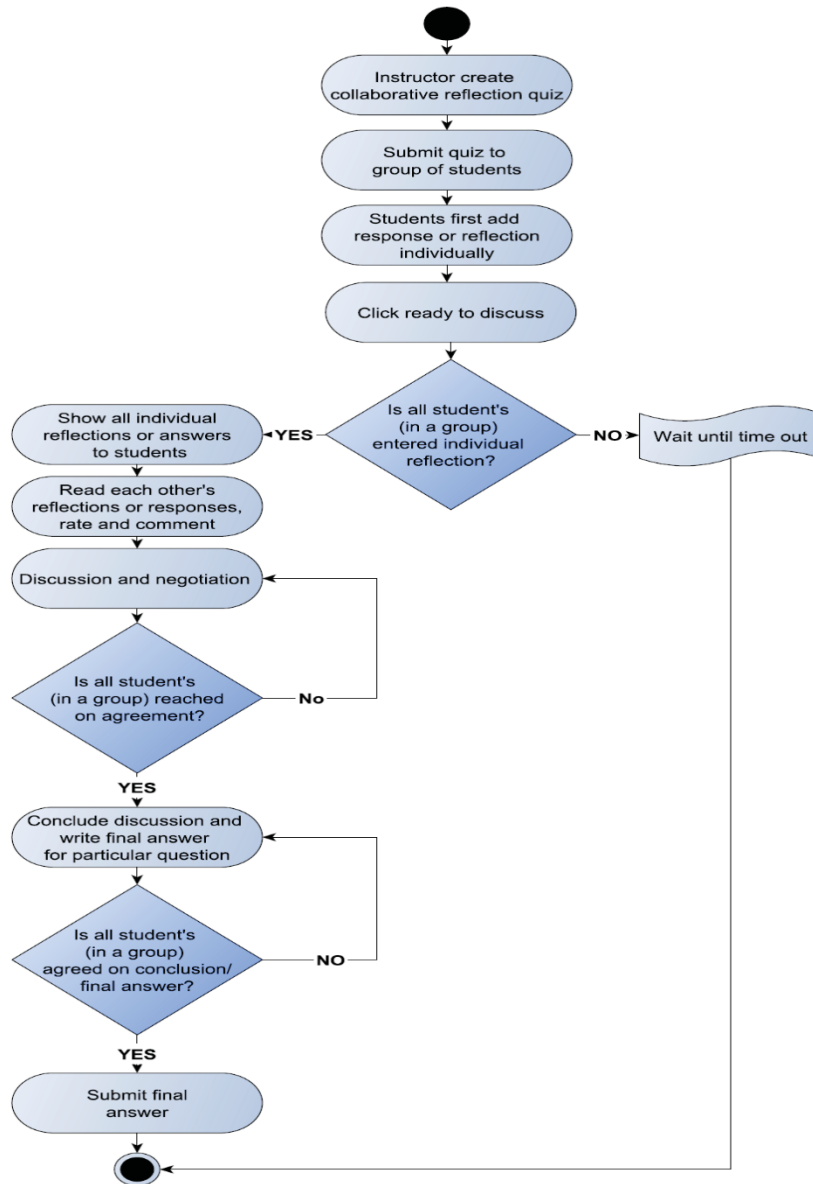


Figure 5.4: Workflow of Co-operative Reflection Model (CRM)

In the system process starts when teacher creates reflection prompt questions and quiz for co-operative reflection by using 'reflection preparation module' of the system which facilitates to design reflection activities according to the project requirements or situation. It also helps to structure reflection prompt questions according to different levels of revised Bloom's taxonomy. After preparing group reflection task teacher send it to specific group of

students, who registered in the system by participating in a group based service learning project through ‘project creation module’ of this system.

According to the conceptual co-operative reflection model, we designed our system to support for each stage and provide a controlled environment for knowledge construction from individual cognition (through individual reflection) to group cognition (through co-operative reflection). System provides individual reflection space where students reflect individually in response to the reflection prompt question by using their web based interface (see Figure 5.5).

This space supports for documenting students individual thoughts/personal understanding that encourages deeper observations of personal service experience. With reference to the knowledge-building process, individual reflection allows students to internalize information collected from service experience, process it with prior knowledge and transform tacit knowledge into explicit knowledge by responding to particular reflection prompt question that trigger individual reflection. At this stage students will utilize his personal understanding of service experience and prior knowledge to reflect without peer support.

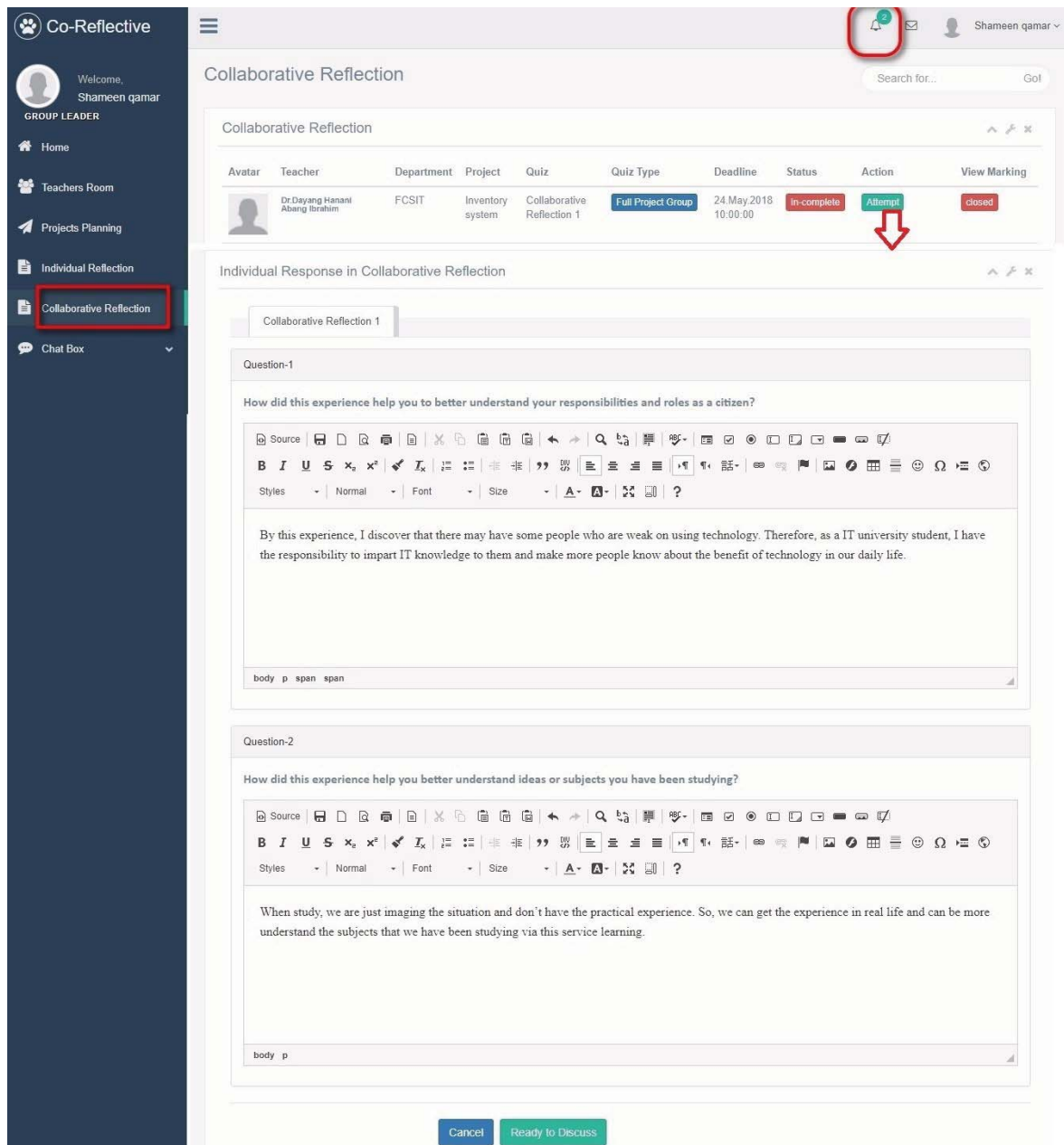


Figure 5.5: User Interface to Add Individual Reflection

Referring back to the proposed model second step is co-operative reflection, for this purpose system allows students to share their individual reflection with other group members. Once all participants of group ready for discussion or want to share their individual thoughts with others, system integrates all responses into an ‘integrated window’ that provides a co-

operative reflective learning environment where students can read, rate and comment on each other's individual reflection (see Figure 5.6).

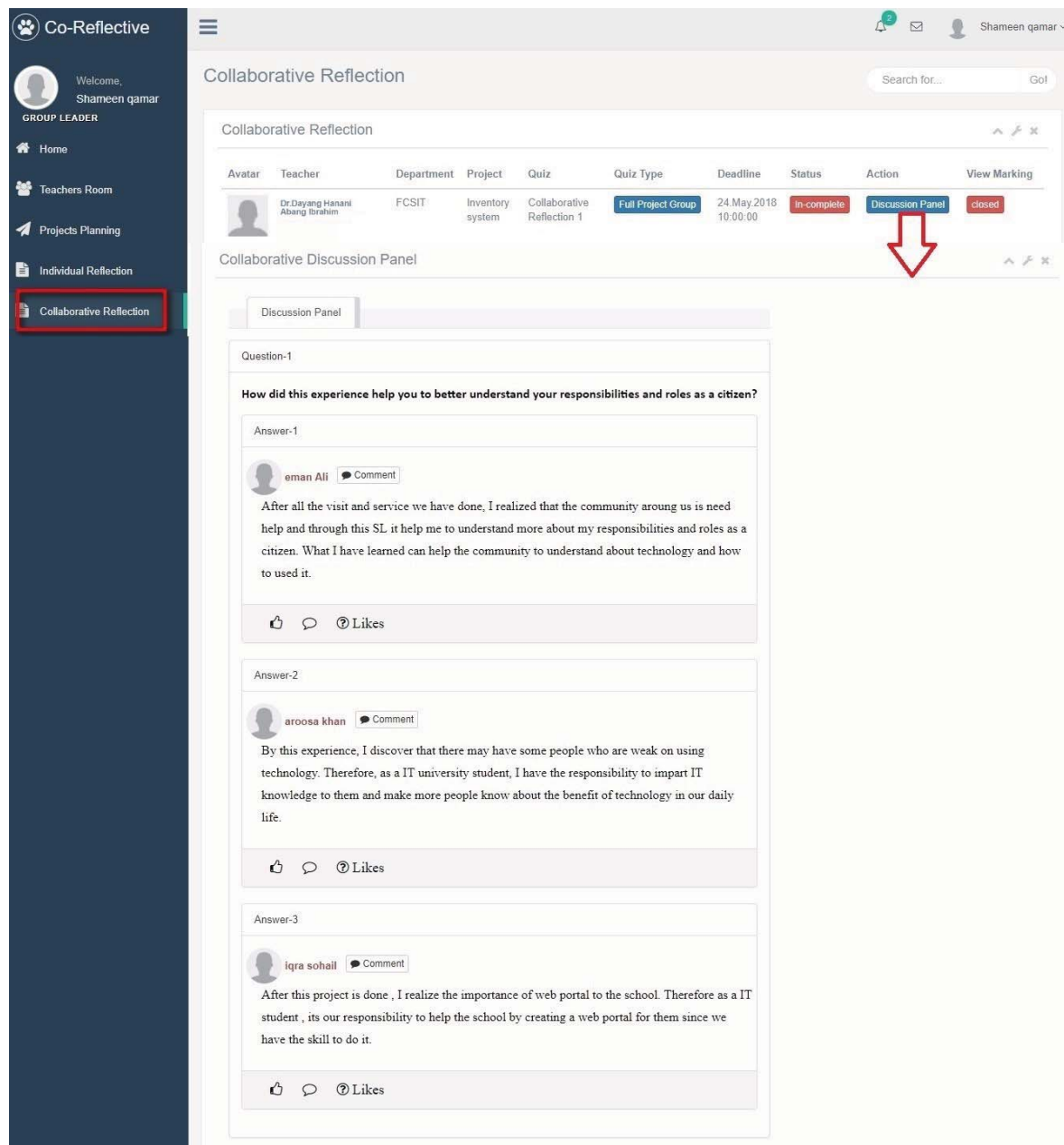


Figure 5.6: User Interface for Co-operative Reflection

It is pertinent to note here, the integrated view of all responses triggers co-operative reflection and student's active participation. Furthermore, it also facilitates documentation of conversations in structured way for specific reflection prompt question which encourages

critical analysis of service experience from different perspectives. Here, system provides easy to use scaffolds for comments (which are based on theory/concepts, based on personal opinion) to enhance understanding of theories and enables personal learning from service experience. Thus, system enables 'externalization' process for knowledge-building, where students can enhance their personal knowledge by sharing their own experience, giving explanations and obtaining new learning from other's experiences.

In order to promote in-depth analysis and discussion during co-operative reflection, system also offers functionality like discussion forum separately for collaboration where students can discuss personal experience (see Figure 5.7). This may support for the recommendation stage of proposed model which helps students to present their own perspective, elaborate it and compare with other's experience. It allows students to present personal suggestions, reflect based on personal knowledge and experience for particular reflection prompt question. It also facilitates documentation of different point of views and discussion that enables recursive reflection that further leads to negotiation for finding shared understanding.

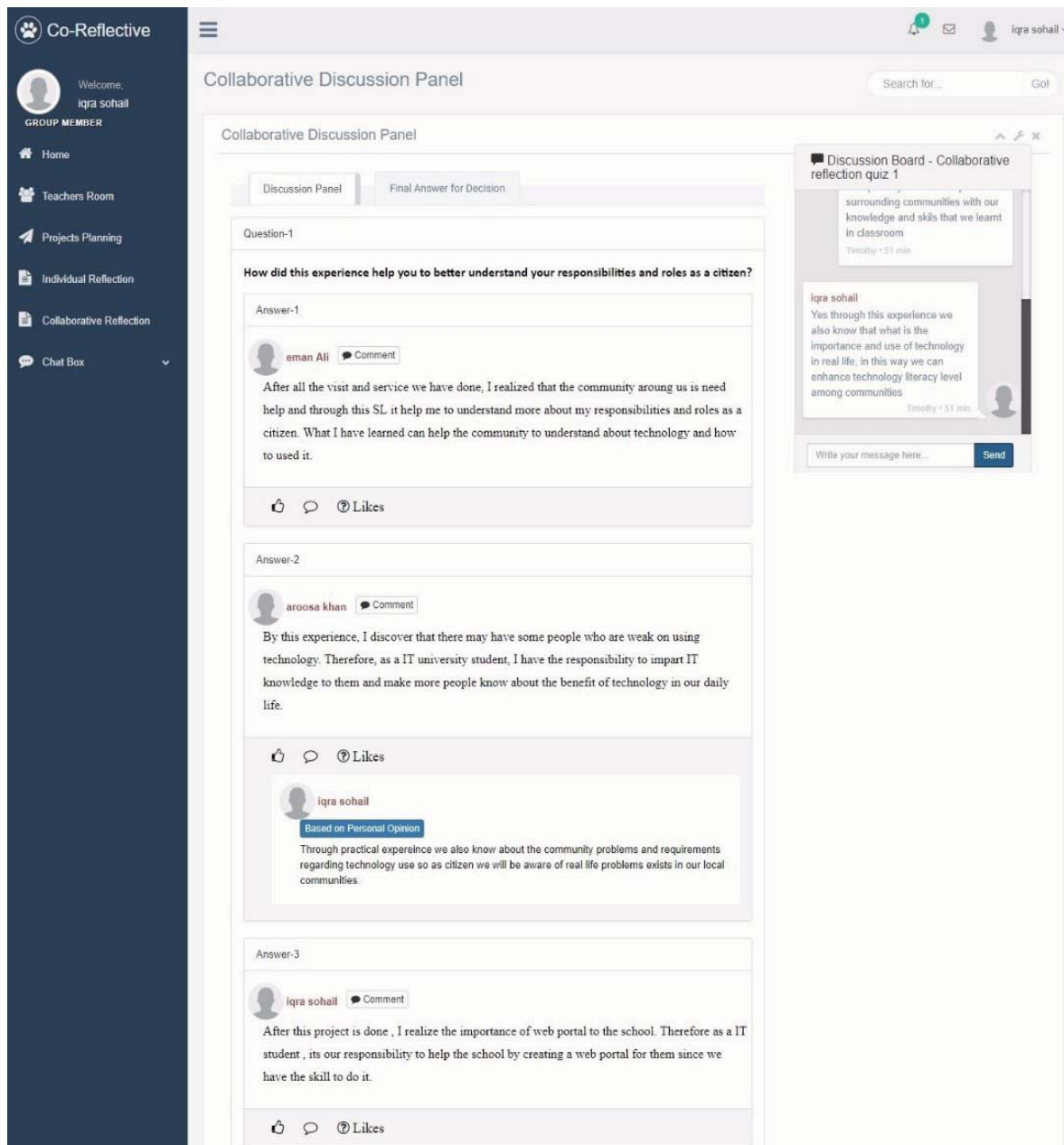


Figure 5.7: User Interface for Integrated View of all Reflections and Discussion

With reference to the knowledge-building as explained in Figure 5.2 system functionalities facilitates ‘conceptualization’ process where students can put their own ideas or solutions while comparing personal understanding with others perspective. It promotes deeper understanding of different concepts / theories in the light of real life group service experience. Besides that, a system enables recursive co-operative reflection and negotiation

on particular situation reflected and the need to develop dialogical interaction to grasp on shared understanding.

In order to promote knowledge-building during co-operative reflection activity and provide technology support for last stage of proposed model system offers a separate space to write final answer, where we asked group leader of each project to draw conclusions on co-operative reflection discussion, and share this with your group members for second opinion (see Figure 5.8). It allows participants to contribute further and draw conclusion on co-operative reflection. This process is second loop reflection to achieve shared understanding and generate new collective knowledge. This is the integration process to maintain shared resolutions and articulation of new collaborative knowledge that is the outcome of group cognition.

5.7 CRM Evaluation

As discussed above, the Co-operative Reflection Model (CRM) is implemented as CRM system to provide structured co-operative reflective learning environment. In order to evaluate the CRM, system usability and success, various workshops were conducted with target users (service learning participants) of the system. These workshops were organized to demonstrate system and test its usability and effectiveness for intended purpose (structured co-operative reflection) for which it was developed. For the purpose of this study service learning course participants from Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak were invited for prototype system testing. These workshops were conducted in academic session 2017-2018, in which total 80 students participated, who completed at least one service learning course.

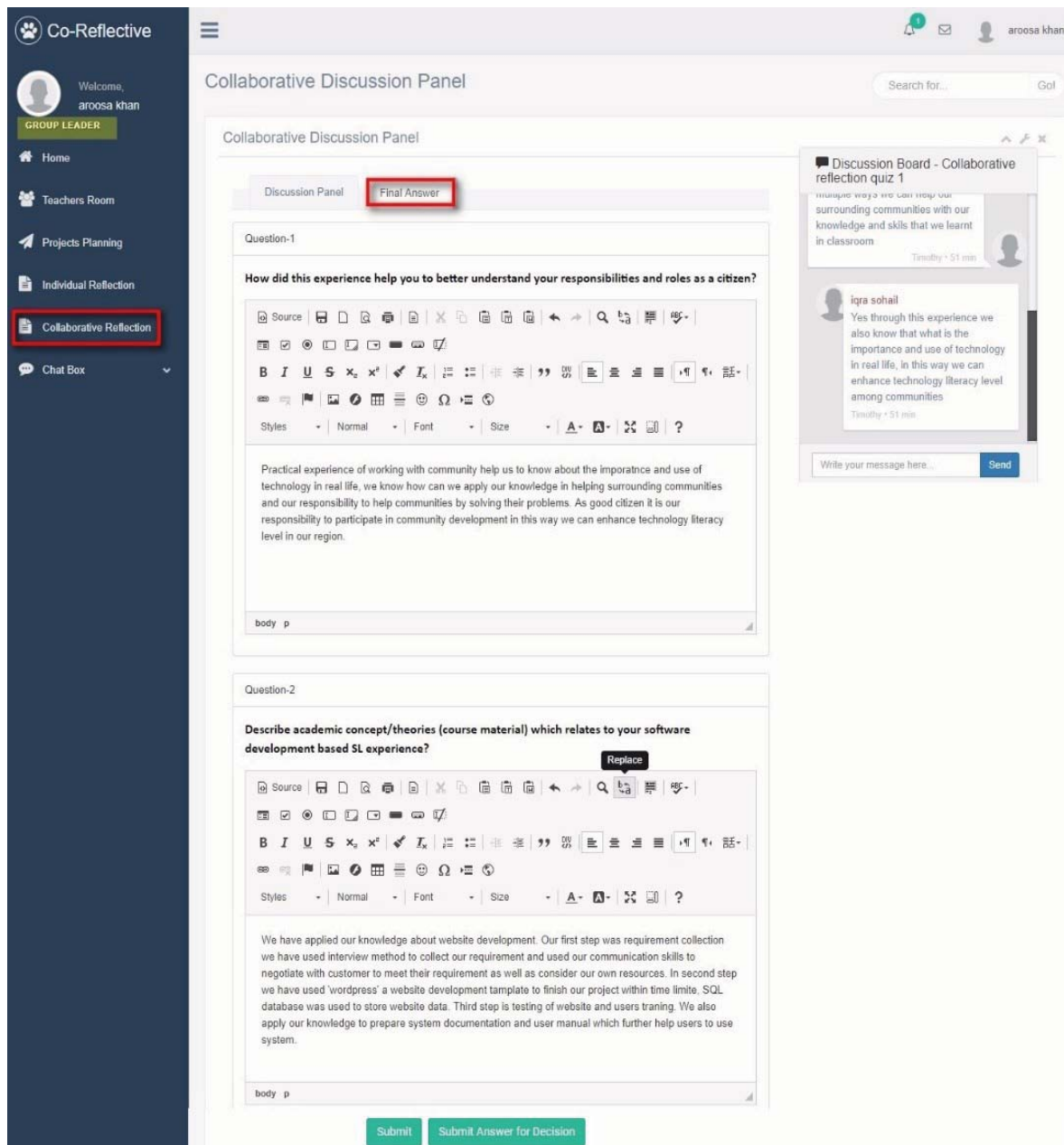


Figure 5.8: User Interface for Drawing Conclusions for Co-operative Reflection

The workshop begins with a brief presentation by researcher which includes introduction of prototype system, co-operative reflection process and some other important concepts related to service learning. Then with the help of faculty, group reflection task (that is based on reflection prompt question) was designed by using reflection preparation module of the system. After group reflection task preparation, it was submitted to the students (who

registered with system) of workshop who were divided into groups, 3-5 number of students in each group. In addition to this soft copy of system user manual is distributed among workshop's participants for their help. At the end of the workshop a self-administrative survey was also conducted for the overall assessment of prototype.

As mentioned in Chapter 3, two types of data was collected during these workshops 1) data retrieved from system database and 2) online questionnaire. It is also mentioned that evaluation of CRM comprises of two steps verification and validation; therefore, the data retrieved from system database is used for verification by employing qualitative method and questionnaire data used for the overall evaluation of prototype system through quantitative method (see next chapter).

As described in Chapter 3, the verification process for CRM evaluation aims to ensure that adopted theories are properly implemented in the designed model. In this study, for the verification of CRM, content analysis method used to analyze group reflection task results with the help of experts. The content analyses process performed by using coding scheme which is adapted from previous studies (see Appendix-2) and three cases were selected from the database. A face to face interview was conducted with experts to obtain their feedback on proposed model and their expert opinion for content analyses. As part of this, co-operative reflection data (which are three cases) and coding scheme were shared with them for content analysis.

5.8 Findings

As discussed above, coders individually applied coding scheme twice to the data produced in the prototype by students for group reflection task. Before coding we organized data and performed pre-analysis to check completeness of the task. A total of 157 messages were posted during co-operative reflection by three groups. After removing all messages which

are not presenting reflective or knowledge-building content (e.g. no clear relation with service experience, learning and knowledge-building), data was shared with coders to analyze level of reflective thinking and knowledge-building. Coding process performed by coders in rigid way to ensure that data coded twice for assessing level of reflective thinking and co-construction of knowledge. After coding, the results were compared and discussed to confirm coding scheme applied in a similar fashion. Then Inter-rater reliability was checked by using Cohen's Kappa, a statistical measurement. Table 5.2 presents the obtained value of Kappa for each group, independently for level of co-operative reflection and knowledge-building. According to threshold value of Kappa explained in Chapter 3, we obtained moderate to substantial level of agreement between coders (see Table 5.2). It is an acceptable value for this study context to ensure the reliability of coding scheme, stability and reproducibility of a study.

Table 5.2: Inter-Rater Reliability with Cohen's Kappa

	Cohen's Kappa	
	Co-operative Reflection	Collaborative Knowledge-building
Group 1	0.68	0.64
Group 2	0.67	0.52
Group 3	0.59	0.56

5.8.1 Co-operative Reflection Presence

The distribution of messages into different levels (categories) of co-operative reflection/reflective thinking and knowledge-building is presented in Table 5.3. It shows the difference of the proportions of codes used for the messages in three groups. The details of each level and sub-levels of co-operative reflection scheme shows that, group-1 has obtained higher values 19% for 'referring to experience' (CR-2.2) and 'creating results' (CR-4.1); and group-2 achieved higher value 13% for 'developing connection between experience and

theories' (CR-3.2) and 16% for 'referring to experience' (CR-2.2) than the group-3. On the other hand, group-3 contains 14% messages for co-operative reflection 'describing experience' (CR-1.3) and 17% for 'developing connection between experience and theories' (CR-3.2). In addition, for collaborative knowledge-building overall higher values obtained for the Level 1 (academic related) in three groups, followed by the level 2 and 3, however, there are significant difference among proportion of messages for sub-levels of knowledge-building level 1 discuss in next section. The difference in the proportions of codes presented in Table 5.4 advise that the participants used the CRM system for all level of reflective thinking and collaborative knowledge-building to different extent.

Table 5.3: Messages Coded for Co-operative Reflection and Collaborative knowledge-building by Reflection Activity

Levels of Reflective Thinking Coding Scheme				
Main Category	Sub-Category	Group 1 (%)	Group 2 (%)	Group 3 (%)
Describing Experience (Level 1)	CR-1.1 Monitoring good practices or issues in a service experience	0.09	0.04	0.11
	CR-1.2 Providing justifications for actions performed in experience, explanation of situations	0.02	0.05	0.06
	CR-1.3 Mentioning personal or other's emotions	0.07	0.09	0.14
Referring to Experience (Level 2)	CR-2.1 Connecting an experience to other experiences, sharing own understanding	0.05	0.13	0.08
	CR-2.2 Responding to other's opinion, contributing your suggestions / new perspectives, Supporting other suggestions	0.19	0.16	0.14
Developing Connection between experience and Contents/Theories (Level 3)	CR-3.1 Present experience relevant course concepts and theories	0.12	0.05	0.08
	CR-3.2 Linking an experience with theoretical concepts or prior knowledge	0.05	0.13	0.17
Creating Results (Level 4)	CR-4.1 Giving evidence with reference of experience, proposing solutions or suggestions	0.19	0.11	0.08
	CR-4.2 Summarizing discussion and drawing conclusion and implications from reflection	0.12	0.11	0.08
	CR-4.3 Integrating academic concepts and service experience, in order to produce shared understanding, connecting all participants ideas/opinions	0.12	0.13	0.06
Total		100	100	100

Table 5.3 continued

Levels of Knowledge-building (CKB) Coding Scheme					
Academic Related (Level 1)	CKB-1.1	Information sharing and discussion related to academic concepts and service experience	0.18	0.24	0.19
	CKB-1.2	Inconsistency among participants, difference of opinion	0.15	0.04	0.08
	CKB-1.3	Recommendations, generating new ideas	0.08	0.16	0.14
	CKB-1.4	Negotiating (negotiation of relative concepts, personal thoughts)	0.15	0.13	0.08
	CKB-1.5	Co-construction of knowledge Agreement statements/application of newly constructed meaning	0.15	0.16	0.08
Task Coordination (Level 2)	CKB-2.1	To proceed discussion, give orders, or lead discussion	0.15	0.11	0.11
	CKB-2.2	Comment on others contribution and questioning about task or others contribution for explanation	0.10	0.15	0.24
Social Interaction (Level 3)	CKB-3.1	Developing interaction to identify each other and proceed discussion on collaborative learning activity	0.05	0.02	0.08
Total			100	100	100

More inclusive analysis to compare the presence of different levels of reflective thinking in three studies is presented in Table 5.4. Among the four main levels of reflective thinking in selected coding scheme, 34% messages of co-operative reflection data were coded for ‘creating results’ (Level 4) of total messages, which is followed by 25% for ‘referring to experience’ (Level 2), 22% for ‘describing experience’ (Level 1), and 19% for ‘developing connection between experience and theories’ (Level 3). The group-1 (which is the case from software development) shows that participants used CRM system to document individual reflection, share personal experiences and linking to others’ experiences. Most of the messages suggest for creating results (42%) which indicates students’ active involvement in reflective discussion and high level of critical thinking. Thus group-1 mainly covers all steps of proposed co-operative reflection model (which are individual reflection, co-operative reflection, recommendation and outcomes) to complete a reflective learning task by using CRM system.

Table 5.4: Total Messages for Co-operative Reflection Levels by Group

Levels of Reflective Thinking	Group 1	Group 2	Group 3	Total	%
Describing Experience (Level 1)	8	10	11	29	0.22
Referring to Experience (Level 2)	10	16	8	34	0.25
Developing Connection between experience and Contents/Theories (Level 3)	7	10	9	26	0.19
Creating Results (Level 4)	18	19	8	45	0.34
Total	43	55	36	134	100

The group-2 (which is the case from custom product development) presents quite similar results but more messages for referring to experience or follow up activities to response to others reflection (29%). As similar to first group the participants of this group also highly

active for concluding and creating results from co-operative reflection process as excerpted from second group:

“Based on your discussion, to me we can apply all skills and knowledge that we learned from this experience during our professional life” (student-3, G2).

Thus, this group shows higher value for academic concepts related activities performed in service learning such as developing connection between service experience and theories or contents e.g. a student wrote:

“I have applied theories and concepts related to design and develop a profiling database system, community need a database system to maintain community information which we know during requirement collection” (student-1, G2).

Therefore, we conclude that students mostly used prototype for responding to others reflection or follow up group reflection, presenting evidence of service connection with course related theories and generating results of the co-operative reflection process.

The group-3 (which is the case from IT training project) shows higher values for the first level of reflection which is describing experience (31%). It shows initial interpretation of service events e.g. student described:

“What I remember service learning project was basic IT training I worked with villagers who requested for training how to use social websites” (student-1, G3).

Description of good or bad practice and emotions e.g.

“Yes mainly developed communication skill as for my experience it was very difficult to teach elders, but it was interesting too when they ask questions” (student-4, G3).

This specifies that participants used prototype for individual reflection and sharing personal experiences to initiate co-operative reflection. More specifically higher interest in telling personal experience, referring to others experiences and follow others response. In this case more messages belong to descriptive, presenting academic activities and emotions may be because of the project demand, in which more activities relating to training others to use particular system, it is hard to get opportunity to apply concrete theories learned in the classroom. A typical example from this case where anonymous student said:

“I think, the academic concepts are not directly related to our service learning project but I can say i have applied my basic computer use skills to train community participants how to use computer for different tasks” (student-2, G3).

Although, there are differences among these cases in extent to which they contribute in different levels of reflective thinking, but we can conclude that in these cases, prototype is used for all steps (levels of reflection) of proposed co-operative reflection process. Figure 5.9 presents the comparative analysis of four levels of co-operative reflection observed in three cases. As depicted in Figure 5.9 students of group-1 and 2 were actively involved in critical level of thinking (synthesizing and producing results), as 42% and 35% messages coded for co-operative reflection level 4 for each group correspondingly followed by group-3 which have displayed a relatively less values 22% for level 4. Further details of collaborative knowledge-building is presented in the next section.

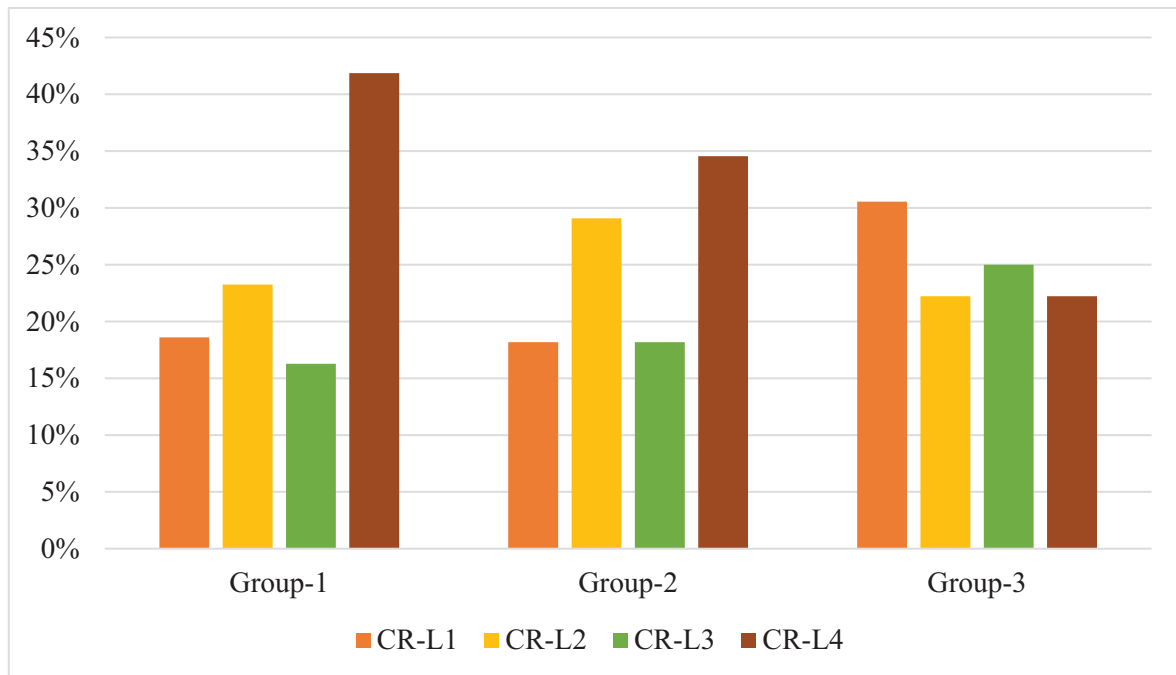


Figure 5.9: Comparative Analysis of Co-operative Reflection Levels

5.8.2 Collaborative Knowledge-Building Presence

With respect to the knowledge-building, in our model we proposed that co-operative reflection support co-construction of knowledge during this process as depicted above in Figure 5.2. In order to proof this, we have analyzed our data also from knowledge-building perspective with the help of experts. The difference of proportion of codes show that prototype is used for different levels of knowledge-building as illustrated in Table 5.3. The results of collaborative knowledge-building coding scheme show higher values (68%) for first level that is academic related than other two levels which are task coordination and social interaction (see table 5.5).

From perspective of knowledge-building group-1 used prototype mainly for academic related activities for example sharing information of course contents with 18% messages, active in exploring, discussing and negotiating on service related activities with 15% messages and more involvement on generating new understanding and summarizing

discussion to produce knowledge from reflection process with 15% messages. Co-construction of knowledge shows student's higher level of critical thinking skills and ability to synthesize the concepts discussed in co-operative reflection and generate conclusions. Also, in group-1 few messages (8%) show recommendations and creation of new ideas as student's contribution (see Table 5.3). Similarly, the data of group-2 shows higher frequency of messages coded for sharing information of concepts and theories applied in community service (24%). In group-2 students are much more active to contribute in co-operative reflection by giving recommendations and new ideas with 16% messages higher than group-1 and 3. As seen in Table 5.3, 16% of messages coded for integrating ideas and synthesizing the concepts to generate new knowledge is also higher than other two groups, one example message excerpted from case:

"I appreciate. Service learning project give us broader understanding of concepts and enhance practical skills, I agree with you my friend, I will never forget what I learn from this experience about database development concepts"

(student-4, G2).

In addition, data from group-1 and 2 shows least messages coded as task coordination and social interaction.

Table 5.5: Total Messages for Collaborative Knowledge-building Levels by Group

Levels of Collaborative Knowledge-building	Group 1	Group 2	Group 3	Total	%
Academic Related (Level 1)	28	40	21	89	0.68
Task Coordination (Level 2)	10	14	13	37	0.28
Social Interaction (Level 3)	2	1	2	5	0.04
Total	40	55	36	131	100

As contrary to above results, 36 % messages of group-3 coded for task coordination (level 2), compared with an average of 28% for all three groups (see Table 5.5). It reflects students mostly focused on asking questions, commenting on others contribution and seeking specific information. Group-3 showed second highest values for sharing information of course concepts with 19 % messages. In addition, 14 % of messages of group-3 were coded as recommendation and giving new ideas, following is the message extracted from group-3.

“I suggest that now we learned that how to work with community I will apply these skills in future community projects” (student-1, G3).

Although in this group students are actively contributing in co-operative reflection and sharing events related to community service however, few messages (8%) coded for negotiation and construction of new knowledge (see Table 5.3). Due to the higher number of messages regarding task coordination, it appeared that students of group-3 had more focus on asking information or clarifications of events and responding to other’s contribution. Moreover, lower values of messages identified for negotiation and integration of knowledge showed that students were not comfortable in summarizing and synthesizing co-operative reflection process to generate new knowledge. It reflects lower level of critical thinking skills, student’s ability to synthesize concepts discussed in co-operative reflection and form shared understanding or new knowledge. In other words, the students of group-3 hardly capture new insights from co-operative reflection task.

There are significant differences among proportions of messages appeared for three levels of collaborative knowledge-building coding scheme in above discussed cases (see Figure 5.10). As group-1 and 2 shows more occurrence of messages for academic related events and especially higher interest for contributing in discussion, negotiating and developing new

knowledge as compare to group-3. Despite of all these differences we can conclude that prototype is used for all three levels of collaborative knowledge-building in these three cases. In this study we analyzed data by differentiating contribution of groups in co-operative reflection to identify the extent to which prototype is used for supporting reflective learning activities. Next section focus on exploring the association of co-operative reflection with collaborative knowledge-building and use statistical measures to prove this concept.

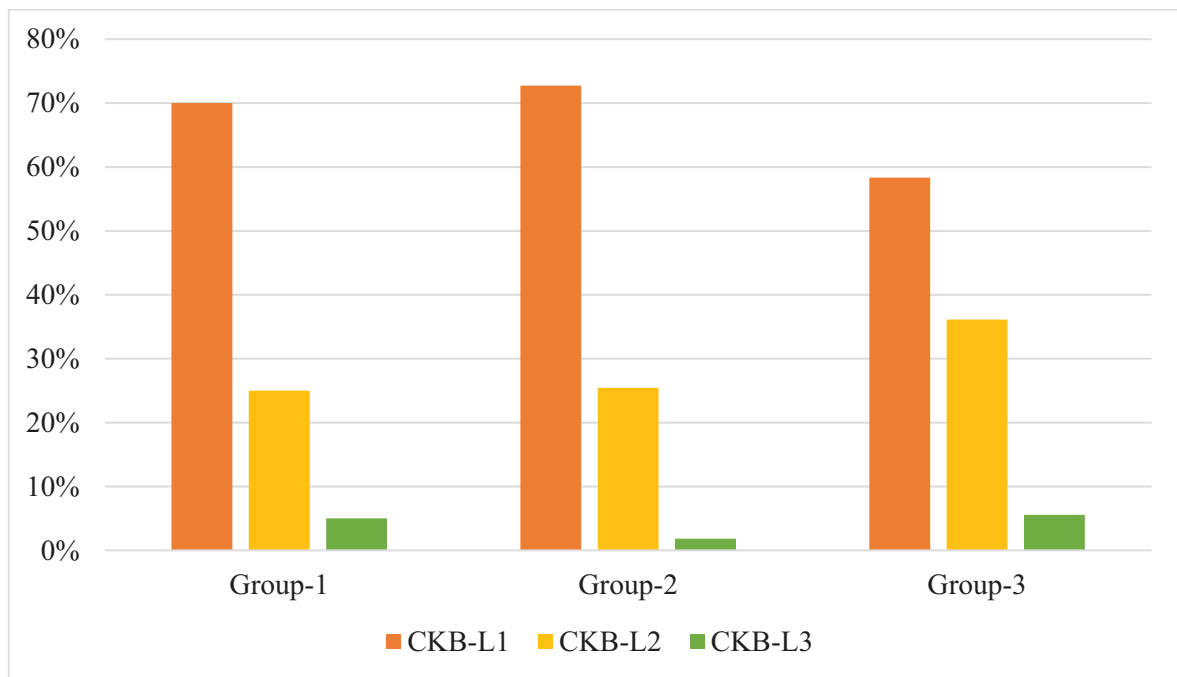


Figure 5.10: Comparative Analysis of Collaborative Knowledge-Building Levels

5.8.3 An Exploratory Analysis of Co-operative Reflection and Knowledge-Building

The Co-operative Reflection Model (CRM) was created with the assumption that the process of co-operative reflection have significant relation with the collaborative knowledge-building. According to this model reflective learning and knowledge-building are equally important to co-operative reflection. Based on the analysis of data it can be seen that codes of co-operative reflection and knowledge-building are not evenly distributed and there are significant difference in the occurrence of these codes in different cases. It suggests that in

our cases we found an association between reflective learning and knowledge-building and different levels of reflective learning and knowledge-building had positive impact. In order to investigate the relationship between co-operative reflective learning and knowledge-building an exploratory analysis was performed. For this purpose, Chi Square (χ^2) test of independence is used to determine the possible relationship between co-operative reflection and collaborative knowledge-building. While investigating the relationship between co-operative reflective learning and knowledge-building we particularly combined all sub-categories into main categories and consider as two independent categorical variables such as co-operative reflection (CR) and collaborative knowledge-building (CKB).

As described in Chapter 3, for Chi Square (χ^2) test of independence two hypotheses are created (null and alternative hypothesis). In this study, we hypothesized that: 1) H_0 = There is no association between co-operative reflection and collaborative knowledge-building, and 2) H_1 = There is association between co-operative reflection and collaborative knowledge-building. Table 5.6 presents the results of Chi Square test of independence which is calculated by using SPSS. Since the results show that there is a significant relationship between co-operative reflection and collaborative knowledge-building with χ^2 value of 13.73, significant at P value 0.003 which is less than $P < 0.05$. Therefore, we will reject the null hypothesis in this study. The strength of association is determined by using Phi and Cramer's value, which is vary between 0 -1. As per rule of thumb Phi and Cramer's value $< .10$ = weak relationship, $0.11-0.30$ = moderate relationship and > 0.30 = strong relationship (Pallant, 2011). In this context, we found Phi and Cramer's value of 0.31 which shows moderate to strong relationship between co-operative reflection and collaborative knowledge-building (see Table 5.6). This suggests that codes/levels of reflective thinking (which are describing experience, referring experience, developing connection between

experience and theories and creating results) have potential effect on the results of collaborative knowledge-building.

Table 5.6: Results of Chi Square (χ^2) Test of Independence for Association between Variables

Independent Variable	Dependent Variable	χ^2 Value	P Value (df)	Phi and Cramer's Value	Decision based on P-Value
Co-operative Reflection (combine with all sub-codes or levels)	Collaborative Knowledge-building (combine with all sub-codes or levels)	13.73	0.003 (3)	0.31*** Moderate to Strong	P < 0.5 reject null hypothesis
Phi and Cramer's Value <.10 = Weak relationship*, 0.11- 0.30 = Moderate**, >0.30 = Strong***					

In addition, non-parametric test chi square (χ^2) goodness of fit is also calculated for each level of coding to investigate significant difference between observed and expected values of specific phenomena. It is used to define that how well theoretical distribution fits with empirical probability distribution in sample data. In this study the occurrence of each sub-category of co-operative reflection and collaborative knowledge-building levels were compared to check the appearance of each sub-category in qualitative data. As similar to χ^2 test of independence here we hypothesized that: 1) H_0 = observed and expected values do not differ and 2) H_1 = there is a difference between the observed and expected values of the sample.

According to the results of Chi Square (χ^2) goodness of fit tests, the P values of 4 main levels of co-operative reflection were greater than 0.05 (see Table 5.7), which showed that there is no significant difference among the occurrence of sub-categories of these levels, means that the hypothesized distribution of sub-coding's fits with the empirical probability distribution. Moreover, for collaborative knowledge-building, the χ^2 values for level 1 is larger than 0.05

which indicates that there is no difference between the occurrence of 5 sub-codes of this level. There are two categories (task coordination and social interaction) of collaborative knowledge-building scheme that indicate difference, where $p < 0.05$ (see Table 5.7).

Table 5.7: Results of Chi Square (χ^2) Goodness of Fit Test

Main Category	χ^2 Value	P-Value (df)	Decision based on P-Value
Levels of Reflective Thinking Coding Scheme			
Describing Experience (Level 1)	0.88	0.64 (2)	$P > 0.5$ accept null hypothesis
Referring to Experience (Level 2)	1.05	0.30 (1)	$P > 0.5$ accept null hypothesis
Developing Connection between experience and Contents/Theories (Level 3)	0.03	0.85 (1)	$P > 0.5$ accept null hypothesis
Creating Results (Level 4)	0.16	0.92 (2)	$P > 0.5$ accept null hypothesis
Levels of Collaborative Knowledge-building Coding Scheme			
Academic Related (Level 1)	6.42	0.17 (4)	$P > 0.5$ accept null hypothesis
Task Coordination (Level 2) and Social Interaction (Level 3)	6.18	0.04 (2)	$P < 0.5$ reject null hypothesis

5.9 Discussion

In this thesis, we studied the missing dimension of reflective learning, which is the influence of co-operative reflection in collaborative knowledge-building in the field of service learning. Examining the three cases, this study provided deeper insights on co-operative reflection, its impact and association with collaborative knowledge-building. By reviewing the current literature of reflective learning exposed a need for more robust research to understand co-operative reflection process to view its outcomes in the field of service learning as discussed in Chapter 2. Here we discuss the findings of this study in the context of the existing literature.

5.9.1 Insights from Extant Literature

The results of this study reports great prevalence of high order reflective thinking in co-operative reflection performed by students through using prototype system. From the perspective of co-operative reflection, these findings are corroborates with the results of prior studies by Smit and Tremethick (2017) and Epler et al. (2013) who described occurrence of high reflective component in group reflection discussions as compare to individual reflection. As contrary to this, Adelopo et al. (2017) have reported limited reflective learning contents in student's group reflection reports which was assessed by using Kember's reflective content analysis scheme. Likewise, Bell et al. (2011) have stated high level non-reflective contents in students' journal which are different than the results reported by Plack et al. (2005) who stated larger reflective components (42%) in students' journal.

These results from existing literature may be based on specific discipline and the process used to conduct reflection activity. As recent studies (Burhan-Horasanlı & Ortactepe, 2016; Epler et al., 2013; Siegel & Schraagen, 2017; Smit & Tremethick, 2017) have reported high level reflective learning component in collaborative reflective discussion as compare to group reflection performed through reports or journals. According to O'Neil (2013), Smit and Tremethick (2017) group reflection allowed students to reflect on the descriptions of other's experiences and also consider their own experiences from others perspective that improved reflective dialogue between students in online learning environment. Findings of our study corroborate with latest research work on co-operative reflective learning in the field of service learning (Smit & Tremethick, 2017), that presents an indication of a higher or critical level of reflection during group reflection activity that may positively influence students learning.

According to the results described above, it is statistically proved that there is a significant association between co-operative reflection and knowledge-building. The results of content analysis also indicated that students were highly involved in summarizing co-operative reflection discussion synthesizing and integrating different ideas to generate new knowledge. These findings seems to suggest that co-operative reflection facilitates students to develop not only critical thinking skills but also enhanced confidence in their knowledge-building skills as a result of their group service learning experience. In this study we found that structured co-operative reflection process is very useful to lead students to develop shared understanding from reflective dialog and generate collaborative knowledge from their service learning experiences. The cases discussed above showed that 68% messages were rated as academic related in co-operative reflection activities which indicates that students were highly involved in collaborative knowledge construction.

Previous studies reported similar results for instance, Stokes et al. (2017) stated that shared endeavor and co-operative reflective learning process improved students' practical and academic understanding. They also argued that important knowledge was created through the process of sharing personal experiences, developing and exchanging ideas. Veen and Dela-Croix (2016) noted in their study of group reflection for professionals, the teachers derive new understanding by cooperating and negotiating on different teaching experiences. Moreover, similar results reported by Siegel and Schraagen (2017) who described through group reflection the implicit knowledge of individual workers shared with others and through collaborative sense making they were able to generate collaborative knowledge about particular phenomena.

From the perspective of technology support for co-operative reflection, Asmawi et al. (2017) noted in their study, the internes and teachers faced challenges regarding the effective use of

Blogs for co-operative reflection practice. On the other hand, Adelopo et al. (2017) and Veen and Dela-Croix (2016) stated the use of online discussion forum for group reflection, and the findings of their study demonstrate that students developed critical thinking skills and confidence as a results of service learning experience. Smit and Tremethick (2017) have reported students in online group reflection reflected on more topics than individual reflection. However, they highlighted the technological constraints and importance to understand different situations and collaboration level in co-operative reflection. Likewise, Adelopo et al. and Foong *et al.* (2017, 2018) emphasized on the importance of scaffolding and understanding students interactions during co-operative reflection which serves to enhance students' contribution in group reflection activity.

According to Adelepo et al. (2017), Blunk et al. (2016), Prilla (2015) and Bell et al. (2011) real-time coordination is successful for co-operative reflection to involves students in generating collaborative knowledge from different experiences than group based project reports or journals. Findings of our study shows that the design of CRM system is highly supportive for co-operative reflection and knowledge-building. As discussed above, our prototype system was particularly designed for conducting co-operative reflection that provides support for designing co-operative reflective learning activities along with a controlled inter-group communication environment for students who working in service learning projects. It also offers throughout students' progress monitoring where teachers can observe students individual reflection and contribution in co-operative reflective discussion that leads towards the understanding of collaborative knowledge-building.

As for the limitations of existing methods used for reflection in service learning course, we found that teachers faced difficulties to see the process of students' collaboration and progress monitoring throughout service learning projects. For instance, through final project

report or group reflective assignment they cannot determine each student's contribution, effort, interest and level of learning in group based service learning project. Since research on co-operative reflection to view the process of knowledge-building is rare and teachers have difficulties to predicting each student contribution and level of learning through reflection assignments. Furthermore, they also faced difficulties how should they structure co-operative reflection activities and intervene to increase the quality of co-operative reflection. In this context, CRM system which is designed and developed in this study provides effective support for structured co-operative reflection and open up new research directions for technology design for co-operative reflection. Next section continue with the explanation of prototype support for co-operative reflection and future research directions.

5.9.2 CRM System Design Support for Co-operative Reflection

The results of CRM system evaluation provides insights of tool support for all levels of co-operative reflection and knowledge-building. We summarized prototype system support for co-operative reflection in two themes: first, based on the findings from three cases we can differentiate among the levels of prototype support for co-operative reflection and secondly identify the limitations to highlight future research directions. In this case, we noted that because of structured co-operative reflection all students in different groups added their individual reflection in terms to describe their personal perspective towards service experience.

In addition, they also formed strong group cooperation environment in which all students interacted frequently for sharing individual reflection and referring to others' experiences. Here prototype facilitates to present an integrated view of individual reflection which enables students to give feedback on others reflection and sustain all feedbacks for particular question. As in group 1 and 2 it was observed that mostly students used scaffolding which

is designed for feedback or response to others reflection. In group 3, although students were engaged in reflective discussion however most of them focused on asking questions or explanation from others and giving feedback to their reflection.

Prototype supports an inter-group discussion environment in which they can exchange different ideas, suggestions on each other's experiences as part of co-operative reflection that leads to documenting and sustaining results from co-operative reflection activity. The recursive reflection process where group leader asked to summarize co-operative reflection discussion and write final answer that generate shared understanding from co-operative reflection of service experience. Throughout co-operative reflection teachers can give feedback on students' contribution and can also prompt necessary discussion when required. As discussed above, this prototype provides support for self-regulated reflection in which students can update daily service learning project progress and reflect on it according to different situations.

In addition to this our analysis reveals that system can improved in different ways such as: we can extend co-operative reflection to intra-group collaboration that may enables different groups to reflect together on different service experiences. We also suggest designing co-operative reflection assessment support by analytical analysis of user behavior in system and automatic content analysis by identifying different linguistic characteristics.

5.10 Summary

This chapter presented a co-operative reflection model, to elaborate the process of collaborative knowledge-building through co-operative reflection. The design aspects of our proposed model includes two components, which are co-operative reflection process (CRP) and synergy of co-operative reflection process and knowledge-building. Along with this, this chapter also elaborated a method for scaffolding co-operative reflection. In this regard, the

proposed model is conceptualized as the second design artefact of this research as outlined in Chapter 3.

This chapter also discussed the development process of a prototype system for conceptual model to conduct and visualize co-operative reflection and knowledge-building process. For this purpose, the layered architecture of the prototype system was constructed to achieve required functionalities. Then, the details of each layer of system architecture was also discussed by focusing on various processes associated with system functionalities. The workflow of CRM is also provided in this chapter, which serves as a base of its underlying concepts and presents a deeper understanding of flow of structured co-operative reflection design in prototype system.

Furthermore, this chapter outlined the evaluation of CRM through demonstrating a prototype system in real-world and examining evaluation results. In this chapter, the first part of evaluation that is verification of CRM is also presented, in which results achieved through execution of co-operative reflection assignments were examined using qualitative content analysis. Then the statistical measures were performed to analyze relationship between co-operative reflection and knowledge-building.

Further, next chapter presents the second part of evaluation which is validating the overall performance of prototype system. For this purpose, Information System (IS) success theory is adapted to validate the effectiveness and the usability of prototype system with real life users who participated in service learning projects.

CHAPTER 6

USABILITY OF CRM SYSTEM

6.1 Introduction

This chapter presents the results of overall evaluation of prototype system, to address the third research objective of this study. As discussed in previous chapter, the feasibility of implemented prototype system is verified by conducting a workshop with the real-world users of the system. The CRM system is evaluated to verify the proposed Co-operative Reflection Model (CRM) as discussed in previous chapter Section 5.8. Information System (IS) success theory was used to assess the overall success of CRM system, for this purpose updated information system success model was adapted and empirically evaluated. In this respect different IS success measures and hypothesis are tested through PLS-SEM method.

6.2 CRM System Evaluation

In order to evaluate the overall success of CRM system updated information system success model is adapted to measure its usability and effectiveness in real-world environment. The measurement of any information system success based on the objectives for which it is being studied. The success of CRM system is measured by system use, user satisfaction and its net benefits for which it was developed. CRM system is designed to provide a co-operative reflective learning environment for students; therefore, it is important to draw attention to understand one of the compulsory dimensions for collaborative learning systems' success which is 'sociability quality'. The construct of 'sociability quality' theoretically linked with social interaction theory for CSCL environment by Kreijns et al. (2007) as discussed in Section 2.11.2. The CSCL environments are designed with social cognitive learning aspects where educational and social functionalities are equally important to provide learners

support for deep learning, critical thinking and shared understanding in order to complete a collaborative learning task (Kreijns et al., 2013).

In this study, by using both IS success theory and social interaction theory we test the construct of '*sociability quality*' as a success dimension of CRM system (i.e. computer supported co-operative reflection system). We theorize that sociability quality which is one of the social functional characteristic of CRM system will influence the collaborative learning system use and user satisfaction towards it by combining this construct with updated IS success model.

The proposed theoretical model is evaluated by using *Partial Least Squares-Structural Equation Modelling* (PLS-SEM) technique, which comprises of measurement model (also called outer model) and structural model (also called inner model) evaluation. For this purpose, SmartPLS-3.2.3 software is used. PLS is a regression analysis method which maximizes the explained variance of all dependent variables of a structural model (Hair et al., 2014). Furthermore, this can also expand the possibilities of prediction goals and it is highly suggested specifically for those conceptual models that includes testing of new variables (Hair et al., 2011). Based on these arguments and description of PLS technique in Chapter 3, researcher decides to use PLS-SEM method in this study to evaluate adapted IS success model which is proposed for the evaluation of CRM system. Next section presents the proposed theoretical model.

6.2.1 Adapting Information System Success theory for CRM System Evaluation

The proposed theoretical model consists of seven constructs: system quality (SQ), information quality (IQ), service quality (SERQ), use (U), user satisfaction (US), net benefits (NB) operationalized from updated IS success model and sociability quality (SOQ) new construct theorized from social interaction theory as depicted in Figure 6.1.

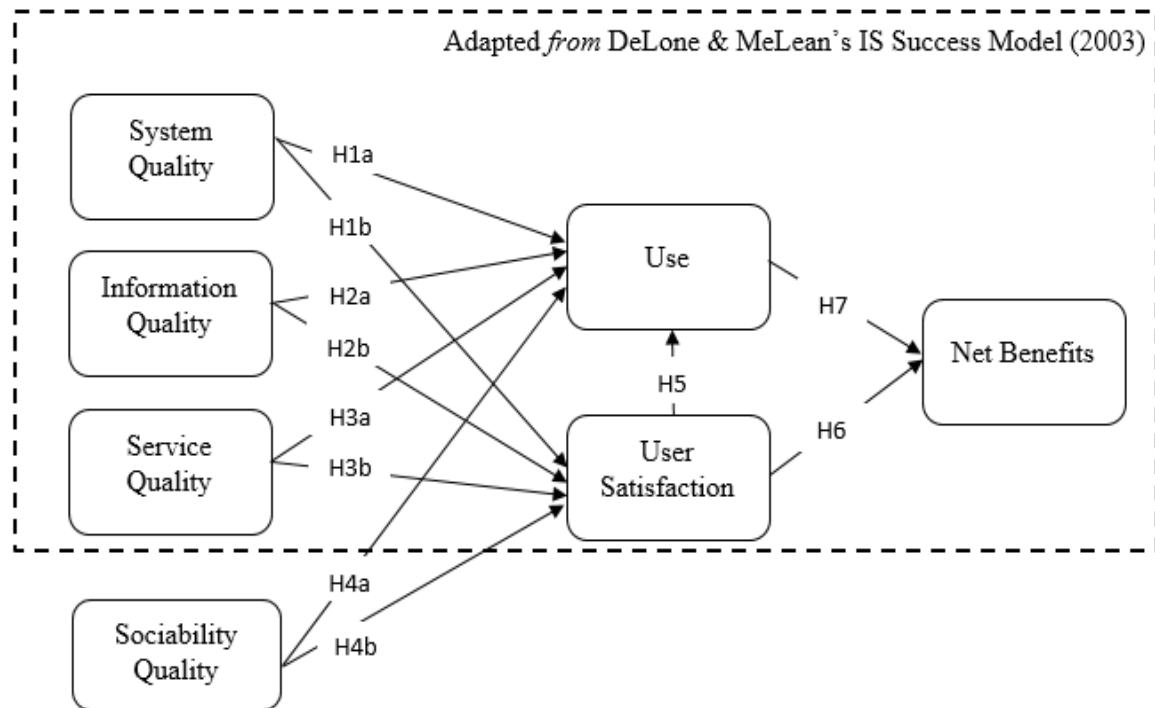


Figure 6.1: Proposed Theoretical Model for CRM System

The proposed theoretical model combines a new success dimension ‘*Sociability Quality*’ (*SOQ*) with updated IS success model (DeLone & McLean, 2003) to determine the effect of sociability quality of CRM system on system use and user satisfaction. This study validates the social component, that is sociability quality of collaborative learning system (CRM system in our case), which plays a vital role in the prediction of system use and user satisfaction, that leads to overall system success (Gao et al., 2010; Junglas et al., 2013).

6.2.2 Constructs and Hypothesis

6.2.2.1 System Quality

System quality of a learning system is crucial for an effective user experience. System quality is generally assessed under several dimensions such as: functionality, reliability, usability, flexibility, integration, user friendly and performance characteristics (DeLone & McLean, 2003). System quality refers to the degree to which system is easy to use and

offering specific characteristics or features that users are expecting to be available while using an information system (Alzahrani et al., 2017; Cidral et al., 2018).

When considering the adoption of learning systems or education related systems the functional and technical quality of system has positive influence on system use and user satisfaction for its overall success (Al-Samarraie et al., 2017; Cidral et al., 2018; Martins et al., 2018; Mohammadi, 2015). Thus, by recognizing the importance and relevance of system quality with the adoption and use of collaborative learning systems, this study proposed the following hypothesis:

H1a. System quality will positively affect CRM system usage

H1b. System quality will positively affect users' satisfaction towards CRM system

6.2.2.2 Information Quality

Information quality is another success dimension which considered one of the important triggers for the adoption and use of information system. Conceptually, it refers to the quality output of system that perceived by system users: information accuracy, reliability, usefulness and understand-ability (Balaban et al., 2013; DeLone & McLean, 2004; Gable et al., 2008). Usually, information quality has been measured in terms of information accuracy, reliability, consistency, relevance, completeness, usefulness and timelines (Cidral et al., 2018; DeLone & McLean, 2003). In the context of learning systems, educational institutes are particularly concerned with integrating information system that not only fulfil the functional requirement but also produce content rich quality information for students learning (Cidral et al., 2018; Hassanzadeh et al., 2012; Machado-Da-Silva et al., 2015; Martins et al., 2018).

In collaborative learning systems, it is important for students to access all available information related to course, group projects and collaborative learning tasks to ensure

effective participation in collaborative learning. Therefore, by perceiving the significance of information quality to use and accept collaborative learning system by users, current study proposed following hypothesis:

H2a. *Information quality produced by CRM system will positively affects its use by users*

H2b. *Information quality produced by CRM system will positively affects user satisfaction towards using it*

6.2.2.3 Service Quality

Service quality refers to the quality of support that users receive from IT training unit or helpdesk. It is considered as effective support for users to use system and conceptually measure it in terms of responsiveness, completeness, security, empathy, reliability, trust and follow-up (Alzahrani et al., 2017). With respect to the learning systems several studies demonstrates that service quality has strong relationship with user satisfaction and system use (Balaban et al., 2013; Farooq et al., 2018; Poulova & Simonova, 2014; Uppal et al., 2017; Wang & Chiu, 2011).

In the adoption and use of collaborative learning system, when online service support is associated with information system as technological component it is effective to enhance students learning (Martins et al., 2018). In the context of this study, from researcher perspective in order to make CRM system usable for users, it is essential to ensure the availability of online help services, online user manual on how to use system and IT staff. Based on these arguments this study hypothesized that:

H3a. *Service quality of CRM system will positively influence users to use it*

H3b. *Service quality of CRM system will positively affect users' satisfaction*

6.2.2.4 Sociability Quality

Sociability quality refers as the ability of information system, the extent to which system perceived to facilitate social interaction, affective connection by conveying emotions and expressions for efficient communication (Gao et al., 2010). According to Kreijns et al. (2004) a collaborative learning system with higher sociability, more likely to enhance social interaction that presents a sound social space that leads to a community of learning. They argued that increase social interaction level provided by collaborative learning system improve the cognitive, affective learning outcomes and co-construction of knowledge.

In the context of collaborative learning, systems with low sociability may reduce efficiency, effectiveness and user satisfaction as system can slow the users' social interaction that cause for difficult collaboration and communication (Brown et al., 2010; Junglas et al., 2013). On the other hand a system with high sociability may increase the social interaction, it is more useful and effective for collaborative learning (Molinillo et al., 2018; Yamada et al., 2016). Conceptually, sociability measures with several factors such as: social affordance of system, immediacy; interactivity, intimacy, social presence and social context to develop community. In this study measurement scale for sociability quality is adopted from previous studies (Brown et al., 2010; Junglas et al., 2013; Kreijns et al., 2007; Yamada et al., 2016). Sociability has a positive and significant relationship with system use (Brown et al., 2010; Gao et al., 2010; Junglas et al., 2013). A system with higher sociability quality motivate users to participate in collaborative learning and their intention to use system which leads to enhance system use and trigger user satisfaction. Thus, this study hypothesize:

H4a. CRM system *capability to provide high quality sociable environment will positively influence its usage*

H4b. CRM system *capability to provide high quality sociable environment will positively influence user satisfaction in using it*

6.2.2.5 User Satisfaction

User satisfaction described as users' perceptions of the extent to which system fulfil their needs, desires and goals (Sanchez-Franco, 2009). It is also referred to as the level to which users are pleased with information system. When considering the adoption and use of learning systems, several studies confirmed significant level of relationship between the degree of user satisfaction towards the system use, which shows not only user intention to use it but also motivation to continues use (Alzahrani et al., 2017; Balaban et al., 2013; Hassanzadeh et al., 2012; Mohammadi, 2015).

The user satisfaction and use are interrelated, system use leads to user satisfaction, whereas more user satisfaction leads to more system use. In this sense, it is a valuable variable, if user is satisfied with the system it will positively influence the arising of benefits related with the use of specific system. Therefore, the interpretation is when users more satisfied with a system then their success levels are also increased. Based on these arguments this study proposed following hypothesis:

H5. *User satisfaction has a positive effect on the use of CRM system*

H6. *User satisfaction has a positive effect on net benefits*

6.2.2.6 Use

System use construct refers to the use of system functionalities or capabilities. This construct specifies the extent and manner to which system is utilized by customers. The intention to use and system use both variables are strongly interconnected (DeLone & McLean, 2003). Several studies suggest intention to use can be used as alternative to system use in some situations (Aparicio et al., 2016; DeLone & McLean, 2004; Martins et al., 2018). Although,

system use refers to behaviour and intention to use describes the user attitude, any of them can be employed depending on the context of study. It is a complex construct and important to study not only how to measure the frequency of use but also the nature of system use. Some scholars assumed that this construct was easiest to measure and incorrectly interpret this concept by only assessing the frequency of system use however, in revised version of IS success model DeLone and McLean (2003, p. 76) stressed on the value of this variable and recommended that researchers must consider the extent, nature, quality and effectiveness of system use.

Thus, special attention required to be given to selecting most appropriate measures depending on the context of study. In this study, measurement instruments for system use were adopted from Balaban et al. (2013) Venkatesh et al. (2003) and Martins et al. (2018). There is a positive and significant relationship tends to be arisen between the use of a learning system by students and the inherent benefits of system usage to them. Therefore, in the context of this study system use assumes to have a positive impact on net benefits.

H7. Use of CRM system has a positive effect on net benefits

6.2.2.7 Net Benefits

Net benefits defined as the extent to which information system contributes to the success of individual users, organizations and other stakeholders (DeLone & McLean, 2003). Net benefits is the only variable which is case specific and depending on the type of information system therefore, the success measures (which are decision measure, cost reduction, improved productivity, time and market efficiency) of an e-commerce system which is analyzed by DeLone and McLean (2003) might not be applicable for other types of information systems. On the other hand, it is a complex construct because it needs new set

of measures to be developed that can be effective to quantify the success of particular type of information system domain.

In this study this variable measure the extent to which CRM system enhances the level of reflective thinking, collaborative learning and knowledge-building at group level. On the same time some key aspects of net benefits which relates to the individual such as critical thinking skills development, achieving collaborative learning outcomes, enhanced transparency in knowledge-building and greater level of communication and collaboration between teachers and student, personal learning and growth. Similarly, instructors conduct different reflective learning activities, based on information produced by system can assess student learning outcomes. In this study, the instrument to measure the net benefits of CRM system were adapted from several previous studies (Balaban et al., 2013; Lin, 2007; Martins et al., 2018).

6.3 Findings

This section presents the demographic information of respondents, evaluation of measurement and structural model. Information about data collection procedure and selection of measurement scale is discussed in Chapter 3. The number of received responses, actual sample size for this study and selection of PLS-SEM analysis have been justified in Section 3.3.4.3. The demographic information; 57% of the respondents were female and 43% were male. Our respondents were undergraduate students who participated in at-least one service learning course, 89% of overall respondents were from the age group of 20-25 years, and 11 % respondents were from the age group of 25-30. Majority of respondents were third year degree students who have experience of service learning projects and reflection activities.

6.3.1 Measurement Model

Assessment of reflective measurement model involves evaluation of variables' internal consistency by composite reliability, outer loading to evaluate the indicators' reliability and assessment of average variance extracted (AVE) for variables' convergent validity. Furthermore, in order to evaluate the discriminant validity of reflective variables Fornell-Larcker criteria, cross loadings and Heterotrait-Monotrait (HTMT) ratio were also calculated. Following sub-sections discuss all of the above mentioned criteria for the evaluation of measurement model of this study.

6.3.1.1 Internal Consistency

Internal consistency is the first criteria for the assessment of reflective measurement model. In this study, researcher uses two measures (which are Cronbach alpha and composite reliability) to assess the level of internal consistency or reliability. Table 6.1 shows the results of Cronbach's alpha and composite reliability. Based on the results all of reflective variables obtained higher level of internal consistency, as all of values reported in Table 6.1 are greater than 0.70 which is the minimum acceptable criteria for Cronbach's alpha and composite reliability.

Specifically, the lowest composite reliability values are 0.894 and 0.915, which was obtained for service quality and information quality. Moreover, the Cronbach alpha's minimum values are 0.855 and 0.884, which belongs to service quality and information quality respectively. Based on these results, it is seen that composite reliability and Cronbach's alpha values for all variables are higher than critical level which shows strong internal consistency of reflective measurement model. In this study, results indicate that measurement scale have acceptable level of internal consistence which shows its reliability.

Table 6.1: Values of Cronbach Alpha, Composite Reliability, Average Variance Extracted and R Square

	Cronbach's Alpha	Composite reliability	Average Variance Extracted (AVE)	R Square
System Quality	0.928	0.940	0.634	--
Information Quality	0.884	0.915	0.683	--
Service Quality	0.855	0.894	0.631	--
Sociability Quality	0.926	0.939	0.660	--
Use	0.886	0.921	0.746	0.662
User Satisfaction	0.892	0.925	0.755	0.615
Net Benefits	0.943	0.951	0.637	0.709

6.3.1.2 Indicators' Reliability

Indicators' reliability measure shows that items of scale have much in common with their underlying variable which is indicated by higher outer loadings of scale items for all reflective variables. As per rule of thumb outer loadings should be greater than 0.70 (Hair et al., 2014; Hulland, 1999). It is suggested that items with lower outer loadings between 0.40-0.70, can be removed, only if the removal of these items leads to a significant change in composite reliability and average variance extracted (AVE) of underlying construct.

Table 6.2 presents the outer loading values of all reflective variables. Results show that all outer loadings values are above the acceptable value of 0.70, except for SRQ-5, NB-5 and NB-9 which obtained values of outer loading 0.583, 0.655, and 0.641 correspondingly. By following the recommendations of Hair et al. (2014), we decided to keep these indicators in the study as the outer loading is closer to the threshold value of 0.70. The removal of these indicators had no significant influence on composite reliability or AVE of fundamental constructs. Thus, the significant level of all outer loading values indicates and justifies the content validity of all reflective measurement scale.

Table 6.2: Outer Loading Values of Measurement Model

	System Quality (SQ)	Information Quality (IQ)	Service Quality (SRQ)	Sociability Quality (SOQ)	Use (U)	User Satisfaction (US)	Net Benefits (NB)
SQ-1	0.832						
SQ-2	0.824						
SQ-3	0.814						
SQ-4	0.728						
SQ-5	0.829						
SQ-6	0.820						
SQ-7	0.779						
SQ-8	0.801						
SQ-9	0.731						
IQ-1		0.795					
IQ-2		0.828					
IQ-3		0.839					
IQ-4		0.822					
IQ-5		0.848					
SRQ-1			0.784				
SRQ-2			0.816				
SRQ-3			0.882				
SRQ-4			0.869				
SRQ-5			0.583				
SOQ-1				0.791			
SOQ-2				0.860			
SOQ-3				0.823			
SOQ-4				0.835			
SOQ-5				0.795			
SOQ-6				0.809			
SOQ-7				0.842			
SOQ-8				0.736			
U-1					0.809		
U-2					0.826		
U-3					0.932		
U-4					0.883		
US-1						0.853	
US-2						0.885	
US-3						0.889	
US-4						0.849	
NB-1							0.833
NB-2							0.840
NB-3							0.815
NB-4							0.813
NB-5							0.655
NB-6							0.770
NB-7							0.763
NB-8							0.758

Table 6.2 continued

NB-9	0.641
NB-10	0.825
NB-11	0.783
NB-12	0.787
NB-13	0.783

6.3.1.3 Convergent Validity

In reflective measurement model usually convergent validity is estimated through average variance extracted (AVE) measure that defines to which extent a reflective variable describes the difference of its measurement indicators (Hair et al., 2014; Henseler et al., 2009). The value of average variance extracted should be above than 0.50 which is acceptable for establishing good convergent validity (Hair et al., 2014).

The values of average variance extracted (AVE) for all constructs and overview of reflective measurement model is presented above Table 6.1. Based on the results, it can be seen that all reflective constructs' AVE value is above 0.5 that achieve the threshold value. With represented values, average variance extracted (AVE) range between a 0.631 lowest to 0.755 highest. The lowest AVE value belongs to Service Quality and highest AVE value belongs to User Satisfaction. Corresponding to these findings the threshold value of AVE (that is 0.05) is achieved for each reflective variable included in proposed conceptual model. The convergent validity of reflective measurement model with all reflective variables is also accomplished. Next section proceed with discriminant validity assessment.

6.3.1.4 Discriminant Validity

In this study three criterions were employed for the assessment of discriminant validity such as 1) Fornell-Larcker, 2) cross loading and 3) Heterotrait-Monotrait ratio (HTMT) analysis.

This section present the results of these three criterions, discussion continues with Fornell-Larcker criteria.

6.3.1.4.1 Fornell-Larcker Criterion

Fornell-Larcker is a traditional measure for assessing discriminant validity of constructs that have reflective measurement model. This measure compare the square root of AVE values with the correlation values of other constructs. The square root of AVE must be greater than the highest correlation value of any other construct (Hair et al., 2014). The basic idea of Fornell-Larcker measure is to ensure that particular variable shares more variance with its personal reflective indicators (items) instead of any other variable in the model (Chin, 2010). There are two methods used for assessment of Fornell-Larcker such as: 1) comparison of the square root of AVE with the correlations of construct and 2) comparison of AVE with the squared correlation of variables in the reflective measurement model (Hair et al., 2014). Although, in both cases main logic is to evaluate that whether a variable is highly correlated with its personal reflective indicators as compare to other constructs.

In this study, Fornell-Larcker is calculated using both above mentioned methods and results are showed in Table 6.3. The results show that AVE values for all reflective variables are greater than their relationship with other variable involved in the reflective model. Hence, these results indicate that the discriminant validity and Fornell-Larcker criteria is accomplished for reflective measurement model.

Table 6.3: Fornell-Larcker Criterion for Measurement Model

	System Quality	Information Quality	Service Quality	Sociability Quality	Use	User Satisfaction	Net Benefits
System Quality	0.796						
Information Quality	0.689	0.826					
Service Quality	0.193	0.170	0.794				
Sociability Quality	0.699	0.755	0.177	0.812			
Use	0.635	0.642	0.325	0.741	0.864		
User Satisfaction	0.714	0.630	0.334	0.685	0.735	0.869	
Net Benefits	0.636	0.720	0.295	0.788	0.786	0.783	0.798

*Values in the bold are square root of Average Variance Extracted (AVE)

6.3.1.4.2 Cross Loadings

Cross loading is another measure used for the assessment of discriminant validity of reflective constructs. It is executed through evaluating cross loading of all indicators of reflective constructs. As per rule, loading of indicators should be higher on their own underlying construct than the other constructs involved in the reflective model (Hair et al., 2014). For the purpose of this study, a complete list of cross loading for all reflective indicators for every construct is showed in Table 6.4. From representing these findings, it can be seen that all indicators have higher loading on their own underlying construct as compare to loading on any other construct included in reflective measurement model. Hence, from these results cross loading evaluation criterion is also fulfilled and demonstrates satisfactory discriminant validity for reflective measurement model.

Table 6.4: Cross Loading Values of Measurement Model

	System Quality (SQ)	Information Quality (IQ)	Service Quality (SRQ)	Sociability Quality (SOQ)	Use (U)	User Satisfaction (US)	Net Benefits (NB)
SQ-1	0.832	0.464	0.094	0.473	0.443	0.458	0.375
SQ-2	0.824	0.508	0.183	0.493	0.502	0.510	0.460
SQ-3	0.814	0.548	0.149	0.627	0.574	0.620	0.637
SQ-4	0.728	0.533	0.108	0.596	0.557	0.644	0.587
SQ-5	0.829	0.610	0.133	0.570	0.509	0.539	0.473
SQ-6	0.820	0.597	0.170	0.588	0.544	0.590	0.539
SQ-7	0.779	0.626	0.233	0.643	0.571	0.682	0.612
SQ-8	0.801	0.544	0.134	0.491	0.402	0.546	0.425
SQ-9	0.731	0.449	0.162	0.441	0.357	0.421	0.316
IQ-1	0.602	0.795	0.132	0.565	0.508	0.475	0.586
IQ-2	0.527	0.828	0.240	0.637	0.618	0.501	0.652
IQ-3	0.555	0.839	0.129	0.652	0.490	0.458	0.586
IQ-4	0.474	0.822	0.111	0.547	0.500	0.500	0.536
IQ-5	0.678	0.848	0.089	0.706	0.524	0.648	0.606
SRQ-1	0.181	0.095	0.784	0.128	0.298	0.250	0.220
SRQ-2	0.177	0.138	0.816	0.170	0.218	0.207	0.239
SRQ-3	0.124	0.129	0.882	0.112	0.337	0.283	0.288
SRQ-4	0.190	0.214	0.869	0.197	0.269	0.372	0.247
SRQ-5	0.068	0.065	0.583	0.083	0.072	0.142	0.151
SOQ-1	0.558	0.548	0.145	0.791	0.578	0.521	0.609
SOQ-2	0.536	0.647	0.146	0.860	0.626	0.627	0.723
SOQ-3	0.563	0.600	0.154	0.823	0.604	0.518	0.631
SOQ-4	0.619	0.588	0.137	0.835	0.625	0.655	0.654
SOQ-5	0.585	0.545	0.119	0.795	0.534	0.561	0.610
SOQ-6	0.480	0.620	0.191	0.809	0.644	0.486	0.646
SOQ-7	0.602	0.711	0.056	0.842	0.611	0.573	0.682
SOQ-8	0.604	0.646	0.210	0.736	0.587	0.494	0.553
Use-1	0.374	0.439	0.274	0.438	0.809	0.528	0.533
Use-2	0.646	0.567	0.251	0.729	0.826	0.730	0.724
Use-3	0.529	0.565	0.312	0.700	0.932	0.606	0.695
Use-4	0.600	0.621	0.289	0.640	0.883	0.649	0.729
US-1	0.597	0.514	0.283	0.594	0.585	0.853	0.646
US-2	0.650	0.587	0.267	0.685	0.651	0.885	0.675
US-3	0.589	0.589	0.350	0.572	0.696	0.889	0.712
US-4	0.645	0.495	0.259	0.530	0.619	0.849	0.685
NB-1	0.492	0.606	0.235	0.619	0.693	0.693	0.833
NB-2	0.473	0.484	0.224	0.574	0.664	0.664	0.840
NB-3	0.527	0.622	0.224	0.674	0.645	0.645	0.815
NB-4	0.575	0.711	0.176	0.725	0.803	0.803	0.813
NB-5	0.520	0.424	0.315	0.575	0.616	0.601	0.655
NB-6	0.612	0.569	0.256	0.713	0.689	0.689	0.770
NB-7	0.476	0.445	0.241	0.573	0.533	0.533	0.763
NB-8	0.564	0.583	0.125	0.655	0.586	0.586	0.758

Table 6.4 continued

NB-9	0.492	0.411	0.255	0.491	0.649	0.623	0.791
NB-10	0.380	0.556	0.262	0.580	0.474	0.474	0.825
NB-11	0.568	0.558	0.230	0.607	0.568	0.568	0.783
NB-12	0.446	0.584	0.432	0.575	0.519	0.519	0.787
NB-13	0.415	0.567	0.212	0.577	0.629	0.629	0.783

6.3.1.4.3 Heterotrait-Monotrait (HTMT) Ratio

Heterotrait-Monotrait (HTMT) Ratio is another criterion recently introduced by Henseler et al. (2015) for the evaluation of discriminant validity of reflective measurement model. They argued that traditional methods for example Fornell-Larcker criteria and cross loading which previously used for discriminant validity is not much reliable in modern research settings. Therefore, they proposed a new technique (that is Heterotrait-Monotrait Ratio of correlations) to assess the discriminant validity of reflective measurement model. This method founded on “Multitrait-Multimethod matrix” (Henseler et al., 2015). As per rule of thumb, HTMT value for the constructs of model should be below 0.90. It is recommend that, if the value of HTMT between two reflective variables is lower than critical value (that is 0.90), it shows that discriminant validity is achieved between reflective variables (Henseler et al., 2015).

In this study the values of HTMT ratio is computed by using SmartPLS-3.2.3. The values of HTMT ratio criteria are ranged as 0.847 highest to 0.186 lowest. As per findings presented in Table 6.5 all the values of HTMT are acceptable and fulfil the criteria of discriminant validity for all reflective constructs included in theoretical model. Based on all three results (which are Fornell-Larcker, Cross Loadings and Heterotrait-Monotrait (HTMT)) discussed above the discriminant validity of all reflective constructs involved in proposed model is achieved.

Table 6.5: Heterotrait-Monotrait (HTMT) Ratio of Measurement Model

	System Quality	Information Quality	Service Quality	Sociability Quality	Use	User Satisfaction	Net Benefits
System Quality	--						
Information Quality	0.748	--					
Service Quality	0.210	0.186	--				
Sociability Quality	0.742	0.832	0.207	--			
Use	0.672	0.714	0.345	0.802	--		
User Satisfaction	0.769	0.703	0.360	0.751	0.817	--	
Net Benefits	0.653	0.783	0.328	0.837	0.837	0.847	--

6.3.2 Structural Model

This section presents the evaluation of structural model. It includes the calculation of predictive capabilities and the significant associations or path coefficients among theoretical constructs of structural model. As suggested by Hair et al. (2014) and Henseler et al. (2009) we evaluate the structural model by, collinearity assessment, path coefficient analysis (beta value), analysing path coefficient significance by using bootstrapping, R^2 value of dependent latent constructs, analysing predictive relevance through Stone-Geisser's Q^2 value and Goodness of Fit (GoF). Henceforth, discussion continues with collinearity assessment, followed by the analysis of path coefficients for assessing the impact and significance of relationship between independent and dependent variables of proposed structural model.

6.3.2.1 Collinearity Assessment

Collinearity refers as strong correlation between variables of a structural model (Hair et al., 2014). Commonly used method for collinearity assessment is variance inflation factor (VIF). As per threshold value, the value of VIF should be greater than 0.20 and less than 5. If VIF

value is higher than 5 it shows potential collinearity issue. In this study, values of VIF for all constructs involved in structural model are presented in Table 6.6. The findings demonstrate that all values of VIF range between 1.043 to 2.948 that successfully complete the assessment criterion. Results of this study depicts that VIF values for all constructs are below 5 therefore, multicollinearity is not a problem for the structural model proposed in this study. Next section discuss the path coefficient values of structural model.

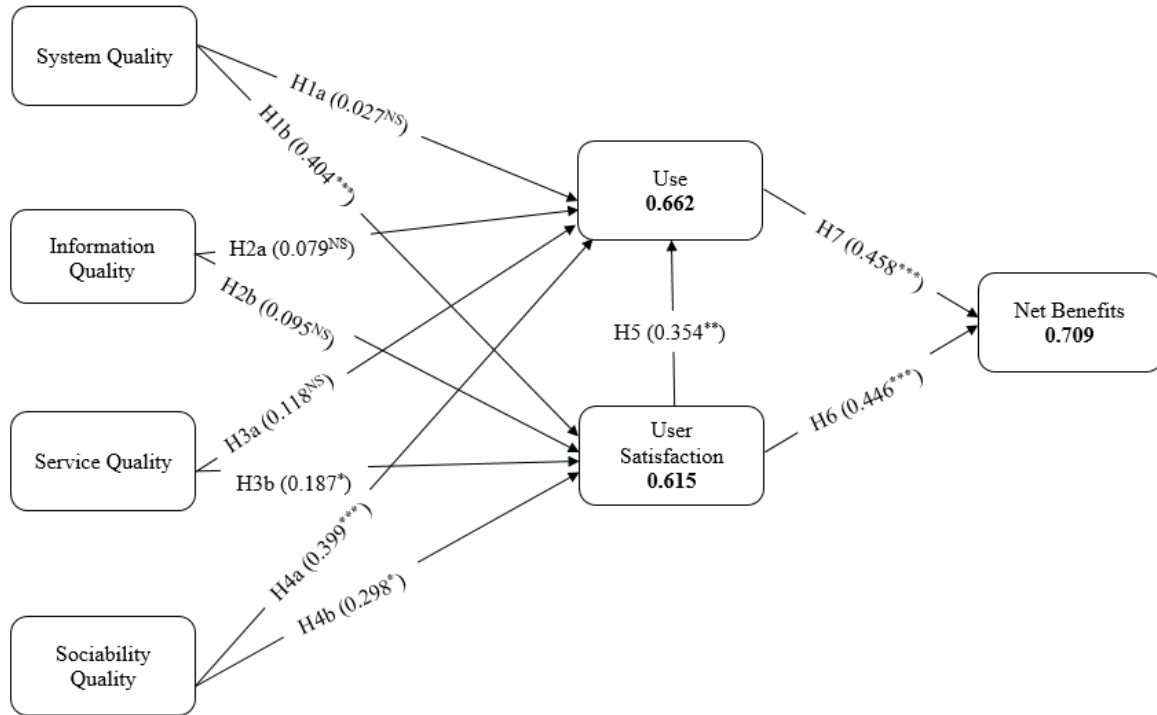
Table 6.6: Variance Inflation Factor (VIF) Values of Structural Model

	System Quality	Information Quality	Service Quality	Sociability Quality	Use	User Satisfaction	Net Benefits
System Quality					2.659	2.236	
Information Quality					2.664	2.641	
Service Quality					1.134	1.043	
Sociability Quality					2.948	2.717	
Use							2.178
User Satisfaction							2.178
Net Benefits							

6.3.2.2 Path Coefficients

Path coefficients defines as the estimated relationships between latent independent and dependent constructs involved in as structural model (Hair et al., 2014). The values of path coefficient are related to the standardized beta (β) which is calculated through regression analysis (Hair et al., 2014, p. 202). In a hypothetical model, every path coefficient value indicates a hypothesis which is established on the relationship between two latent constructs (Chin & Newsted, 1999). As a rule of thumb, the values of path coefficient range between -1 and +1. According to Hair et al. (2014) if path coefficient value closer to +1 it indicates a

strong and positive relationship otherwise, negative relationship for negative values. For this study, values of path coefficients are demonstrated in Figure 6.2.



Note: *** $P < 0.001$, ** $P < 0.1$, * $P < 0.5$, NS = Not Significant

Figure 6.2: Findings of Structural Model

Results demonstrate that all path coefficient values are positive and range between 0.027 and 0.458. According to results the maximum path coefficient values are between (system) use to net benefits ($\beta = 0.458$) and between user satisfaction to net benefits ($\beta = 0.446$). While the lowest path coefficient values found between system quality to (system) use ($\beta = 0.027$) and between information quality and (system) use ($\beta = 0.079$). All the findings represent that path coefficient values of all variables are positive however, there is a clear difference in the magnitude and strength of relationship between constructs of proposed structural model. According to Hair et al. (2014), it is vital to assess the significance and relevance of path coefficient values. For this purpose, Bootstrapping procedure is provided in smart PLS for evaluating the significance and relevance of path coefficient to give

meaningful understanding level to these values. Next section proceed with the discussion of the significance of path coefficient.

6.3.2.3 Significance and Relevance of Path Coefficients (Bootstrapping)

6.3.2.3.1 Significance of Path Coefficients (t value)

In order to determine that path coefficient values are significantly different than zero or not, it eventually based on the t-values (Hair et al., 2014; Henseler et al., 2009). A built in re-sampling technique called bootstrapping routine in SmartPLS software is used for calculating *t*-statistics values in this study. According to the suggestions of Hair et al. (2014) researcher have used 5000 samples in bootstrapping routine to obtain t-values for all path coefficients involved in structural model. It is pertinent to note that, for evaluating significance of path coefficients this study follows the rule of thumb, *t*-value > 1.96 and *p* < 0.05. Table 6.7 presents the t-values and P-values for all path coefficients.

Table 6.7: Path Coefficients (Original Sample, Mean, STDEV, T-Values, and P-Values) Values of Structural Model

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
SQ ->U	0.027	0.043	0.132	0.200	0.841
SQ -> US	0.404	0.416	0.120	3.353	0.001
IQ->U	0.079	0.091	0.106	0.742	0.458
IQ->US	0.095	0.089	0.103	0.924	0.356
SERQ->U	0.118	0.125	0.076	1.555	0.120
SERQ->US	0.187	0.198	0.080	2.350	0.019
SOQ->U	0.399	0.391	0.118	3.368	0.001
SOQ->US	0.298	0.279	0.135	2.211	0.027
US->U	0.354	0.330	0.131	2.709	0.007
U->NB	0.458	0.457	0.098	4.651	0.000
US->NB	0.446	0.447	0.096	4.640	0.000

Notes: SQ=System Quality, IQ=Information Quality, SERQ=Service Quality, SOQ=Sociability Quality, U=Use, US=User Satisfaction, NB=Net Benefits

These findings illustrate that in this study t-values ranges between 0.200 and 4.651. Among that highest t-values are found between (system) use and net benefits (t-value = 4.65; $p < 0.01$), user satisfaction and net benefits (t-value = 4.640; $p < 0.01$) and sociability quality and (system) use (t-value = 3.368; $p < 0.01$). Whereas the lowest t-values found between system quality and (system) use (t-value = 0.200; $p > 0.05$) and between information quality to user satisfaction (t-values = 0.924; $p > 0.05$). From the overall analysis of t-values we found that most of the path coefficient values (or relationships) are significant at threshold value (that is $p < 0.01$ and $p < 0.05$), except for relationship between system quality to (system) use, information quality to user satisfaction and service quality to (system) use. Based on these findings it is determined that theoretical model of this study illustrate a considerable level of explanatory significant. Next section continue with the discussion about the relevance of path coefficient values.

6.3.2.3.2 Significance of Path Coefficients (Total effect size)

After evaluating the significance of path coefficient values next step is evaluating the relevance of these values. The main logic behind this criterion is to assess total effect size of path coefficient values, it means that value of path coefficient might be significance however its total effect size can be very small that unable to catch managerial appreciation. According to Hair et al. (2014) it is essential to assess relative importance of path coefficient for comprehensive assessment of structural model. Therefore, to evaluate significance of path coefficient values, they recommend the usage of total effect size measure (values), it is derived from sum of direct and indirect effect. Total effect size values for all constructs is presented in Table 6.8.

Table 6.8: Total Effects of Structural Model

	System Quality	Information Quality	Service Quality	Sociability Quality	Use	User Satisfaction	Net Benefits
System Quality					0.169	0.404	0.258
Information Quality					0.112	0.095	0.094
Service Quality					0.184	0.187	0.168
Sociability Quality					0.505	0.298	0.364
Use							0.458
User Satisfaction					0.354		0.608
Net Benefits							

As per findings, the relation between *sociability quality* $\rightarrow$ *use* obtained maximum total effect value of 0.505, which shows relevance of sociability quality and use. The relation between *user satisfaction* $\rightarrow$ *use* with total effect value of 0.354, which indicates relevance of sociability quality and user satisfaction for explaining system use. Similarly, relation between *system quality* $\rightarrow$ *user satisfaction* has maximum total effect values of 0.404, followed by the relation between *sociability quality* $\rightarrow$ *user satisfaction* 0.298, which show the relevance of system quality and sociability quality for explaining user satisfaction towards an information system. The relation between *user satisfaction* $\rightarrow$ *net benefits* obtained maximum total effect value of 0.608, followed by relation between *use* $\rightarrow$ *net benefits*, which specify that relevance of (system) use and user satisfaction for explaining net benefits of information system. Whereas, relation between *information quality* $\rightarrow$ *use* and *system quality* $\rightarrow$ *use* obtained lowest total effect values of 0.112 and 0.169 respectively, which shows a weak relevance of information quality and system quality for explaining system use.

Furthermore, for the purpose to measure the significance of total effect size discussed above, a bootstrapping procedure was employed with 5000 samples. The complete list of t-values and p-values for total effect findings is presented in Table 6.9. These results indicate that most of the total effect values are found significant at $p < 0.05$ level, excluding system quality and information quality which shows non-significant total effect values for (system) use. After inclusive discussion about the significance of path coefficient values next section proceeds with the assessment of R^2 value.

Table 6.9: Total Effects (Mean, STDEV, T-Values, and P-Values) of Structural Model

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
SQ ->U	0.169	0.180	0.133	1.278	0.201
SQ -> US	0.404	0.416	0.120	3.353	0.001
SQ->NB	0.258	0.265	0.105	2.461	0.014
IQ->U	0.112	0.119	0.116	0.970	0.332
IQ->US	0.095	0.089	0.103	0.924	0.356
IQ->NB	0.094	0.096	0.086	1.096	0.273
SERQ->U	0.184	0.191	0.078	2.354	0.019
SERQ->US	0.187	0.198	0.080	2.350	0.019
SERQ->NB	0.168	0.176	0.058	2.893	0.004
SOQ->U	0.505	0.484	0.131	3.850	0.000
SOQ->US	0.298	0.279	0.135	2.211	0.027
SOQ->NB	0.364	0.349	0.116	3.138	0.002
US->U	0.354	0.330	0.131	2.709	0.007
U->NB	0.458	0.457	0.098	4.651	0.000
US->NB	0.608	0.600	0.081	7.505	0.000

Notes: SQ=System Quality, IQ=Information Quality, SERQ=Service Quality, SOQ=Sociability Quality, U=Use, US=User Satisfaction, NB=Net Benefits

6.3.2.4 Coefficients of Determination (R^2 Value)

Coefficients of determination (R^2 value) is a generally used measure for assessing the predictive accuracy of proposed structural model (Hair et al., 2014). The R^2 values are calculated through multiple regression analysis and derived through PLS-SEM. R^2 values refers as the extent to which independent constructs explain the variation in their dependent

constructs (Chin, 2010). The findings of R^2 values range between 0 to 1 and as per rule of thumb a R^2 value closer to 1 specifies greater level of predictive accuracy. The findings of R^2 values for all dependent constructs is presented in Table 6.1. Furthermore, graphical demonstration of proposed structural model along with values of R^2 and path coefficient are also presented in Figure 6.2.

These results show that, R^2 values for all dependent variables are ranged as 0.615 lowest to 0.709 highest and all values are significant at $p < 0.05$ that shows an acceptable fit of model to data. In this study, highest R^2 value 0.709 and next highest R^2 value 0.662 belongs to net benefits and (system) use respectively. These R^2 values depict that theoretical model have sufficient explanatory significance. Hence, it is important to note that defining the fitness of conceptual model by only using the R^2 value is not a suitable approach (Hair et al., 2014). The R^2 value tend to be increased by adding further (non-significant) independent constructs (Hair et al., 2014). It means, if more independent constructs pointing to a target dependent construct, its R^2 value is higher. To address this problem Hair et al. (2014) recommend that structural model must be parsimonious. They defined parsimony of the structural model as its ability to elucidate data through greater R^2 value by using minimum possible independent constructs. For this purpose, researcher have given much attention to exploit the parsimony of proposed structural model. Hereafter, discussion proceeds with the assessment of another measure predictive relevance (Q^2) in next section then Goodness of Fit (GOF) test.

6.3.2.5 Predictive Relevance Q^2 Using Blindfolding

As discussed above, predictive accuracy is one of the important feature of PLS-SEM that is assessed by reproduction of latent dependent variables through employing a non-parametric method (Chin, 2010; Hair et al., 2014; Henseler et al., 2009). In this study, Stone-Geisser's Q^2 test is used to measure predictive relevance, which is derived through built in blindfolding

procedure in PLS software. Here it is important to notice that blindfolding technique is only applicable to the latent dependent variables that involves reflective measurement model (Hair et al., 2014).

Additionally, PLS calculate Q^2 values through two different methods such as: cross validated redundancy and cross validated communality. According to Hair et al. (2014) cross validated redundancy technique is more suitable, as it builds on the estimations of both measurement and structural model, while the cross validated communality technique builds on the variable scores on target dependent variable and it is not considering the complete structural model. Based on the suggestions of Hair et al. (2014) this study uses the cross validated redundancy technique, findings of Q^2 values (that is cross validated redundancy) are presented in Table 6.10.

Table 6.10: Predictive Relevance Q^2 (Construct Cross-validated Redundancy) of Proposed Conceptual Model

	SSO	SSE	$Q^2 (=1-SSE/SSO)$
System Quality	720.000	720.000	--
Information Quality	400.000	400.000	--
Service Quality	400.000	400.000	--
Sociability Quality	640.000	640.000	--
Use	320.000	177.462	0.445
User Satisfaction	320.000	186.625	0.417
Net Benefits	880.000	523.818	0.405

As per rule, if Q^2 value is greater than zero, it indicates that independent constructs of a structural model have predictive relevance for dependent constructs (Chin, 2010; Hair et al., 2014). In order to perform blindfolding procedure of seven times omission distance was employed (Hair et al., 2014). As presented in the Table 6.11 all Q^2 values for latent dependent variables are greater than zero. Based on these findings of cross validated redundancy approach, the highest predictive relevance in proposed structural model is

attained by (system) use with a Q^2 value of 0.445, followed by user satisfaction with Q^2 value of 0.417. Whereas, the lowest Q^2 values of 0.405 is obtained by net benefits.

All Q^2 values discussed above support the underlying assumption that all dependent constructs involved in proposed structural model have strong predictive relevance. After a comprehensive analysis of structural model and measurement model, it is confirmed that both models show significant results.

6.3.2.6 Effect Size f^2

The effect size (f^2) criterion is used for assessing the difference in R^2 value when a particular independent variable is absent from model and evaluate the effect of the omitted independent variable on the dependent variables. The effect size (f^2) calculation based on this formula: $f^2 = (R^2 \text{ included} - R^2 \text{ excluded}) / (1 - R^2 \text{ included})$. For the assessment of effect size (f^2) scholars (Chin, 1998; Haque et al., 2009; Shanmugapriya & Subramanian, 2015) have informed threshold values, the effect of independent predictor variable is larger in a structural model if $f^2 = > 0.350$; it is medium $f^2 = > 0.15$ and it is small if $f^2 = > 0.02$. In this study, the effect size (f^2) values for all possible relationships is depicted in Table 6.12. After this discussion proceeds with the assessment of another measure Goodness of Fit (GoF) to confirm the parsimony of proposed structural model.

6.3.2.7 Goodness of Fit (GoF)

In PLS-SEM technique, R^2 value is primarily used as measure to evaluate the explanatory power of structural model however, it enables to produce overall Goodness of Fit (GoF) indices (Wasko & Faraj, 2005). Tenenhaus et al. (2005) proposed a diagnostic tool which is used for PLS-SEM, as GoF indices to assess model fit. The structural model's Goodness of Fit (GoF) is measured through geometric mean of the average variance extracted (AVE) values, along with the average of R^2 values and is calculated by following empirical formula:

$GoF = (\sqrt{(AVE \times R^2)})$. While, Tenenhaus et al. (2005) did not described any threshold value for the Goodness of Fit (GoF) indices. Later on, Wetzels et al. (2009) informed following threshold values for evaluating the results of the Goodness of Fit (GoF) analysis which are $GoF_{small} = 0.1$; $GoF_{medium} = 0.25$; and $GoF_{large} = 0.36$. In addition to this Henseler et al. (2016) reported that a good model fit demonstrates that model is parsimonious. Based on the guidelines from Tenenhaus et al. (2005) and Henseler et al. (2016) the values of Goodness of Fit (GoF) index for proposed structural model is calculated in this study, which is outlined in Table 6.11. The values of GoF indicates that conceptual model of this study obtained a Goodness of Fit (GoF) index value 0.6699, which shows a good GoF_{large} model fit.

Table 6.11: Goodness of Fit (GoF) Index of Proposed Conceptual Model

	AVE	R Square
System Quality	0.634	
Information Quality	0.683	
Service Quality	0.631	
Sociability Quality	0.660	
Use	0.746	0.662
User Satisfaction	0.755	0.615
Net Benefits	0.637	0.709
Average Score	0.6780	0.6620
$AVE \times R^2$		0.4488
$GoF = \sqrt{(AVE \times R^2)}$		0.6699

6.4 Discussion on Hypothesis Testing

As discussed above, the proposed IS success model address the third research objective of this study, which shows how successful the implementation of CRM system from user's perspective. In order to evaluate the newly developed CRM system and highlight the specific areas where system need improvement, we proposed IS success model and a PLS confirmatory test was used to show the effects of proposed dimensions of success on each

other. Based on established relationships in proposed model we can assess which dimension required more attention to improve the implementation and usage of CRM system.

According to results majority of the hypothesized relationship in the model were empirically verified and supported by CRM system. Table 6.12 presents a summary on the significance and decision on research hypothesis discussed above. In results, (system) use is explained by information quality, sociability quality and user satisfaction. In addition, user satisfaction is explained by system quality, service quality and sociability quality. Net benefits are determined by the usage of system and user satisfaction in the case of CRM system. In summary, H1b, H3b, H4a, H4b, H5, H6 and H7 are significant, only H1a, H2a, H2b and H3a are not significant in this study.

In this study hypothesis one (H1a) was not supported, which means CRM system use is not determined by the system quality; on contrary, results specify system quality has positive influence on user satisfaction toward the use of CRM system (H1b), this hypothesis found significant at ($\beta = 0.404^{***}$; $p < 0.001$). Similar results reported by other e-learning studies (Aparicio et al., 2017; Balaban et al., 2013; Cidral et al., 2018; Costa et al., 2016; Machado-Da-Silva et al., 2015; Martins et al., 2018; Urbach et al., 2010), they found system quality statistically significant and positive on user satisfaction however they found no significant direct effect of system quality on system use. In our case these results indicate that if an institute provides a co-operative reflection system, students may use it individually from the perceived system quality.

Based on results, hypothesis H2a and H2b indicate that information quality has no significant influence on CRM system usage and user satisfaction. It can be due to the different sample, as in our study respondents were university students who have participated in service learning program however, other studies had participants from different level. Moreover,

CRM system is still at early stage of development this might be another factor for experiencing non-significant results for information quality dimension. Our results confirmed against Balaban et al. (2013) study where they found that information quality has no significant direct impact on use and user satisfaction; however it was reported information quality has positive affect on net benefits. With these findings they argued that information quality dimension significantly influence arising net benefits of system that in turn affect system use and user satisfaction. Although some studies (Aparicio et al., 2017; Cidral et al., 2018) conducted in the field of e-learning system found different results, as information quality has a positive effect on e-learning usage and user satisfaction towards quality of information, reliability of course contents and usefulness. In addition a recent study found similar results for information quality dimension for education management information system success (Martins et al., 2018).

Findings of service quality dimension indicate that service quality (H3a) has no significant effect on (system) use that means that system use is not determine by the service quality provided by system. These findings are consistent with other studies (Aparicio et al., 2017; Cidral et al., 2018; Hassanzadeh et al., 2012; Tam & Oliveira, 2016; Urbach et al., 2010) which reported that service quality do not has positive influence on system usage. Although some studies (Balaban et al., 2013; Martins et al., 2018) support that quality of service provided by technology has positive effect on system usage. They suggest that if users experienced any problem and want to ask for help from service portal, poor service quality may affect their intention to use system. On contrary service quality found as success determinant on user satisfaction, as hypothesis H3b posits that it has positive impact on user satisfaction at ($\beta = 0.187^*$; $p < 0.05$). This result shows that when learners perceive good service quality from support system, they become more satisfied, in turn motivated to use

system. These findings are substantiated previous studies (Aparicio et al., 2017; Balaban et al., 2013; Martins et al., 2018; Mohammadi, 2015) and indicate that service quality positively influence user satisfaction of e-portfolio, e-learning and education management system. On the other hand some studies (Cidral et al., 2018; Sun et al., 2008; Urbach et al., 2010) found different results, where service quality was not considered statistically significant to enhance user satisfaction toward systems.

The results of sociability quality, H4a and H4b found significant in this study. These results indicate that sociability quality has statistically significant impact on (system) use and user satisfaction at ($\beta = 0.399^{***}$; $p < 0.001$) and ($\beta = 0.298^*$; $p < 0.05$) respectively. This can show that sociability quality is a critical success determinant for system use and user satisfaction in the context of collaborative learning system. According to Junglas et al. (2013) sociability has positive direct relation with enjoyment construct and indirect relation with intention to use in virtual learning systems. Likewise, results from Yamada et al. (2016) study significantly support of system characteristics with expressive social component in computer supported collaborative learning systems.

As mentioned in the literature review chapter, we consider sociability quality as the quality of medium (technology) that enhanced users' social interaction in collaborative learning environment. Sociability has positive relation with social interaction that enhance the quality of social space in collaborative learning systems (Kreijns et al., 2007, 2013; Tu & McIsaac, 2002). Another study also found that social functional characteristics of collaborative technologies has statistically significant impact on use and performance expectancy (Brown et al., 2010) and they argued that quality of a sociability of specific collaborative technology significantly influence users' intention to use specific system.

Hypothesis H5 was supported with statistical results ($\beta = 0.354^{**}$; $p < 0.01$), which indicate that user satisfaction has a significant positive impact on system use. Several studies (Cidral et al., 2018; Hassanzadeh et al., 2012; Martins et al., 2018; Tam & Oliveira, 2016; Urbach et al., 2010) support findings of this study, as they stated that user satisfaction has positive effect on system usage, when user more satisfied with system quality it increase system usage. In this context results from Mohammadi's (2015) study confirms that user satisfaction is a significant factor towards students' intention to use e-learning system, while a study conducted by Aparicio et al. (2017) found different results. They described that there were no significant relationship between user satisfaction and use and this might be due to the insufficient data for supporting positive affect of user satisfaction on system usage.

Findings indicate that CRM system use and user satisfaction have significant positive impact on net benefits of the system (H6 and H7) and these findings corroborating with the results of various studies (Aparicio et al., 2017; Balaban et al., 2013; Martins et al., 2018). This indicate that if students are satisfied with system usage then they can able to perform all collaborative reflective learning tasks easily that increase their performance or productivity. Furthermore, findings show that more students use CRM system, they perceive more individual benefits. In this study hypothesis H6 and H7 were found significant at ($\beta = 0.446^{***}$; $p < 0.001$) and ($\beta = 0.458^{***}$; $p < 0.001$) respectively. The positive impact of system use and perceived user satisfaction on net benefits support that these independent constructs are valid substitute for net benefits (Cidral et al., 2018).

Findings of this study demonstrates that system quality, sociability quality and user satisfaction are significant determinants for the use of CRM system. System quality, service quality and sociability quality significantly affect user satisfaction in collaborative learning

system context. Additionally, use and user satisfaction are significant success determinants that contributing in achieving net benefits of an information system.

6.5 Theoretical and Practical Implications

In the field of information system success, there are various studies that studied the adoption and success of e-learning system. While this study presents a modified theoretical IS success model to evaluate prototype system (i.e. CRM system). It is validated with newly developed CRM system to assess its overall success in real-world environment. This study reveals that sociability quality of CRM system is strong success dimension to determine system use and users' satisfaction towards it. More specifically sociability quality of a system positively influence system use and user satisfaction. Along with this other system characteristics which are hypothesized in this study such as system quality, service quality, information quality and use, user satisfaction and net benefits contribute in the success of CRM system. More importantly, findings demonstrates that system use, and user satisfaction are interdependent, both found positive and significant determinants for predicting net benefits of CRM system. Overall IS success model proposed in this study explains 70% of the variation of net benefits for CRM system.

From research perspective there are two theoretical implications derived from the validation of theoretical model proposed in this study, which are high sociability quality of system is important factor to determine the success of any collaborative learning system (CRM system in this study). This dimension has not been studied earlier mainly as system characteristic in the context of collaborative learning systems. In this context, our study contributes to information system success theory by combining updated IS success theory (DeLone & McLean, 2003) with sociability quality (Brown et al., 2010; Kreijns et al., 2007; Yamada et al., 2016) which is most import characteristic of any collaborative learning system. Another

theoretical contribution is our model validates information success theory for collaborative learning system particularly with newly developed CRM system.

This empirical study demonstrate that existing success dimensions of information system success model do not fully cover the collaborative learning system success; as one of the important factor, which is social interaction may has positive impact on students' performance in computer supported collaborative learning system is missing (Kreijns et al., 2013; Yamada et al., 2016). For this reason, in this study a new dimension '*Sociability Quality*' was included to better study the collaborative learning system success determinants. Results discussed above indicate the success of CRM system determined by system quality, service quality, sociability quality, use, user satisfaction and net benefits.

From practical implication perspective this study brings insights to collaborative learning system developers and designers. One of the practical implications of this study is that collaborative learning systems should afford social technological features to enhance sociability of systems that as a result facilitates high quality social interaction and presence by providing an effective collaborative learning environment, which is important aspect in CSCL system's success. Based on our results, stakeholders can get benefit if considering highly sociable collaborative learning system to increase quality social interaction. A collaborative learning system with higher sociability quality should facilitate the articulation of high quality social interaction between students for critical thinking and co-construction of knowledge, thus significantly influencing system use and learners' satisfaction towards system.

Additionally, this study also demonstrate that system quality and service quality have significant impact on user satisfaction. If system quality is high and able to fulfil all user requirements it may affect system usage, although maturity of system is also important. From

our results we also learned that system use, and users' satisfaction is significant determinant of net benefits. If learners use system more often, they can perceive more benefits that will lead to improved user satisfaction. We also learned that perception of learner independent performance in collaborative learning environment is depends on learners perceived system quality. If collaborative learning system is easy to collaborate, providing well-structured information and essential functionalities it will increase system usage and user satisfaction towards system.

Table 6.12: Hypothesis Testing for Proposed Conceptual Model

	Hypothesis	β	<i>t</i> -Value	<i>p</i> -Value	Decision	Effect size f^2
H1a	System quality will positively affect users towards using CRM system	0.027 (NS)	0.200	0.841	Not supported	0.010
H1b	System quality will positively trigger users' satisfaction towards CRM system use	0.404***	3.353	0.001	Supported	0.189 medium
H2a	Information quality produced by CRM system will positively affects its use by users	0.079 (NS)	0.742	0.458	Not supported	0.007
H2b	Information quality produced by CRM system will positively affects user satisfaction towards using it	0.095 (NS)	0.924	0.356	Not supported	0.009
H3a	Service quality of CRM system will positively influence users to use it	0.118 (NS)	1.555	0.120	Not supported	0.036 small
H3b	Service quality of CRM system will positively affect users' satisfaction	0.187*	2.350	0.019	Supported	0.087 small
H4a	CRM system capacity to provide high quality sociable environment will positively influence its use by users	0.399***	3.368	0.001	Supported	0.160 medium
H4b	CRM system capacity to provide high quality sociable environment will positively influence user satisfaction in using it	0.298*	2.211	0.027	Supported	0.085 small
H5	User satisfaction has a positive effect on the use of CRM system	0.354**	2.709	0.007	Supported	0.143 medium
H6	User satisfaction has a positive effect on net benefits	0.446***	4.651	0.000	Supported	0.313 large
H7	Use of CRM system has a positive effect on net benefits	0.458***	4.640	0.000	Supported	0.330 large

Note: *** $P < 0.001$, ** $P < 0.01$, * $P < 0.05$, NS = Not Significance; effect size f^2 : > 0.350 large, > 0.150 medium, > 0.02 small (Chin, 1998; Haque et al., 2009; Shanmugapriya and Subramanian, 2015)

6.6 Summary

This chapter presented the overall evaluation of CRM system, through the demonstration of system, in a workshop with real-world users. First part of this chapter presented a proposed theoretical model, based on IS success theory (DeLone & McLean, 2003) and social interaction theory (Kreijns et al., 2007), which was empirically evaluated by using advanced structural equation modelling technique (that is PLS-SEM). Furthermore, the details of every construct of proposed model, and hypothetical relationships among them were discussed in this chapter.

The evaluation of proposed model starts with measurement model assessment by using a number of statistical tests, which are internal consistency of scales, indicators' reliability, convergent and discriminant validity. Then, several statistical measurements were also applied for structural model's evaluation, which are collinearity assessment, path coefficient, significance and relevance of path coefficient values, assessment of coefficient determination, assessment of predictive relevance Q^2 and effect size f^2 and Goodness of Fit model. Final part of this chapter discussed the hypothesized relationships of structural model and its significance in the context of collaborative learning system success. Theoretical and practical implications were also discussed in detail.

Next chapter presents the results and achievements of this study in the light of research questions and objectives stated in the Chapter 1. Further, research contributions and future research directions in this field of service learning and co-operative reflection are presented in next chapter.

CHAPTER 7

CONCLUSION AND FUTURE WORKS

7.1 Introduction

This chapter presents the research summary and achievements of this study. It demonstrates the main research objectives of the study, which have been achieved and also highlights the results and conclusions drawn from the findings of this study. This chapter also highlights the main research contributions of this study, which have advanced the overall body of knowledge in the field of experiential learning pedagogy. Furthermore, this chapter also elaborates the practical implications derived from the findings of this study, along with some proposed future research directions. By doing so, this chapter also addresses the last phase of DSRM that is communication and documentation of this study. Therefore, this chapter is aimed to review and synthesize the findings of the design, development and evaluation of all proposed artefacts of this study.

7.2 Research Summary

The research problem, which is stated in Section 1.3, was addressed by conceptualization, design, implementation and evaluation of a technology integration framework and co-operative reflection model for service learning. This study comprises of three components: 1) technology integration framework; 2) co-operative reflection model (CRM); and 3) CRM system's evaluation. The proposed framework draws on Kolb's experiential learning theory, which encompasses three major components which are identification of common phases for service learning implementation, technology support layer and stakeholder's involvement patterns for technology integration. Further, validation of framework indicates, that these components are essential for technology integration in service learning projects.

A co-operative reflection model (CRM) was also designed by integrating social constructivism and knowledge-building theories. The prototype implementation of CRM, along with its demonstration in real world case study setting indicates the feasibility of proposed model, for conducting structured co-operative reflection and supporting collaborative critical thinking and co-construction of knowledge. The evaluation of the CRM includes verification of the concept, by using qualitative research approach, which explicitly indicates the viability of the proposed model.

The success and usability of CRM system was also assessed by employing updated information system success model. The assessment of this model shows that the new success dimension that is ‘sociability quality’ in updated IS success model has a significant impact on the use behavior of CRM system.

7.3 Objective Achievements

7.3.1 Technology Integration Framework for Service Learning

The first objective of this study, which is also stated in Chapter 1, was to:

“To design and propose a framework for technology integration in service learning.”

First objective of this study included three components: 1) investigate and understand the existing methods, underlying concepts and current status of the use of ICT in service learning 2) design a technology integration framework for service learning and 3) validation of the proposed framework and identify further research considerations.

As a first step of this research and corresponding to the first component of this objective a comprehensive review of literature in the field of service learning was performed. To address this, Chapter 2 of this study presented the underlying concepts, theories, review of existing service learning frameworks and review of the literature about the use and adoption of ICT in the context of service learning. Chapter 2 begins with the general definition of service

learning, elaborated on the underpinning theory and specific requirements for its integration in higher education. Then Chapter 2 presented a critical review of existing service learning frameworks, explained the role of ICT in service learning and specified the current challenges regarding ICT utilization in this field. As a result, two main research strands were identified, which are 1) design of a technology integration framework, and 2) developing co-operative reflection model and evaluating its effectiveness by implementing a prototype system. For this purpose, existing reflection models were also exhaustively discussed in Chapter 2.

To address the other two components of the first objective of this study, Chapter 4 presented the design of technology integration framework for service learning. This framework is the first design artefact of this study, which was developed by employing both Kolb's experiential learning theory and design science research methodology. The proposed framework consists of three components, which are 1) identification of common phases for service learning implementation, which was based on Kolb's experiential learning theory, 2) ICT support layer for service learning, which showed the application of technology for every phase and 3) stakeholders' involvement patterns in service learning, which explained their role and their involvement in the service learning pedagogy.

Furthermore, this framework was evaluated by using a case study method. For this purpose, a case of real-life service learning program in Faculty of Computer Science and Information Technology in Universiti Malaysia Sarawak (UNIMAS) was investigated. Two types of results were produced from framework evaluation, which are 1) quantitative results of survey and 2) qualitative results of semi-structured interviews. In order to evaluate every component of proposed framework, survey data was examined separately for descriptive analysis. The findings of first component (that is identification of common phases for service learning

implementation) of framework, revealed that all phases achieved more than 70% value, which shows higher level of respondents' agreement, which indicates the importance and significance of proposed common phases for service learning implementation.

With regard to the ICT support for service learning, respondents were asked to reflect on the application of existing technologies in different phases of service learning. Findings showed that, current technologies were highly recommended for being effectively used in planning, implementation and management phases of service learning; however, respondents were less satisfied with the effectiveness of existing technologies for reflection and assessment phase. For last component of framework, we have directly asked respondents about their role and responsibilities in the different implementation phases of service learning. According to results, there were three roles assigned to service learning team, which are coordinator, course instructor and site supervisor, they were directly or indirectly involved in all identified phases of service learning.

Additionally, qualitative data helped in understanding the whole process of service learning implementation, in the Faculty of Computer Science and Information Technology, UNIMAS (selected case study). As this faculty have developed their own methodology for implementing service learning in their computer science curriculum, which includes most of the common phases identified in the proposed framework, which are planning, analysis, reflection and evaluation. Corresponding to the technology integration and its actual use, they mentioned specific technologies, which were used for different activities in different phases of service learning, e.g. database system used for management phase for record maintenance, e-learning platform used for course management and instruction delivery, Microsoft and Google application used for individual reflection, social media, e-mail mobile applications (e.g. WhatsApp) were used for communication and collaboration. Manual

methods were also used for some phases, such as reflection, particularly group reflection and its assessment. In this case, course instructors and site supervisors reported that, it was quite challenging to conduct co-operative reflection without any framework and technology support.

This framework informed that, for effective technology integration in service learning pedagogy, academicians should consider three important factors, 1) service learning implementation phases, along with their sub-activities for the selection of suitable technology, before actual use, 2) second important factor regarding technology integration is technology itself, as different technologies have different potentials, properties, limitations and affordability level, which can significantly affect their suitability for certain phases or sub-activities to achieve desired objectives, and 3) third factor is related to the nature of this pedagogy, program structure, community service, in a practical working environment, involvement of multiple participants, also influences the level of technology integration. As practical and unpredicted working environment, participants' capabilities to use technology and involvement patterns of multiple participants, can also influence the process of technology integration in service learning pedagogy.

7.3.2 Co-operative Reflection Model (CRM)

The second objective of this research was defined as:

“To propose a Co-operative Reflection Model (CRM) and view its outcomes from service learning perspective.”

To achieve this objective, as the second design artefact of this research, an exhaustive systematic review of existing studies in the field of reflective learning was performed, to understand the impact of reflection in service learning. Furthermore, this study also explored the existing reflection models and their limitations. A comparative analysis of existing

reflection models, which is discussed in Section 2.8.2, has revealed that, majority of the existing models were designed for individual reflection, and that they considered reflection as an individual learning activity. However, there were few studies which had elaborated on the concept of collective/co-operative reflection.

As presented in Chapter 5, this objective was achieved successfully, and a Co-operative Reflection Model (CRM) was proposed. This model was developed by employing social constructivism learning theory and Stahl's collaborative knowledge-building theory. The inherent concept of CRM was, aimed to view the process of collaborative knowledge-building, through co-operative reflection, in the context of service learning. Proposed CRM consists of two main components 1) co-operative reflection process, which explained five important stages that are a) group experience, b) individual reflection, c) co-operative reflection, d) recommendations and e) decision & outcomes and 2) synergy of co-operative reflection and knowledge-building, which described the process of collaborative knowledge-building, through co-operative reflection. This component further comprises of five sub-processes that are a) internalization b) externalization, c) conceptualization, d) negotiation and e) integration and collaborative knowledge articulation, which defined how collaborative knowledge-building takes place from individual reflection to co-operative reflection.

The second part of this objective was evaluating the effectiveness of this model, which was achieved through implementation of a CRM system, which also contributed to the understanding and validation of this model. Section 5.6 presented a detailed description of CRM system implementation, which is a computer supported co-operative reflection system. Expected functionalities of CRM system, which are based on the logical concepts of proposed model, were also specified in Section 3.3.3.1, in Chapter 3. A detailed description

of CRM system implementation architecture was also presented in Section 5.6.1, which comprised of three layers 1) data, 2) business and 3) presentation layer.

According to the identified functionalities of CRM system, business layer consists of seven modules, which was designed to support the underlying logic of CRM. In order to proficiently implement the CRM system, a workflow of CRM was presented in Section 5.6.2, which is the core module (structured co-operative reflection module) of the prototype system. Thus, the other modules of prototype system were designed to implement a comprehensive co-operative reflection system, which directly or indirectly supports the core module of this system.

Logically, CRM system comprised of four types of reflection activities 1) structured co-operative reflection, which directly reflects the proposed model, 2) self-regulated reflection, which was designed for updating daily project progress and reflection on it, 3) teacher / student initiated reflection, which was designed to share personal experiences and stories, or project related material to reflect on the mutual experiences and 4) individual reflection, which was separately designed to measure students' individual behavior and attitude towards service learning projects.

After the implementation phase of this study, next step was verification and validation of CRM, which was performed through demonstration and testing of CRM system in the real-world environment. For this purpose, workshops were conducted with the service learning course participants in Universiti Malaysia Sarawak (UNIMAS), where co-operative reflection tasks were given to the participants (see details presented in Section 3.3.4.2). In order to validate proposed co-operative reflection model (CRM), data was collected as a co-operative reflection task, which was later retrieved from the system's database, and was later assessed by using content analysis method. For this purpose, service learning experts were

also invited to assist us for the assessment of co-operative reflection output data, for level of reflective thinking and knowledge-building by employing pre-defined coding scheme. The findings of CRM evaluation were highlighted in Section 5.8. The co-operative reflection data of service learning course (that is retrieved from system database) were also analyzed, to determine the levels and frequencies of reflective thinking and knowledge-building. Quantitative analysis of co-operative reflection data confirmed the presence of different levels of reflective thinking, and also the presence of collaborative knowledge-building process (that is based on coding scheme). In order to determine the relationship between co-operative reflection and knowledge-building, a well-known statistical measure Chi Square (χ^2) was also used to obtain to assess the association between two variables.

The results of the evaluation process not only allowed us to verify the feasibility of proposed model, but also indicate that the CRM system was successfully used for conducting structured co-operative reflection, in order to achieve both collaborative reflective thinking and knowledge-building. In addition, Section 5.9 has discussed findings of this study in the light of extant literature and elaborate on CRM system support for co-operative reflection. These findings have led us to the identification of various areas, which require further improvement. Additionally, for the validation of CRM system, overall assessment of CRM system usability and effectiveness is also presented in Chapter 6 (see next section).

7.3.3 Evaluation of CRM system usability and effectiveness

The third and last objective of this research was to:

“To evaluate the technology integration framework, CRM system usability and effectiveness”

As part of the evaluation process, CRM system’s feasibility was validated through its demonstration in real-world environment. To fill this requirement, detail of system

demonstration e.g. selection of research setting, data collection procedure, sample size, research method, measurement scale selection and validation and description of data analysis method are presented in Section 3.3.4.3. Details of overall CRM system's success, effectiveness and utility are also outlined in Chapter 6.

The most popular and commonly used framework in the field of information system (that is information system success model) was adapted to measure the success of CRM system developed in this study. For this purpose, a theoretical model, was proposed which is outlined in Section 6.2.1. Seven success dimensions (system quality, information quality, service quality, sociability quality, use, user satisfaction and net benefits) were recognized in this model, which is designed for the assessment of CRM system. A new success dimension (sociability quality) was also introduced in this model to evaluate the success of CRM system, which is a computer supported co-operative reflection system. The sociability quality dimension represents the capability of system, to provide effective communication medium for social interaction and collaboration among users. Furthermore, it also provides a suitable component for measuring the success of advance computer supported collaborative learning systems. In this study, it is assumed that, sociability quality is a predictor of system use, and user satisfaction, which ultimately affect the net benefits, for the evaluation of collaborative learning systems. Details of all constructs and hypothetical relationships were discussed in Section 6.2.2.

Partial Least Square-Structural Equation Modelling (PLS-SEM) technique was used for the evaluation of this theoretical model. In PLS-SEM the evaluation of theoretical model consists of two steps, which are 1) assessment of the measurement model and 2) assessment of the structural model. Findings of the measurement model have confirmed, that indicator's reliability and validity were achieved at a satisfactory and significant level. Results of the

structural model revealed that majority of the proposed hypotheses, were found significant and positive, which confirmed the success of CRM system. Although, results from this study contribute in the literature of information system success, and also shed light on new success dimensions for measuring success of computer supported collaborative learning systems, by extending the theory of information system success. However, some of the results were not, as expected and were contrary to our initial propositions (e.g. CRM system evaluation in our case), for instance weak impact of system quality and information quality on system use. However, it is pertinent to note that, except for the weak influence of system quality and information quality, all other hypothesized relations, were found positive and significant. As a result, theoretical model, was empirically validated and demonstrated a significant predictive relevance with an acceptable value of goodness of fit (GOF) index.

7.4 Contributions and Implications

Findings of this study have led to a number of theoretical and practical contributions, which can be helpful in the context of technological enhancement of service learning and application of developed information systems in following ways:

1. a successful design and application of technology integration framework for service learning, which draws on Kolb's experiential learning theory. It has incorporated three important factors for technology integration which are identification of common phases for service learning implementation, technology support layer and stakeholders' involvement patterns. This framework presents significant theoretical contribution, by advancing Kolb's experiential learning theory from the technology integration perspective, in the context of service learning pedagogy. By considering three important components of proposed framework, which can influence academicians' intention to adopt and use specific technologies, according to the

requirements of their service learning projects. Practically, this framework can support academicians and practitioners in more vigorous selection of suitable technologies, for service learning projects.

Policy makers can also use this framework, which will help them to focus on three important components, highlighted in the proposed framework for technology integration in service learning. Furthermore, this study also presents a new direction for deeper understanding of the effective usage of widespread technologies, in the experiential learning pedagogy. Findings of this study have explored the limitations of existing technologies for different phases involved in the service learning pedagogy;

2. the design and development of new Co-operative Reflection Model (CRM) to view the process of knowledge-building, through co-operative reflection. Two important components of this model which are co-operative reflection process and synergy of knowledge-building, with co-operative reflection process, will enhance the concept of group/collective reflection, to understand how collaborative critical thinking and knowledge-building take place during co-operative reflection, in the context of service learning. Hence, this model can assist academicians to conduct a structured co-operative reflection and view students' progress in collaborative reflective thinking, with co-construction of knowledge. A step-by-step process of co-operative reflection and explanation of knowledge-building, during this process, also serves as guidelines for students to perform effectively in their service learning projects. In order to validate and assess the feasibility of the proposed CRM model, a CRM system was also implemented, which shows its applicability by implementing co-operative reflection system. From practicality perspective, CRM system provides a

co-operative reflective learning environment, which can assist academicians to conduct structured co-operative reflection, during their service learning projects, assess and monitor students' level of reflective thinking and knowledge-building, from community based service learning projects. Furthermore, proposed CRM also serves as guidelines to implementing advanced technology for co-operative reflection; and

3. the information system success model is proposed and validated to evaluate the success of CRM system implemented in this study. Theoretically, this model contributes to existing IS success model, by incorporating sociability quality as a new success dimension, for collaborative learning systems. This model will help to better understand, the CRM system's usability, user satisfaction and success in a real-world environment, with actual users, and contributes to both theory and practice. Although, proposed IS success model is validated with the help of our newly developed prototype system, but it can also help researchers to measure the success of other collaborative learning systems, and it can also be employed to explore, how users perceive other systems.

Furthermore, proposed information system success model, can serve as a guide to understand the success drivers of other computer supported collaborative learning systems. Furthermore, it can also assist future researchers to explore which system features can positively affect the users' perception of the intended net benefits of system use, and whether users are satisfied with the overall usage of a specific system. Another advantage of this model is the introduction of sociability quality for the assessment of collaborative learning systems, which is found as a significant attribute of system success. Based on these characteristics of collaborative learning

system (that is sociability quality), identified in this study, it is righteous to claim that, findings of this study will motivate future researchers to investigate, additional adequate success dimensions in the context of collaborative learning information systems.

7.5 Future Research Directions

On the base of the findings derived from this study, several future work directions are highlighted, which can be considered in future within the scope of this research area. Some of them could address the limitation of this study, and others highlight the areas in which this research work can be extended.

The proposed technology-integration framework can be further validated through development of a comprehensive technological platform, which can fulfil the requirements of technology support for all phases, involved in service-learning implementation. In addition, an empirical study for assessing the adoption and use of existing technologies, throughout service-learning projects can also be considered as a future work. This framework can be extended by testing it in other universities for technology integration in service learning and identifying additional factors, which can affect technology integration process.

The future studies on co-operative reflection can also explore the methods used for the assessment of co-operative reflection and knowledge-building. This approach can be useful for enriching the proposed model, with further requirement for different domains and contexts. Based on the logical arguments, advanced technology support for automatic assessment of co-operative reflection, and analytical assessment of users' behavior, can also be designed and implemented in future studies. The CRM system can also be improved by

adding more functionalities, to enhance overall system quality and credibility of the information created during co-operative reflection activity.

Additionally, the proposed information system success model, which is theorized in this study, can also be re-validated by testing it, with a larger sample size, in any different research settings, by evaluating the success of other types of collaborative learning systems.

It can also be improved by exploring new dimensions, which can influence collaborative learning system usage and its success in the real world.

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APPENDICES

Appendix 1: Questionnaire for Technology Integration Framework Evaluation

QUESTIONNAIRE:



Version: 4-A

Technology Integration Framework for Service Learning
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This is a PhD study aimed to explore the adoption of Information and Communication Technologies (ICT's) in service learning in Faculty of Computer Science and Information Technology. Findings of this study will come up with a conceptual framework for technology integration in different phases of service learning. Moreover, investigate the effective use of current technologies in different phases of service-learning projects which helps to evaluate the framework and identify the future directions. Furthermore, these results will be useful for policy makers in future using technologies in different service-learning projects.

All data collected through this questionnaire shall be protected and shall be used only for the purpose of this research. This study is being supervised by: Associate Professor Dr. Dayang Nurfatimah bt Awang Iskandar and Dr. Dayang Hanani bt Abang Ibrahim at Universiti Malaysia Sarawak, Malaysia.

In case of any query, please contact the undersigned.

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**Please answer all questions*

Appendix 1-A: Service learning team

Name: _____

Gender: ☐ Male ☐ Female

Select your role in SL program: *(please tick whichever applies)*

- ☐ Coordinator
- ☐ Course Instructor
- ☐ Supervisor
- ☐ Course instructor & Supervisor
- ☐ Coordinator & Supervisor

Component 1: Service Learning phases and their sub-activities

To what extent do you agree that following phases and sub-activities are important in service learning implementation

Phases	Sub-activities	Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
Planning & preparation	Redesigning course, establish awareness, searching communities, community engagement, socialize concept					
Implementation	Requirement collection and analysis, design, development, test, deployment					
Reflection	Selection of reflection mode, model and method					
Assessment & evaluation	Student, faculty and community assessment					

	Overall program evaluation					
Administration and management	Management of human resources, physical resources, Financial support legal and ethical issues and monitoring					

Component 2: ICT application in service learning phases (respondents service learning Team)

To what extent do you agree with the following statement

Statements	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I use existing tools and applications (e.g., learning management system, power point, internet etc.) for planning and preparation phase of service learning					
Existing software/applications are useful and effective for planning and preparation (including sub-activities) phase of service learning					
I use existing tools and applications (e.g., Google applications, power point etc.) for implementation phase of service learning					
Existing software/applications are useful and effective for implementation (including sub-activities) phase of service learning					
I use existing tools and applications (e.g., Google & Microsoft applications) for reflection phase of service learning					
Existing software/applications are useful and effective for reflection (including sub-activities) phase of service learning					
I use existing tools and applications (e.g., educational software, internet) for evaluation & assessment phase of service learning					

Existing software/applications are useful and effective for evaluation & assessment (including sub-activities) phase of service learning					
I use existing tools and applications (e.g., database management system) for administration & management phase of service learning					
Existing software/applications are useful and effective for administration & management (including sub-activities) phase of service learning					
To what extent do you agree with the use of ICT for communication and collaboration in service learning projects					
Statements					
Existing ICT's (e.g. social network sites, online discussion forum etc.) useful and effective for collaboration with participants of service learning					
Existing ICT's (e.g. social network sites, instant messaging etc.) useful and effective for communication with participants of service learning					
Existing software/applications are useful and effective for monitoring and tracking student's progress in service learning projects					

A BUNDLE OF THANKS FOR YOUR TIME

Appendix 1-B: Service learning students

Gender: ☐ Male ☐ Female

Select age group: *(please tick whichever applies)*

- ☐ 18-20 Years
☐ 20-22 Years
☐ 22-25+ Years

Select your study program: *(please tick whichever applies)*

- ☐ Computational Science
☐ Software Engineering
☐ Information System
☐ Multimedia Computing
☐ Network Computing

Component 2: ICT application in service learning phases (respondents students)

To what extent do you agree with the following statement

Phases	Statements	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Implementation	Existing requirement collection & analysis software/applications (e.g., Google Doc, Open Data Kit, SimpleMind etc.) are useful in SL project					
	Existing software design and development software/applications (e.g., Visual basic, JDeveloper etc.) useful for SL project					
	Existing project management software/applications (e.g., Microsoft project management, Timeline, Podio) are useful in SL project					

Reflection	Existing software/applications (e.g., e-portfolio, Microsoft applications, video development software etc.) are useful for reflection					
	Existing software/applications(e.g., e-portfolio Microsoft world, Power point, video development software) are effective for reflection					
	Existing software/applications (e.g., project management software) are useful for tracking and monitoring the progress of SL project					
To what extent do you agree with the use of ICT for communication and collaboration in service learning projects						
Statements						
Existing ICT's (e.g., Facebook, VOIP, Instant messaging and Twitter) are useful for communication during SL project						
Existing ICT's (e.g., Google apps, online discussion forum) are useful for collaboration with others during SL project						

A BUNDLE OF THANKS FOR YOUR TIME

Appendix 2: Coding Scheme for Assessment of Co-operative Reflection and Knowledge-Building

Co-operative reflection and knowledge-building measures or coding scheme for content analysis

C#	Measures or coding scheme category	Description Reference	SC#	Sub-codes
Part 1: Levels of Reflective Thinking				
CR-1	Describing experience (Level 1)	Describing service experience, personal thoughts, emotions, it can be individual to trigger collaborative reflection	CR-1.1	Monitoring good practices or issues in a service experience
			CR-1.2	Providing justifications for actions performed in experience, explanation of situations
			CR-1.3	Mentioning personal or other's emotions
CR-2	Referring to experiences (Level 2)	Sharing your experiences with other's commenting and engaging in collaborative discussion. initiating interaction and asking for information feedback from other participants	CR-2.1	Connecting an experience to other experiences, sharing own understanding
			CR-2.2	Responding to other's opinion, contributing your suggestions / new perspectives, Supporting other suggestions
CR-3	Developing connection between experience and contents/theories (Level 3)	Connecting experience with theory, developing a connection between experience and prior knowledge.	CR-3.1	Present experience relevant course concepts and theories
			CR-3.2	Linking an experience with theoretical concepts or prior knowledge
CR-4	Creating results (Level 4)	Drawing conclusion from group experience, agreed on shared understanding and transforming insights into practice	CR-4.1	Giving evidence with reference of experience, proposing solutions or suggestions
			CR-4.2	Summarizing discussion and drawing conclusion and implications from reflection
			CR-4.3	Integrating academic concepts and service experience, in order to produce shared

					understanding, connecting all participants ideas/opinions
Part 2: Levels of Knowledge-building					
KB-1	Academic Related (Level 1)	Statements of personal observations/opinions related to service experience or academic learning Asking questions and answering to clarify disagreements Statements to test new knowledge against existing cognitive schema, personal experience Negotiating meanings of terms and negotiation of the relative weight to be used for various agreement Summarizing agreements the meta-cognitive statements that shows new knowledge construction	KB-1.1	Information sharing and discussion related to academic concepts and service experience	
			KB-1.2	Inconsistency among participants, difference of opinion	
			KB-1.3	Recommendations, generating new ideas	
			KB-1.4	Negotiating (negotiation of relative concepts, personal thoughts)	
			KB-1.5	Co-construction of knowledge Agreement statements/application of newly constructed meaning	
KB-2	Task coordination (Level 2)	Statements for task coordination, leading discussion Comment of task coordination Questions about task	KB-2.1	To proceed discussion, give orders, or lead discussion	
			KB-2.2	Comment on others contribution and questioning about task or others contribution for explanation	
KB-3	Social interaction (Level 3)	Statements to interact, social interaction related to learning task	KB-3.1	Developing interaction to identify each other and proceed discussion on collaborative learning activity	
Source: Adapted from Prilla et al. (2015); Hou & Wu (2011) and Rodriguez (2014)					

Appendix 3: Questionnaire for CRM System Evaluation

QUESTIONNAIRE:

Version: 5-A



CRM System: A Computer Supported Co-operative Reflection System's Evaluation

This PhD study designed to explore the effective use of CRM system for co-operative reflection activities in service-learning program. IS Success Model is adapted to evaluate the success of implemented CRM system in real-world. Results of this study will benefit to explore the usability and effectiveness of CRM system for co-operative reflection and knowledge-building in student's reflection learning activities. Along with this, these findings will be helpful for educators and developers about the design of computer supported co-operative reflective systems and open up future research directions for determining the success dimensions for collaborative learning systems. Moreover, results of this study also help to understand how implemented system help for co-operative reflection to enhance students' capabilities of reflective learning.

All data gathered through this questionnaire shall be kept confidential and shall be used only for research purpose. This study is being supervised by: Associate Professor Dr. Dayang Nurfatimah Awang Iskander and Dr. Dayang Hanani Abang Ibrahim at Universiti Malaysia Sarawak, Malaysia.

In case of any query, please contact the undersigned.

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Faculty of Computer Science and Information Technology
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**Please answer all question*

Measuring CRM System Success: with Advanced IS success model

System Quality (SQ):

Please indicate your level of agreement with the following statements:

(1 = Strongly disagree, 7 = Strongly agree, 0 = Don't know)

		0	1	2	3	4	5	6	7
SQ1	CRM system is easy to use.	☐	☐	☐	☐	☐	☐	☐	☐
SQ2	CRM system includes necessary functions for managing reflection practice.	☐	☐	☐	☐	☐	☐	☐	☐
SQ3	The functionalities of CRM system were very useful for collaborative reflective learning.	☐	☐	☐	☐	☐	☐	☐	☐
SQ4	CRM system provides flexible and interactive features between user and system.	☐	☐	☐	☐	☐	☐	☐	☐
SQ5	CRM system is user friendly and reliable	☐	☐	☐	☐	☐	☐	☐	☐
SQ6	CRM system provides adequate functions for co-operative reflection and knowledge-building task	☐	☐	☐	☐	☐	☐	☐	☐
SQ7	CRM system provides well structured, guided and collaborative learning environment	☐	☐	☐	☐	☐	☐	☐	☐
SQ8	It is easy for me to use and understand various features of CRM system	☐	☐	☐	☐	☐	☐	☐	☐
SQ9	I can easily interact with CRM system	☐	☐	☐	☐	☐	☐	☐	☐

Information Quality(IQ):

Please indicate your level of agreement with the following statements:

(1 = Strongly disagree, 7 = Strongly agree, 0 = Don't know)

		0	1	2	3	4	5	6	7
IQ1	CRM system provides content and information required for reflection practice.	☐	☐	☐	☐	☐	☐	☐	☐
IQ2	CRM system provides up-to-date content and information.	☐	☐	☐	☐	☐	☐	☐	☐
IQ3	The information provided by CRM system is concise and relevant.	☐	☐	☐	☐	☐	☐	☐	☐
IQ4	CRM system provides comprehensive information which I exactly want for reflective learning.	☐	☐	☐	☐	☐	☐	☐	☐
IQ5	CRM system provides readable, clear, well formatted and easy to understand information	☐	☐	☐	☐	☐	☐	☐	☐

Service Quality (SRQ):

Please indicate your level of agreement with the following statements:

(1 = Strongly disagree, 7 = Strongly agree, 0 = Don't know)

		0	1	2	3	4	5	6	7
SRQ1	CRM system provides proper online assistance in the case of difficulties with using the system	☐	☐	☐	☐	☐	☐	☐	☐
SRQ2	My University IT department facilitates me if I face any difficulty while using CRM system.	☐	☐	☐	☐	☐	☐	☐	☐
SRQ3	CRM system is compatible with other technologies I used.	☐	☐	☐	☐	☐	☐	☐	☐
SRQ4	A technical staff is available to provide help for using system.	☐	☐	☐	☐	☐	☐	☐	☐
SRQ5	Teachers/Organizers are always willing to help.	☐	☐	☐	☐	☐	☐	☐	☐

Sociability Quality (SOQ):

Please indicate your level of agreement with the following statements:

(1 = Strongly disagree, 7 = Strongly agree, 0 = Don't know)

		0	1	2	3	4	5	6	7
SOQ1	CRM system enables me to easily contact with my group members	☐	☐	☐	☐	☐	☐	☐	☐
SOQ2	CRM system provides excellent communication medium for social interaction.	☐	☐	☐	☐	☐	☐	☐	☐
SOQ3	CRM system supports an effective and efficient sharing of information and documents with my group members	☐	☐	☐	☐	☐	☐	☐	☐
SOQ4	Using CRM system enables us to develop into a well performing team.	☐	☐	☐	☐	☐	☐	☐	☐
SOQ5	I felt comfortable participating in the collaborative discussions through CRM system.	☐	☐	☐	☐	☐	☐	☐	☐
SOQ6	I could comfortably communicate using the CRM system during collaborative work to express my own ideas/opinions.	☐	☐	☐	☐	☐	☐	☐	☐
SOQ7	CRM system enables me to develop good work relationships with my teammates	☐	☐	☐	☐	☐	☐	☐	☐
SOQ8	The CRM system enables us to create a sociable environment for non-task related conversation	☐	☐	☐	☐	☐	☐	☐	☐
SOQ9	Using CRM system to interact with others creates a personal environment for communication	☐	☐	☐	☐	☐	☐	☐	☐

User Satisfaction (US):

Please indicate your level of agreement with the following statements:

(1 = Strongly disagree, 7 = Strongly agree, 0 = Don't know)

		0	1	2	3	4	5	6	7
US1	I find the CRM system useful in reflective learning.	☐	☐	☐	☐	☐	☐	☐	☐
US2	I like working with the CRM system.	☐	☐	☐	☐	☐	☐	☐	☐
US3	The functions provided by CRM system are satisfactory for reflective learning	☐	☐	☐	☐	☐	☐	☐	☐
US4	Overall, I am satisfied with the performance of the CRM system	☐	☐	☐	☐	☐	☐	☐	☐

Use (U):

Please indicate your level of agreement with the following statements:

(1 = Strongly disagree, 7 = Strongly agree, 0 = Don't know)

		0	1	2	3	4	5	6	7
U1	While using CRM system, I use available features that help me to participate in collaborative reflection.	☐	☐	☐	☐	☐	☐	☐	☐
U2	Based on my experience, I am very likely to use CRM system.	☐	☐	☐	☐	☐	☐	☐	☐
U3	While using CRM system, I collaborate with my peers and teachers.	☐	☐	☐	☐	☐	☐	☐	☐
U4	I use many functions of the CRM system.	☐	☐	☐	☐	☐	☐	☐	☐

Net Benefits of the system (NB):

Please indicate your level of agreement with the following statements:

(1 = Strongly disagree, 7 = Strongly agree, 0 = Don't know)

		0	1	2	3	4	5	6	7
NB1	The CRM system encourages me to develop positive attitude to collaborative reflective learning.	☐	☐	☐	☐	☐	☐	☐	☐
NB2	The CRM system help to involves students actively in the collaborative learning process.	☐	☐	☐	☐	☐	☐	☐	☐
NB3	Using CRM system helps me to fulfil collaborative reflective learning outcomes.	☐	☐	☐	☐	☐	☐	☐	☐
NB4	Using CRM system helps me to make connection between informal (learning at community service site) and formal (learning in classrooms) learning experience.	☐	☐	☐	☐	☐	☐	☐	☐
NB5	The CRM system helps the teacher to conduct structured co-operative reflection activity.	☐	☐	☐	☐	☐	☐	☐	☐
NB6	My performance in the class is enhanced by using CRM system	☐	☐	☐	☐	☐	☐	☐	☐

Collaborative Knowledge-building and Critical Thinking Skills Development

NB7	Using CRM system promotes critical thinking skills and collaborative knowledge-building.	☐	☐	☐	☐	☐	☐	☐	☐
NB8	Using CRM system leads to increased transparency in co-operative reflection and knowledge-building.	☐	☐	☐	☐	☐	☐	☐	☐
NB9	Using CRM system encourages discussion and negotiation to reached on shared understanding	☐	☐	☐	☐	☐	☐	☐	☐
NB10	The CRM system enhanced interaction between me, peers and teachers	☐	☐	☐	☐	☐	☐	☐	☐
Personal Growth									
NB11	I am able to work collaboratively with others	☐	☐	☐	☐	☐	☐	☐	☐
NB12	I am able to critically analyse practical experience to produce new understanding	☐	☐	☐	☐	☐	☐	☐	☐
NB13	I am able to show my own progress (personal growth) and compare myself with others	☐	☐	☐	☐	☐	☐	☐	☐

Demographic Information

Gender: ☐ Male ☐ Female

Age Group: *(please tick whichever applies)*

☐ 18-20 Years
☐ 20-22 Years
☐ 22-25 Years
☐ More than 25 Years

Select your program: *(please tick whichever applies)*

☐ Computational Science
☐ Software Engineering
☐ Information System
☐ Multimedia Computing
☐ Network Computing

A BUNDLE OF THANKS FOR YOUR TIME

Appendix 4: List of Publications from this Thesis

1. **Salam, M.**, Awang Iskandar, D. N., Ibrahim, D. H. A., & Farooq, M. S. (2019a). Service learning in higher education: A systematic literature review. *Asia Pacific Education Review*, 20(4), 573–593. <https://doi.org/10.1007/s12564-019-09580-6>
2. **Salam, M.**, Awang Iskandar, D. N., Ibrahim, D. H. A., & Farooq, M. S. (2019b). Technology integration in service-learning pedagogy: A holistic framework. *Telematics and Informatics*, 38, 257–273. <https://doi.org/10.1016/j.tele.2019.02.002>
3. **Salam, M.**, Ibrahim, D. H. A., & Awang, D. N. (2019). Co-Reflective System: Supporting Collaborative Critical Thinking and Knowledge Building. *International Journal of Innovation in Enterprise System*, 3(01), 9–23. <https://doi.org/10.25124/ijies.v3i01.126>
4. **Salam, M.**, Iskandar, D. N. F. A., & Ibrahim, D. H. A. (2017). Service Learning Support for Academic Learning and Skills Development. *Journal of Telecommunication, Electronic and Computer Engineering*, 9(2–10), 111–117.