Supporting Effective Online Learning Groups for eLearning Systems

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UiA University of Agder

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Supporting Effective Online Learning Groups for eLearning Systems

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Dedicated to

My father Micheal Baraza, my mother Regina Baraza, my wife Lydia Kayinza, and my children Ethan Sanya Baraza Emmanuel, Esme Sanyu Baraza Valentine, Erino Ojambo Baraza Elijah, Eitan Mabwibwi Baraza Victor and Erich Mangeni Baraza Eden.

Abstract

Learning in groups has been advocated to increase learning based on the social constructivist learning theory. ICT has been preferred to bridge the gap between distance learning students for possibilities to enhance the benefits of learning groups. However, although learning groups can bring about meaningful learning, learning groups in online environments are often not working.

To solve this problem, this study uses design science approaches to establish methods and factors that support effective online learning groups. Within design science three case studies were used. These case studies were used under three research areas: context of online learning groups, processes to support effective online learning groups and tools to support effective online learning groups. The study adopted mixed methods in the evaluation stage of the adopted design science.

Establishing the context of online learning groups laid a foundation for this study. This was done using a survey approach that covered the five regions in Uganda, semi-structured interviews with experienced online learning facilitators and observation of interaction logs of online courses at both the University of Agder and Makerere University. Initially, preliminary findings of effective online learning groups were established. The preliminary findings consist of the need for: study guide, trained online tutors, motivating and sustaining interaction, high levels of cognitive interactions, peer assessment based activities and ICT.

From the context of online learning groups, the Methods and Factors for Effective Online Learning Groups (FEOLG) were established. FEOLG include: supporting institutional online learning group policy; supporting institutional online learning group technology; quality of online learning group activity; quality of the online learning group; and quality of online learning group facilitation. The factors were evaluated using online learning courses based on existing Makerere University eLearning Environment (MUELE) and online learning group design.

The thesis contributes: methods for creating online learning groups, methods for structuring online learning group activities, methods for facilitating online learning groups, and the establishment of factors for supporting effective online learning groups.

The results of this thesis are published in thirteen publications, six of which are included in the thesis.

Preface and Acknowledgments

This dissertation is a result of the research work carried out under the Distance Education Leapfrogging Project (DELP) at the Department of Information and Communication Technology (ICT), Faculty of Engineering and Science, University of Agder (UiA), Norway and the Institute of Open, Distance and eLearning, College of Education and External Studies, Makerere University, Uganda, for three years. The completion of this dissertation would not have been possible without the support of several individuals.

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Lastly, I express my deep respect and intense gratitude to God.

Godfrey Mayende
October 2020
Grimstad, Norway

List of Publications

The author of this dissertation published a total of thirteen peer-reviewed scientific papers during the PhD project with nine publications as a first author and four as a co-author. Six of these publications are included as part of this thesis.

Papers Included in the Dissertation

Paper A: Godfrey Mayende, Paul Birevu Muyinda, Andreas Prinz, Ghislain Maurice Norbert Isabwe, and Dianah Nampijja, "Online Learning Needs Assessment in Uganda", *Digital Media in Teaching and its Added Value*, Waxmann Verlag, pp. 208-224, 2015.

Paper B: Godfrey Mayende, Andreas Prinz, Ghislain Maurice Norbert Isabwe, and Paul Birevu Muyinda, "Supporting Learning Groups in Online Learning Environment", *Proc. 7th International Conference on Computer Supported Education (CSEDU(2))*, pp. 390-396, 2015, DOI: 10.5220/0005433903900396.

Paper C: Godfrey Mayende, Ghislain Maurice Norbert Isabwe, Paul Birevu Muyinda, and Andreas Prinz, "Peer Assessment Based Assignment to Enhance Interactions in Online Learning Groups", *Proc. 2015 International Conference on Interactive Collaborative Learning*, IEEE, pp. 668-672, 2015, DOI: 10.1109/ICL.2015.7318106.

Paper D: Godfrey Mayende, Andreas Prinz, Ghislain Maurice Norbert Isabwe, and Paul Birevu Muyinda, "Learning Groups in MOOCs: Lessons for Online Learning in Higher Education", *International Journal of Engineering Pedagogy*, iJEP, pp. 109-124, 2017, DOI: 10.3991/ijep.v7i2.6925.

Paper E: Godfrey Mayende, Andreas Prinz, and Ghislain Maurice Norbert Isabwe, "Improving Communication in Online Learning Systems", *Proc. 9th International Conference on Computer Supported Education*, CSEDU, pp. 300-307, 2017, DOI: 10.5220/0006311103000307.

Paper F: Godfrey Mayende, Andreas Prinz, Paul Birevu Muyinda, and Ghislain Maurice Norbert Isabwe, "Towards Technology for Supporting Effective Online Learning Groups", *In: Auer M., Tsiatsos T. (eds) Interactive Mobile Communication Technologies and Learning. IMCL 2017. Advances in Intelligent Systems and Computing*, vol 725. Springer, Cham. pp. 361-371, 2018, DOI: 10.1007/978-3-319-75175-7_37

Publications Not Included in the Dissertation

Paper G: Godfrey Mayende, Paul Birevu Muyinda, Ghislain Maurice Norbert Isabwe, Micheal Walimbwa, and Samuel Ndeda Siminyu, "Facebook Mediated Interaction and Learning in Distance Learning at Makerere University", *Proc. International Conference e-Learning*, Multi Conference on Computer Science and Information Systems, pp. 333-338, 2014, https://files.eric.ed.gov/fulltext/ED557270.pdf

Paper H: Paul Birevu Muyinda, Godfrey Mayende, and Jonathan Kizito, "Requirements for a Seamless Collaborative and Cooperative MLearning System", *In: Wong LH., Milrad M., Specht M. (eds) Seamless Learning in the Age of Mobile Connectivity.* , Springer, Singapore. pp. 201-222, 2015, DOI: 10.1007/978-981-287-113-8_11

Paper I: Godfrey Mayende, Andreas Prinz, Ghislain Maurice Norbert Isabwe, Paul Birevu Muyinda, and Dianah Nampijja, "Philosophical and Ethical concerns in researching Online Learning Groups", *Proc. 2016 IEEE Conference on e-Learning, e-Management and e-Services*, IEEE, pp. 96-101, 2016, DOI: 10.1109/IC3e.2016.8009047.

Paper J: Godfrey Mayende, Andreas Prinz, Ghislain Maurice Norbert Isabwe, and Paul Birevu Muyinda, "Learning Groups for MOOCs Lessons for Online Learning in Higher Education", *In: Auer M., Guralnick D., Uhomoibhi J. (eds) Interactive Collaborative Learning. ICL 2016. Advances in Intelligent Systems and Computing*, vol 544. pp. 185 - 198, 2017, Springer, Cham. DOI: 10.1007/978-3-319-50337-0_16

Paper K: Gerald Gwamba, Godfrey Mayende, Ghislain Maurice Norbert Isabwe, and Paul Birevu Muyinda, "Conceptualising Design of Learning Management Systems to Address Institutional Realities", *In: Auer M., Guralnick D.,*

Simonics I. (eds) Teaching and Learning in a Digital World. ICL 2017. Advances in Intelligent Systems and Computing, , vol 716. pp. 43-50, 2018, Springer, Cham. DOI: 10.1007/978-3-319-73204-6_6

Paper L: Harriet Mutambo Nabushawo, Paul Birevu Muyinda, Ghislain Maurice Norbert Isabwe, Andreas Prinz, and Godfrey Mayende, "Improving Online Interaction Among Blended Distance Learners at Makerere University", *In: Auer M., Guralnick D., Simonics I. (eds) Teaching and Learning in a Digital World. ICL 2017. Advances in Intelligent Systems and Computing*, vol 715. pp. 63-69, 2018, Springer, Cham. DOI: 10.1007/978-3-319-73210-7_8

Paper M: Gerald Gwamba, Jaco Renken, Dianah Nampijja, Godfrey Mayende, and Paul Birevu Muyinda, "Contextualisation of eLearning Systems in Higher Education Institutions", *In: Auer M., Tsiatsos T. (eds) Interactive Mobile Communication Technologies and Learning. IMCL 2017. Advances in Intelligent Systems and Computing,* , vol 725. pp. 44-55, 2018, Springer, Cham. DOI: 10.1007/978-3-319-75175-7_6

Contents

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List of Abbreviations

CSCL	Computer Supported Collaborative Learning
CSI	Computer Supported Interaction
DE	Distance Education
DELP	Distance Education Leapfrogging Project
FEOLG	Factors for Effective Online Learning Groups
FDG	Focus Group Discussion
HCI	Human Computer Interaction
IAM	Interaction Analysis Model
ICT	Information and Communication Technology
IS	Information Systems
LG	Learning Groups
LMS	Learning Management System
MAK	Makerere University
MOOC	Massive Open Online Courses
MS	Microsoft
MUELE	Makerere University Electronic Learning Environment
NTC	National Teachers College
OLG	Online Learning Groups
PC	Personal Computers
RQ	Research Question
SNA	Social Network Analysis
UICT	Uganda Institute of Information and Communication Technology
UiA	University of Agder
ZPD	Zone of Proximal Development

PART I

Chapter 1

Introduction

This chapter starts by presenting the background and motivation of the Ph.D study. In section 1.2, the problem is stated. The research areas with corresponding research questions are elaborated in section 1.3. The research approach is described in section 1.4. The research scope and contributions are presented in sections 1.5 and 1.6, respectively. Finally, the structure of the thesis is outlined in section 1.7.

1.1 Background and Motivation

Learning is the acquisition of knowledge or skills in addition to attitude or change of behavior through study and experience [1–3]. Traditionally, learning is categorised under three main learning theories: behaviorism, cognitivism and constructivism. Behaviorism focuses on observable things: how people behave and how they change particular behaviors [4–6]. Under behaviorism, the definition of learning is reduced to simple conditioning: the stimulus and the response [7]. Cognitivism focuses on the mind in making sense of the material world. Cognitivism models the mental structures and processes that operate in the mind in order to explain behavior [2,5,6]. Constructivists did not believe that people are like machines which are given input or stimuli and produce output or response as the earlier theories had suggested. Constructivism suggests that the learner is much more actively involved in collaboration with the teacher and peers in creating (constructing) knowledge [5, 6, 8, 9]. The constructivist theory posits that people construct their own understanding and knowledge of the world through experiencing the world, and reflecting on those experiences [8,9]. Constructivist learning renders itself so well with distance learning.

Distance learning offers possibilities for learning, in particular catering for the

high demand for higher education under limited infrastructure [10, 11]. Distance learning is a mode of study where learners have minimal face-to-face contact with the facilitators: the learners learn on their own, away from the institutions, most of the time [12–15]. As the use of ICT in distance learning is growing, distance learning has also been referred to as online learning [16, 17]. Online learning, as a subset of distance learning, has always been concerned with provision of access to a learning experience which is more flexible in time and in space than campus-based learning [18]. Online learning implies learning through the use of online learning environments. However, in developing countries, distance learning is still dominated by the first generation distance learning model which is heavily characterized by print and face-to-face [15, 19]. In recent times, distance learning is increasingly conducted online. Facilitators of first generation distance learning are giving learners collaborative assignments in groups with the aim of bringing them together. These collaborative assignments are making it possible for the disparately located learners to work together in groups hence facilitating collaborative learning.

Collaborative learning hinges on knowledge construction in a social manner where each learner has control over his/her own learning. Collaborative learning is underpinned by the social constructivist learning theory [20]. Advances in ICTs are providing numerous possibilities for harnessing collaborative learning in learning groups. Group learning has been preferred [21] to boost interaction and learning [18]. Learning groups are learners working together collaboratively to solve a problem or create something. The collaboration is aimed at learning where each learner is accountable to the learning group. There is an ongoing debate [22, 23] on the level of engagement of ICT supported interaction in the learning groups. Vygotsky [20] argues that a persons learning may be enhanced through engagement with others. Moore [24] identified three types of interaction: learner-facilitator, learner-content, and learner-learner interactions. Anderson [25] concurs that meaningful learning can be achieved if there is a high level of interaction between either learner and learner or learner and content or facilitator and learner. However, Hay [26] argue that facilitator-learner interaction was the strongest in bringing about meaningful learning as compared to learner-learner interaction. Increased interactions can be achieved through ICT supported collaborative learning. Given that many distance learning students are working students and not co-located, computer supported collaborative learning can offer possibilities for learning in groups.

Collaborative learning is a pre-cursor to student-centred learning both in traditional and online learning. It enhances learner engagements and interactions which bring about meaningful learning. It therefore goes without saying that collaborative

learning is best achieved through learning groups. Educational technology specialists believe that the use of ICT in education is a major catalyst in changing the way universities perform their core functions [1, 27, 28]. Universities need to accelerate the change in teaching styles, change in students approaches to learning and change in the way information and educational materials are accessed. Yet online learning makes even collaborative learning more challenging to achieve. Learning groups in online courses are not easy to make efficient given that these groups are online and the learners are not co-located. This requires new knowledge and guidelines to help in achieving the success of learning groups. Many times, learning groups are set up in the online learning environment but learners do not interact with one another.

1.2 Problem Statement

Learning groups have been widely used and highly advocated for increasing interactions among learners [16, 29]. Many distance learning practitioners have used learning groups with the aim of fostering learning in those groups. Many higher education institutions are moving towards student-centered learning approaches where groups are a great means to allow for collaborative activities.

Educationists in first generation distance learning, use group assignments to help in the initiation of learning groups. Many times, the group assignments end up being done by just one or two group members and the remaining members just put their names on the group assignment. Often, this is caused by learners not being co-located and the lack of clarity from the teachers on how to work collaboratively in such groups. This deters meaningful interactions which are a precursor for learning. Hence, no meaningful learning as envisaged when giving out the group assignment is achieved. This has often caused increase in failure rates.

The penetration of ICTs in distance learning creates possibilities of bridging the gap between the learners and facilitators. Even if the learners are placed in learning groups within the online environments, many times, there is no interaction. Many institutions are exploiting the integration of learning groups in online learning activities, but most lack clear guidelines on how to exploit this opportunity to the benefit of the students, as well as the educators. Learning happens through engagement/interactions [20, 30]. So the problem is that **although learning groups can bring about meaningful learning, learning groups in distance learning are often not working.**

The introduction of computer supported collaborative learning (CSCL) can offer possibilities of students' interactions. However, motivating and sustaining effective

student interactions is not easy to achieve. This requires planning, coordination and implementation of curriculum, pedagogy and technology. Therefore, this study aims at investigating how learning groups can work effectively in online learning environments.

1.3 Research Areas

To solve the problem, the study provides methods and guidelines for supporting effective online learning groups. To achieve this the study focuses on three research areas: (1) context of online learning groups, (2) processes to support effective online learning groups and (3) tools to support effective online learning groups. The first research area is concerned with the context of online learning groups and seeks to understand what online learning groups are. Based on the context, the processes to support effective online learning groups focus on understanding the processes in order to determine the factors influencing effective online learning groups. Finally, the third area focuses on tools to support effective online learning groups; implements the processes and evaluates the methods and factors. The research questions that guide the solving of the problem stated above have been placed in the research areas as shown in Table 1.1.

Table 1.1: Overview of research areas and research questions

Research areas	**Research questions**
Context of online learning groups	**RQ1:** What is the context for online learning groups? **RQ2:** What is an effective online learning group?
Processes to support effective online learning groups	**RQ3:** How can effective online learning groups be formed? **RQ4:** How can effective online learning group interaction be sustained?
Tools to support effective online learning groups	**RQ5:** What guides the design of tools to support effective online learning groups? **RQ6:** What tools should be used to support effective online learning groups?

Context of online learning groups. The context was established by providing answers to RQ1 and RQ2. To answer RQ1 a survey of higher education institutions in Uganda was conducted. This established the context of online learning in Uganda. To answer RQ2 a study including experienced online facilitators and existing online courses at the University of Agder was conducted. The answers to RQ1 and RQ2 created a foundation to solve the research problem by providing indicators for establishing the methods and factors of effective online learning groups.

Processes to support effective online learning groups. To establish the processes for effective online learning groups, answers were sought for RQ3 and RQ4. To answer RQ3 and RQ4, two studies on online learning courses were conducted. RQ3 addressed how online learning groups should be formed. RQ4 addressed how to sustain effective online learning groups. This was mostly done to understand the interventions by the facilitator in triggering the interactions in online learning groups. The answers to RQ3 and RQ4 provided solutions to the research problem on how to form and sustain effective online learning groups.

Tools to support effective online learning groups. To establish tools for effective online learning groups, answers were sought for RQ5 and RQ6. RQ5 was aimed at establishing the guidelines for supporting effective online learning groups. These guidelines were designed based on the processes discussed in the earlier research area. RQ6 aimed at implementing the factors in the online learning courses. The factors were then evaluated based on two online learning courses at Makerere University. The answers to RQ5 and RQ6 provided methods and factors for effective online learning groups as a solution to the research problem. Therefore, the methods and factors for effective online learning groups are the solution to the PhD research problem.

1.4 Research Approach

Given that this study is planned to create an artifact (methods & guidelines for supporting effective online learning groups), the design science approach was used. The design science stages shown in Figure 1.1 are adopted from [31,32]. The stages are; definition of the objectives for a solution, design and development, case studies, and evaluation. The distinct stages and their corresponding descriptions are in the subsequent itemized section.

Definition of the objectives for a solution. This stage used the problem definition and knowledge of what was possible and feasible to define the objectives. In this study research questions were used. The research questions were categorized into three research areas as indicated in Section 1.3.

Design and Development. This stage established an artifact which was used in the research. This artifact was methods and guidelines for the creation of effective online learning groups. The artifact was established after finding out the needs of the end users of the desired solution.

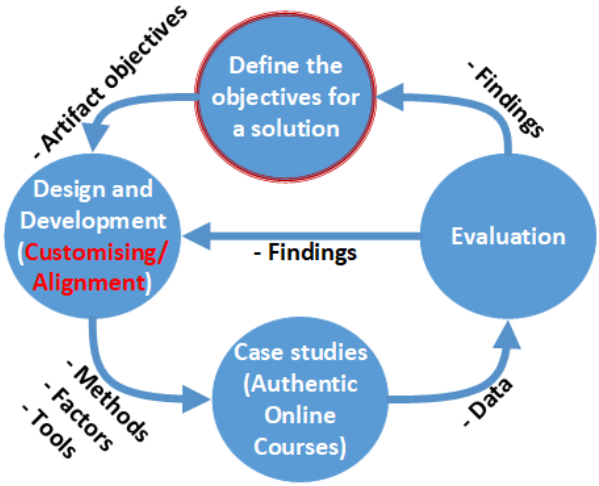

Figure 1.1: Design science methodology

Case studies. This stage demonstrated the use of the artifact to solve one or more instances of the problem. This study used five independent case studies (online courses) to demonstrate the instances of the problem as suggested from the artifact. This helped in gradually improving and refining the artifact.

Evaluation. This stage observed and analyzed how well the artifact provided a solution to the research challenge. At this point mixed methods (qualitative and quantitative methods) were used. The qualitative methods were observations of online interactions, interviews and focus group discussion while quantitative methods were online surveys. This stage iterated the design and development stage or the definition of the objectives of a solution stage. The iteration helped in improving the objective of the solution and the artifacts. Case studies to improve the artifact and iterate in stages were used.

1.5 Research Scope

The scope of the research is described below.

- **Higher Education**. This study was restricted to the higher education institutions of learning. The courses were within a higher education context. One of the courses was a MOOC which allowed admission of all persons interested in the course. Still, this course was within higher education since participants were supposed to have completed secondary education.

- **Distance Learning**. This study does not look into co-located learners. The

learners are geographically distributed and access learning through institutional online environments.

- **Learning groups**. This study only focuses on learning group activities. The study does not work with individual activities.

1.6 Contributions of the PhD Dissertation

The overall results of this PhD dissertation are methods and factors for supporting effective online learning groups. The main contributions of this dissertation are summarized as follows (C1 to C4).

C1 A method for the better creation of online learning groups has been developed. This provides guidance on the process/steps for the creation of online learning groups. The detailed explanation is in section 4.2.4.

C2 A method for better structuring of online learning group activities has been developed. Emphasis has been placed on structures that enable online peer feedback and guidance. The detailed explanation can be found in section 4.2.3.

C3 A method for better facilitation of online learning groups has been established. Emphasis has been placed on facilitator presence that scaffolds learners by provoking them through the levels of Blooms taxonomy. The detailed explanation is in section 4.2.5.

C4 Factors for supporting effective online learning groups have been established. These factors inform instructional design for online learning courses. These factors provide guidance to both education technologists and designers of online systems. The factors are; (1) *supporting institutional policy*, (2) *supporting institutional technology*, (3) *quality of learning group activity*, (4) *quality of learning groups* and (5) *quality of learning group facilitation*. The detailed explanation can be found in section 4.2.

1.7 Structure of the Thesis

This dissertation is prepared as a collection of scientific papers. The dissertation is presented in two parts, Part I and Part II.

Part I provides a summary of the PhD work in six chapters. Chapter one provides the introduction to the PhD dissertation by stating the problem, research areas and approaches used in the research. Chapter two gives a background on online learning groups. Chapter three describes the research methodology used in conducting the PhD research. Chapter four presents the research findings. Chapter five provides the evaluation and discussion of the results. Chapter six presents the summary of the research and suggests areas of further research.

Part II consists of six peer reviewed scientific papers (Papers A-F). Out of these six papers one is a book chapter, one is a journal paper and four are conference papers.

Paper A (Online Learning Needs Assessment in Uganda) presents the online learning needs assessment. This helped in establishing the context of use. This paper surveys higher education institutions of learning in Uganda. This survey samples all the regions of Uganda, because this project is aimed at finding solutions contextualized for Uganda. Through this, online learning needs were established. It provides answers to RQ1.

Paper B (Supporting Learning Groups in Online Learning Environment) presents preliminary findings of effective online learning groups. The paper interviewed experienced online facilitators at the University of Agder and observed online interaction logs in two online learning courses at the University of Agder. This outlined key needs that assisted in having an effective online learning group. It provides answers to RQ2.

Paper C (Peer Assessment Based Assignment to Enhance Interactions in Online Learning Groups) presented online learning group processes. The study was conducted on a course at Makerere University which ran for 15 weeks. Through observations of online interactions and interviews indicators for effective online learning groups were identified thereby answering RQ3 and RQ4.

Paper D (Learning Groups in MOOCs: Lessons for Online Learning in Higher Education) presented online learning group processes. The study was conducted on a MOOC course at the University of Agder which ran for 10 weeks. Through observations of online interactions in groups and surveys indicators for effective online learning groups were identified thereby answering RQ3 and RQ4.

Paper E (Improving Communication in Online Learning Systems) presented online learning group processes and tools. The study was conducted on courses run on mindvalley and facebook platforms. From course interaction logs, interaction statistics and content analysis was done to determine the communications in the online learning systems. This paper established indicators and tools for effective

online learning groups, hence answering RQ4 and RQ6.

Paper F (Towards Technology for Supporting Effective Online Learning Groups) is based on paper C, D and E to extract methods and factors for effective online learning groups. The methods and factors are used within existing online learning systems to determine online learning tools. The factors were evaluated using a focus group discussion and interviews. This paper provided answers to RQ5 and RQ6.

Chapter 2

Online Learning Groups

This chapter presents the state of the current research on online learning groups. Section 2.1 describes online learning. Section 2.2 describes learning groups while Section 2.3 deals with pedagogical theories of learning groups. Section 2.4 describes online learning groups. Finally, Section 2.5 presents research approaches for online learning groups.

2.1 Online Learning

This section describes online learning in the context of online learning theories. It presents an analysis of the status of online learning groups in Uganda and assesses online learning needs. It also presents the tools used in online learning.

2.1.1 Online Learning Theories

Online learning has been defined as learning that takes place partially or entirely over the internet making information or knowledge available to users disregarding time restrictions or geographical proximity [33]. Online learning has worked well with distance learning given that learners are separated in time and space from each other [34]. First generation distance learning is a mode of study where learners have minimal face-to-face contact with the facilitators: the learners learn on their own, away from the institutions, most of the time [35]. However, online learning has also worked with traditional class room systems which blend online and traditional learning. Currently, distance learning allows for occasional face-to-face meetings blended with online learning [17, 36]. Online learning and its integration into the teaching and learning curriculum is very much rooted in the constructivist school

of thought, where learners active participation is emphasized [17, 37–39]. Online courses offer the opportunity to create a highly social learning environment, characterized by participation and interactivity for both learners and facilitators [40]. It is presumed that learners are active contributors of knowledge and help in creating and designing instructional artifacts that aid learning. Different technologies have been suggested worldwide for teaching and learning [41].

Universities therefore have the duty to guarantee an academic culture that promotes the use of ICT in teaching and learning. This process calls for increased ICT training to fight ICT illiteracy [42], creation of distance education programs [13], a break away from the traditional chalk and talk method of teaching to a more blended online method that would facilitate ICT integration into instruction and learning. The next section presents the status of online learning in Uganda.

2.1.2 Status of Online Learning in Uganda

In Uganda. For insatance: The demand for higher education in Uganda has opened up doors for the demand for distance learning [13] given the limited infrastructure [42–44]. Distance learning comes with limitations associated with not being co-located. The use of ICT in teaching and learning is promising to support distance learning. This support is bringing into effect what is referred to as online learning. However, Uganda like other developing countries is still in the early stages of online learning [42]. The active integration of ICT in the teaching and learning processes is still minimal in most universities in Uganda [44]. This is a result of such challenges as inadequate levels of ICT infrastructure [42–44], poor or no internet connectivity [45], high illiteracy levels [42], absence of adequate numbers of ICT trainers [42, 45], and limited financial resources allocated to ICT in teaching and learning [42, 45] (Details in Paper A). Considerable efforts should therefore be geared towards addressing these challenges if we are to reap online learning benefits in Ugandan higher education. Universities in Uganda need to fast track the change in teaching styles, change in students approaches to learning and change in the way information and educational materials are accessed. These changes should be done within online learning systems.

2.1.3 Online Learning Systems

Some of the online learning systems are institutional-based or online communities. Institutional online learning systems are referred to as learning management systems (LMS). There are two kinds of LMS; open source and proprietary learning

management systems. Open source learning management systems allow easy customization and they are free while proprietary learning management systems are off-the-shelf systems ready for buying and often not easy to customize [46, 47]. Several universities have adopted either open source or proprietary learning management systems. Makerere University, initially used the commercial learning management system "Blackboard". However, due to the costs involved, it has since shifted to the open source learning management system "Moodle". Majorly, open source learning management systems were developed for PC access. However, with the emergence of mobile phones and their increasing usage in developing countries, customization is under way to support mobile technologies [48–52].

Social media is also breaking grounds in teaching and learning [53–57]. Universities are using social media as a back-end stream of the existing learning management systems. However, the use of institutional LMS is critical for easy control and management. This allows easy access and monitoring of students' learning within the system and especially within learning groups.

2.2 Learning Groups

This study adopted Jacques and Salmon's [58] definition of learning groups as people who come together to share knowledge, for personal development or to learn from each other through discussion. These groups are used to bring learners together to work while they are not in their face-to-face period. Studies have shown that meaningful learning is achieved through learner engagement [20, 25]. Chen [59] defines engagement as learner-facilitator and/ or learner-learner interaction. Learner engagement can be achieved through the use of learning groups. Haythornthwaite [60] argues that working in groups can help students participate in active construction of knowledge, enhance problem solving skills, share ideas and opinions, and be able to gain valuable experience. However, learner engagement does not just happen within groups. Many times group work requires increased time and dependence on peers which is often in direct conflict with students' perceptions of online learning [61]. This requires a well-planned setup of the learning groups with appropriate activities which are connected to learning outcomes. In addition, the facilitators should assist in mediating the interaction within the group through questioning to provoke high-level interactions. For facilitators to effectively mediate learning groups, training is required [58]. The next section presents the pedagogical theories used in learning groups.

2.2.1 Formation of Learning Groups

The effective functioning of learning groups depends on many factors, among them is the group formation. Formation of learning groups is the process of bringing learners together to discuss or create something [62]. It is the responsibility of the teacher to decide how groups are formed. There are several ways in which learning groups can be formed. The groups can be self-created or automatically created randomly or dependent on the learner profiles [62]. Self-creation is the process of allowing learners or participants to select the members they would like to be with in the groups. Usually, learners prefer self-created groups in order to determine who they would be with in a group. This method saves time for the facilitator since planning is less. Self-created groups often bring together participants who are friends or share something in common. This has been shared by [63] who established that learners who self-create groups tend to choose groups of the same gender and ethnicity. However, there are challenges with self-created groups. In [64] it was found that the worst group experience was when groups were self-created while [65] found that the best experience was when teachers were in control of forming the groups. Automatic group creation can be random or based upon information about the learners. Random group creation brings together diverse learners which can bring about proper functioning of a group. When groups are created through a mix of profiles and based on previous experience, there is increased achievement. Several studies have suggested that random group creation makes learners more serious although trust takes some time to build. If groups are created automatically, there must be some kind of criteria to group learners. Usually, forming groups with a mixture of knowledgeable peers and slow learners would help the group to function. This relates with Vygotsky theory where the more knowledgeable peer can scaffold others.

2.2.2 Trust for Well-functioning Learning Groups

A well-functioning group is one where learners actively interact within the groups. For groups to function-well, trust building among learners within a group is paramount [66]. Trust and interaction are directly correlated. Online learning groups make trust building difficult, given the distance between learners and diverse cultures. For trust to be built, the teacher must create activities that build the trust. Groups that stay long together can cultivate trust among the group members [67]. However, keeping learners in a group for long periods without adding activites that promote trust may not necessarily guarantee functionality of the group.

2.2.3 Interaction in Learning Groups

Dascalu et al [68] believe that to have effective discussion groups there is need to have a friendly environment where learners feel free and comfortable enough to express their ideas. The characteristics that bring about success of learning groups are categorized into personal attributes and organizational attributes [69]. Personal attributes include learners' trust, self-awareness, motivation, commitment and willingness to share experience. The organizational attributes include group size, similarity of experience (age) or status, geographical proximity, agreed aims and ground rules, flexibility to tailor group to learners' needs, non-hierarchical structures, autonomy from external authorities, planning ahead, clarity of decision making and regular review and feedback [69]. Learners' motivation is a key attribute in encouraging interaction in learning groups.

Use of grades to motivate learners has been widely used in online learning environments. Grades encourage learners to contribute in online discussion forums. However, [70, 71] believe that grades do not encourage high levels of interaction other than interaction at lower levels of Blooms taxonomy. When students are motivated by grades, they only submit mandatory posts or comments but are less obliged to post or comment on non-graded posts. Online facilitators have used such guidelines as setting a number of posts as a way of encouraging learners to participate in online learning groups. However, Murphy and Coleman [72] found that the quality of discussions declined when learners were forced by the course requirement to post a certain number of posts. For learner-centered approaches, the facilitator's contribution in the online learning groups should be minimal in order to avoid contributors' resignation in anticipation of the facilitator's comment. The facilitator should rather come in to provide feedback to learners where need be, refocus or end discussions. This said, learners often prefer the facilitator to give constant feedback. However, Arend [73] found that in forums that exhibit lower-level critical thinking, the instructors were very active in the online discussions, sometimes responding to nearly every learner post. Jones [74] found that if learners are introduced to topics that interest them, they are more likely to be motivated to contribute in the learning groups. Asking learners to review their peers can help increase deep interaction in an online learning environment. Peer facilitation motivated learners to contribute in online discussions [69].

2.3 Pedagogical Theories of Learning Groups

This section presents the underlying theories for learning groups. First, the constructivist learning theory is presented, then the social constructivist learning theory and finally collaborative learning. The section also deals with interaction in learning groups.

2.3.1 Constructivist Learning Theory

Hein [8] refers to constructivism as the idea that learners construct knowledge for themselves. Learners individually or socially construct meaning as they learn. According to the constructivist learning theory, constructing meaning is effective learning. This construction should be directed and contextualized, and not only based on hands-on but also reflective to help the change in mind. All hands-on must pass the test of mind for effective learning. There are two main branches to the constructivist learning theory. The first of these is the individual constructivist learning theory which is connected to the works of Piaget [75]. The second is the social constructivist learning theory which is connected to the works of Vygotsky [75]. While Piaget and Vygotsky both advocate for a focus on the learners from the pedagogical point of view, it is Vygotsky's ideas of social constructivism that underpin this study.

2.3.2 Social Constructivist Learning Theory

Social constructivist learning focuses on the effects of social interactions, language and culture on learning [4]. Vygotsky argued that all cognitive functions originate from social interactions [20]. This interaction is very important in a learning process which connects well with online learning groups. Social constructivism explains the processes of learning in three concepts: the zone of proximal development, intersubjectivity and enculturation [4, 20, 76].

1) The zone of proximal development was defined by Vygotsky as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers"([20],p.86). This is applicable with learning groups since the more knowledgeable peers can help in scaffolding others. This is equally applicable when the facilitators extend help to the learning group members. Facilitators do this through provoking the learners within the groups through questioning to assist learning.

2) Intersubjectivity is the mutual understanding that is achieved between people through effective communication. This is in agreement with online learning groups which require effective communication during interaction.

3) Enculturation is the process whereby the currently established culture enables an individual to learn the accepted norms and values of the culture or society in which the individual lives. Through social interaction, learners can co-create solutions in what is called collaborative working which leads to collaborative learning.

2.3.3 Collaborative Learning

Collaborative learning refers to instructional methods that encourage students to work together and find a common solution to a task [77]. Collaborative learning involves joint intellectual effort by groups of students who are mutually searching for meanings, understanding or solutions [78]. This approach is learner-centred rather than teacher-centred and knowledge is viewed as a social construct, facilitated by peer interaction, evaluation and cooperation. This, means that learning is not only active but interactive [79]. The skills gained from collaborative learning are highly transferable to team-based work environments [80]. Anderson in his online learning framework argues that sufficient levels of deep and meaningful learning can be developed, as long as one of the three forms of interaction (student-teacher, student-student or student-content) is at a very high level. The other two may be offered at minimal levels or even eliminated without degrading the educational experience. [25]. Andersons online learning framework is informed by the social constructivist learning theory. Based on the above, fourth and fifth generation distance learning can afford students to interact with one another. Student-student interaction is one of the major forms of interaction highlighted by [25] to increase learning. Therefore, careful integration of computer supported interaction can play a big role in increasing interaction among distance learning students.

Collaborative learning is based on consensus building through interaction by group members, in contrast to competition. This can be very helpful for distance learners majority of whom are adults. Psychologists and educationalists influenced by [20] claim that students working in small groups can share and evaluate ideas, and develop their critical thinking [81–84]. Collaborative activities are essential for information sharing, knowledge acquisition, and skill development [85]. Different ICTs have been adopted for collaborative learning in distance learning that takes the form of eLearning. Effective collaborative learning calls for high interactions among group members.

2.4 Online Learning Groups

Online learning groups are groups of learners working together to solve a learning task in an online learning environment [86]. Learning groups help in initiation of active learning. Facilitators use online learning groups to bring together learners to interact. Online learning groups are common in distance learning programmes. Group interaction allows learners to negotiate meanings, to express themselves in the language of the subject and to establish a more intimate and dialectical contact with academic and teaching staff than more formal methods permit. However, group interaction does not just happen. It requires planning and activities that bring about interactions. Online learning groups present a set of problems, namely; unequal workload by members, social conflicts among members, social loafing, and lack of knowledge of online learning group facilitation [61]. Also, when the group size is big, effective interaction between the learners becomes almost impossible. Therefore, the smaller the group, the more cohesion, and the larger the group, the more the tension.

Several tools that enable interaction in our everyday life include social media tools like WhatsApp, Facebook, Twitter, Chats, Skype and Google hangout [87–91]. However, having interactive tools alone can not guarantee effective online learning groups. There are other actions that both the facilitators and learners ought to do to bring about effective group interactions. The tools can enable asynchronous interactions which is commonly used in online learning. However, it comes with such challenges as not being able to see body postures, facial expressions and hear the tone of voice. These non-verbal communications are important for effective interactions. Even if the tools can support synchronous interactions, there is still a challenge of bandwidth [92] most especially in developing countries which is one of the contexts of this study.

2.5 Research Approaches for Online Learning Groups

2.5.1 Interaction Analysis

Research done on collaborative learning was mostly using the quantitative approaches where the researchers would get the number of posts made by each student and the number of comments. This was not very helpful in understanding the interaction levels and learning processes. The introduction of interaction analysis in analyzing qualitative interactions has seen deeper understanding of the learners' interactions. In research on interaction analysis, the most used model in collaborative learning is

the Interaction Analysis Model (IAM) [93]. This model was developed to help in assessing the critical thinking, social and cognitive presence, problem solving, emotion expression and knowledge construction. Interaction analysis can help both the learners and facilitators to improve the quality of interactions and activities. IAM was developed with different phases of knowledge construction and with more emphasis on qualitative methods. Research into interaction analysis has revealed that teachers who do not provoke learners into the higher cognitive levels will end at the lower levels of Blooms taxonomy [70]. This therefore retains the facilitator as an important factor in online learning groups.

2.5.2 Affordance Analysis e-Learning Design Methodology

The affordance analysis e-Learning design methodology framework illustrates how learning tasks can be matched to learning technologies [94]. From Figure 2.1: The

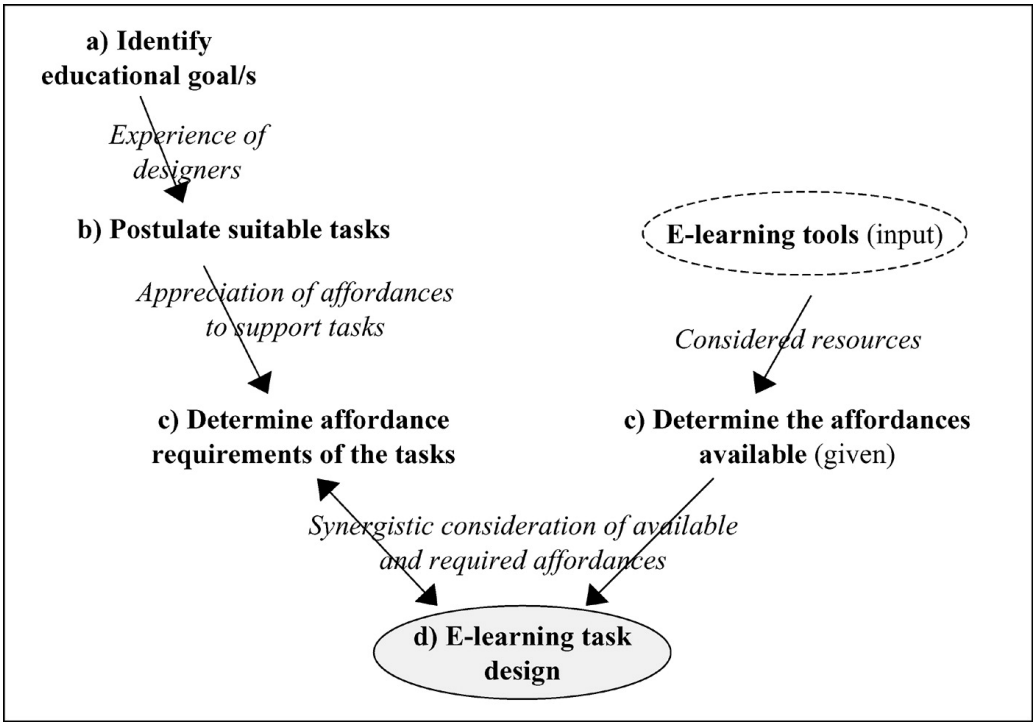

Figure 2.1: The affordance analysis e-Learning design methodology

affordance analysis e-Learning design methodology we describe the steps shown in Figure 2.1 for coming up with e-Learning task design below.

Initially we start by identifying the educational goal. Our educational goal was to enhance interactions among students in the learning groups. The educational challenge was non-participation by individual group members in group assignments. Usually, a few members do the group assignment and just include other

members names. This deters meaningful learning since many students do not participate in the group assignments.

Secondly, we postulate suitable learning tasks from the experiences of the designer to come up with the task which is in line with the educational goal of enhanced interaction.

Thirdly, we determine the affordance requirements of the tasks. Here we basically come up with requirements which will support the task.

Fourth, we determine the affordances available depending on the technologies available establish affordances of the technologies. This helps in contextualizing the available technology to be used for the task.

Finally, we come up with an e-learning task design by matching the affordances of the task and tools. Each media type has its strengths and weaknesses. Using the media whose affordances mismatch the intended learning task can be frustrating to the learners [95].

2.5.3 Five Stage Model

This study is in tandem with the five-stage model of Gilly [96]. This model follows two strands; e-moderating and technical support. As you traverse through the different levels of the model, the amount of interactivity increase and learning. The five stages are access and motivation, online socialization, information exchange, knowledge construction and development. At each stage the model shows the support needed for the technical support and e-moderation. For the access and motivation stage, the technical support need is setting up systems and accessing while e-moderation requires welcoming and encouraging. At the online socialization stage, the technical needs are sending and receiving messages to support the socialization while e-moderating needs will concentrate on familiarizing and proving bridges between cultural, social and learning environments. Under the information exchange stage, the technical support is searching, and personalizing software while e-moderation will require facilitating and supporting use of learning materials. At the knowledge construction stage, the technical support needs are conferencing while e-moderation will require a facilitating process. Finally, the development stage will have technical support needs of providing links outside closed conferences while e-moderation will require supporting and responding. This model relates well with online learning groups since group engagement increases when learners stay together in a group for a long time. This resonates well with the Tuckman five stage model of group formation. Tuckmans five stages of group formation include forming, storming, norming, performing, and adjourning [97].

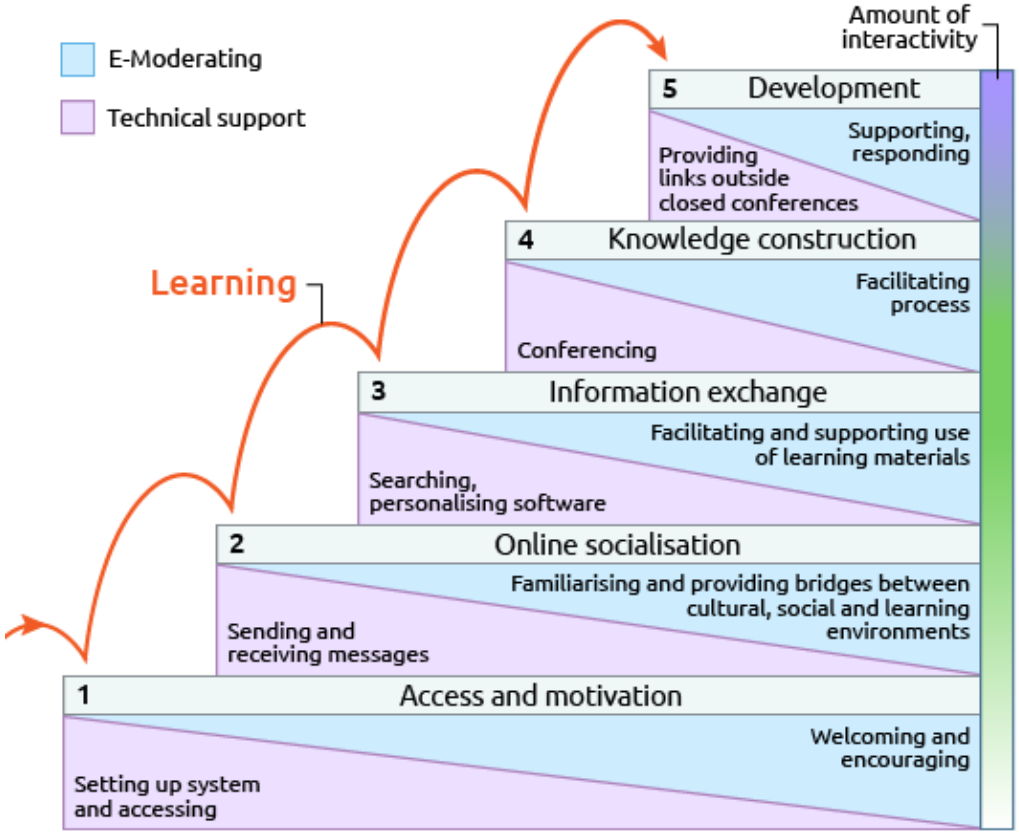

Figure 2.2: Gilly five stage model

Chapter 3

Methodology

This chapter describes the methodology used in this study. Section 3.1 presents the research paradigm for philosophical positioning. Section 3.2 presents the research design. Section 3.3 provides an overview of methods and research outputs. The case studies are presented in section 3.4. In section 3.5, data collection is presented. Ethical considerations and data analysis and interpretation are finally presented in section 3.6 and 3.7 respectively.

3.1 Research Paradigm

This study is underpinned by pragmatism. Pragmatism is a philosophical framework within which multiple assumptions and diverse methods comfortably reside. This approach allows the application of a mixed method design [98]. Pragmatists regard practicability as central to their philosophy and believe that we should not engage in studies that are meaningless to society. This is in line with the design science methodology [31, 32] where design artifacts must be established within practice. This is appropriate when researching online learning groups because of its use of authentic online courses. Pragmatism is not committed to one system of philosophy but rather employs all available avenues aimed at problem solving. As noted by Johnsen [99], to pragmatists, theory building is in favor of a science that produces practical, immediate, and useful knowledge. The design science approach is appropriate because it produces practical, immediate, and useful knowledge. Design science study goes beyond participants observation and enhances participants active involvement through problem solving interventions in the research process [100]. Rigor and relevance in such studies respect the practice and problem-solving inter-

ventions.

3.2 Research Design

This study adopted the design science research methodology. As shown in Figure 1.1 four stages are used. The first stage defines the objectives for a solution, the second is concerned with design and development, the third stage looks at the case studies while the last is the evaluation. Even with the design science methodology a research design is still required. A research design provides a framework for the collection and analysis of data [101]. The study used a case study research design. A case study design was chosen in-order to deeply understand online learning groups and their contexts. The case studies were selected from online courses at University of Agder (UiA) and Makerere University (MAK). UiA and MAK were used because of the existing partnership between the two institutions.

The evaluation stage adopted mixed methods. Qualitative methods were selected because of the need to understand the interaction within online learning groups. This interaction could not be studied using quantitative methods. Quantitative methods were selected because of the numbers of students who were distributed across the world.

3.3 Overview of Methods and Research Output

The distinct methods were applied at different phases in the research process as shown in Figure 3.1. The methods are presented in the three different research areas of context, processes and tools as elaborated in Section 1.3. In the context area, a survey was used to collect data which was analyzed statistically to determine the needs for online learning in Uganda (Paper A). Paper B was based on two research methods namely, interviews and observation which were analyzed using thematic and interaction analysis. These two papers helped us in determining the context of the research study. In the processes research area, three papers were published: Paper C, Paper D and Paper E. The methods used in Paper C were observation and interviews that were analyzed with interaction analysis and thematic analysis, respectively. Paper D was based on a survey and observation which were analyzed using statistical and interaction analysis, respectively. The method for Paper E was observation with content analysis. The processes research area determined how effective online learning groups are formed and sustained. Finally, under the tools research area Paper F was published. Its findings are presented in Section 4.3 and

Section 5.2. Paper F was based on interviews and focus group discussion which were analyzed using thematic analysis. The methods and factors were further evaluated using survey, a focus group discussion and observation. These helped in establishing the correctness of the methods and factors. The methods are further presented in Section 3.5.

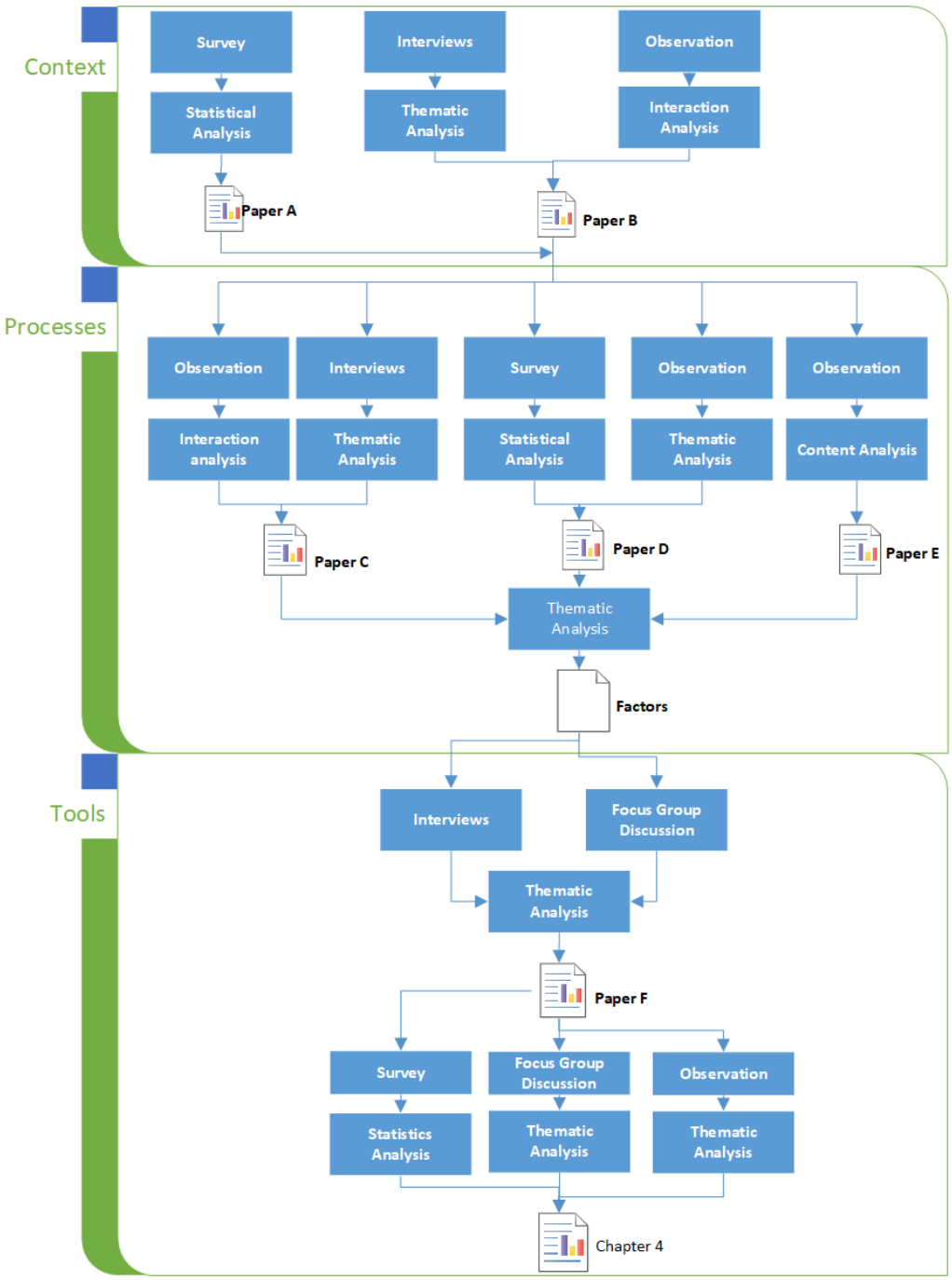

Figure 3.1: Detailed overview of methods and research outputs

Table 3.1 describes the methods and their corresponding dates, size, duration and publication. The methods are provided within their research areas.

Table 3.1: Overview of methods and their details

Research Area	Methods	When	Size	Duration	Publication
Context	Survey	Autumn 2014	150 Respondents (100% response)	15 Weeks	Paper A
	Interviews	Autumn 2014	5 teachers (Each 1 hour)	12 Weeks	
	Observation	Autumn 2014	2 Online Discussion Forums (Each 5 participants)	12 Weeks	
Processes	Observation	Spring 2015	9 Online discussion forums (Each 5 participants)	15 Weeks	Paper C
	Interview	Spring 2015	10 Learners (Each 1 hour)	15 Weeks	
	Survey	Jan to March 2015 and 2016	61 (2015) and 66 (2016) - (For 2015 92% response and 2016 96% response)	10 Weeks	Paper D
	Observation	Jan to March 2015 and 2016	2 Online Discussion Forums (Each 35 participants)	10 Weeks	
	Observation	Autumn 2015 until January 2016	Online Discussion Forums (1613 participants)	17 Weeks	Paper E
Tools	Interviews	Autumn 2017	4 teachers (Each 1 hour)	10 Weeks	Paper F
	Focus Group Discussion	Autumn 2017	1 FGD with 6 teachers (For 1 hour)	10 Weeks	
	Survey	Autumn 2017	98 respondents (89% response)	15 Weeks	section 4.3 and 5.2
	Focus Group Discussion	Autumn 2017	1 FGD with 6 teachers (For 1 hour)	15 Weeks	
	Observation	Autumn 2017	2 online discussion forums (Each 5 participants)	15 Weeks	

As identified in Figure 3.1 and Table 3.1 there are three qualitative methods used, namely interviews, observation, and focus group discussions while the survey was quantitative. The methods are described below.

- **Interviews:** This method is used to collect data mainly in the form of opinions, and experiences. The data was collected through a conversation with the respondents. In this study, interviews were used in the three research area of context, processes and tools. Under the context research area, unstructured interviews were conducted with *experienced online facilitators* to understand the context of online learning groups. Unstructured interviews do not require a researcher to prepare questions but rather ask open ended questions which naturally fall into a conversation like an exchange. Under the processes research area, *learners* were interviewed to understand the processes within the learning group. For the tools research area, *facilitators* were interviewed to establish the correctness of the methods and factors. Given that groups follow the constructivist approach, this method was helpful in understanding what happens within online learning groups. Unstructured interviews were selected because they offer a respondent a chance to qualify his/her response through follow up questions.

- **Observations:** Observation is the acquisition of data from a primary source. In this study, the interactions of learners and facilitators within online learning discussion fora were observed. Observation was used during the evaluation of different case studies as shown in Figure 3.1. The observation in the context research area looked at interaction logs used in the previous online learning courses. For the processes and tools research areas, observation was done on online courses as they were being conducted. The observation was mostly done within the online learning groups. The need to understand the interactions within online learning groups prompted the use of observation. Observation helped in understanding the type of processes and interventions happening within learning groups and specifically what activities the facilitators worked with to increase interaction.

- **Focus group discussion:** This research method involved interactive and directed discussion guided by the researcher [102]. The FGDs were used in the tools research area in order to determine the methods and factors and their correctness. This was done with six facilitators in the FGD. The selection of the six facilitators focused on those already running online courses. The facilitators were required to have experience of at least two years running

online course(s) with emphasis on those using groups in their online learning courses. These FGDs helped respondents to interact and get a common understanding of the evaluation in order to have explicit methods and factors.

- **Survey:** This research method was used for collecting quantitative data. The survey was used in the different case studies under all the research areas. Initially, in the context area a survey was conducted across higher institutions in Uganda to establish the needs of online learning which helped in establishing the context. Under the processes research area a survey was conducted in a MOOC course. In the tools research area a survey was conducted to evaluate the factors. The surveys were mainly used for the respondents who were sparsely distributed and many. This helped in collecting data from multiple participants across the course.

3.4 Case Studies

The case studies used are described under the following subsections: Online Learning Groups, Blended Distance Learning course, a MOOC course, Large Online Courses,and Makerere University eLearning Environment (MUELE) courses. This study is within the higher education context. The online learning courses were selected from courses at Makerere University and University of Agder. They are summarized in Table 3.2.

3.4.1 Online Learning Groups

This was an exploratory study to get insights into online learning groups. The study considered two courses; SV-408-1: E-Teaching I - The International Online Tutor Course, and ME-413-1: Research Methods in Development and Planning Studies to the initial context of online learning groups. These courses were run at the University of Agder at master's level. The SV-408-1 course was under the master of development studies while the ME-413-1 course was under the master of multimedia and educational technology. The study participants were experienced online facilitators at the University of Agder and interaction logs within the online discussion forums. Five online facilitators with experience in running online learning courses were interviewed and two discussion forums each with 5 members were analyzed. Qualitative methods (interviews and observation) were used to understand online learning groups. Data was analyzed through thematic analysis (transcriptions and

Table 3.2: Overview of case studies

Case	Course title	Domain	Location	Platform	Paper
Online Learning Groups	ME-413-1: Research Methods in Development and Planning, and SV-408-1: E-Teaching I - The International Online Tutor Course	Postgraduate Development Studies and Multimedia and Educational Technology courses	University of Agder	Fronter LMS	Paper B
Blended Distance Learning Course	COX3221 Research Methodology	Undergraduate Business Course	Makerere University	Facebook	Paper C
MOOC Course	MOOC Success Unleash Yourself	MOOC Project Planing and Management course	University of Agder	NovoEd	Paper D
Large Online Courses	Uncompromised Life, Soulvana and Duality	Personal skills	University of Agder	Facebook and Mindvalley	Paper E
MUELE Courses	COX2108 Information Technology I and COX3107 Information Technology II	Undergraduate Business Course	Makerere University	Moodle	Paper F

categorization) to understand the preliminary findings for supporting online groups. The learning group interactions were analyzed using interaction analysis.

3.4.2 Blended Distance Learning Course

Makerere University is a dual mode university with both conventional and distance learning programmes [15]. This study considered a course unit in the undergraduate blended distance learning business programme in order to understand the processes of online learning groups. The study participants were students of business research methodology. The class size was 46 learners. The class was divided into five groups. Each group was asked to search and identify a journal paper on research methods of 8 to 12 pages and then submit to the facilitator for approval. Once the paper was approved, it was uploaded in the Facebook research methods course group area. Each group was required to critically discuss the methodology used, identify gaps and suggest possibilities with references. Groups were required to collaboratively work together and post one page of their findings on their group area. The group submission was submitted as a comment on the uploaded journal paper for the group. Thereafter each student provided comments for at least five other group submissions. Once comments were made, the group members reconvened and used the comments provided to improve their submission and resubmit a final version. The final submission was sent by e-mail to the facilitator. Each student earned marks for commenting on the five group submissions from other groups. Each group also earned a group mark for the final and preliminary submissions made by the group. However, students were encouraged to give more comments or react to the comments from their peers. This activity was done for two weeks. Qualitative methods (structured interviews and observation) were used to evaluate the learning approach used. Data was analyzed through transcriptions and categorization to understand the effectiveness of learning group processes. The learning group interactions were analyzed using interaction analysis and affordance eLearning framework methodology [94].

3.4.3 MOOC Course

This study was carried out on a MOOC titled Success - Unleash Yourself run by the University of Agder using the NovoEd platform (https://novoed.com/ successagder-2016). The course was run twice in 2015 and 2016 between the months of January to March. The study aimed at understanding online learning group processes and to identify effective online learning group mechanisms. Online learning groups can

help to bring distributed learners together to work. The goal was to establish processes of effective online learning groups in the MOOC. The research questions answered related to how effective learning groups can be formed and how effective online learning group interactions can be sustained. Furthermore, the study answered the question of how to increase interaction of learners during online learning group processes. Interaction is encouraged to increase learners engagement when completing group assignments. In the first module, there were auto-assigned learning groups of around 30 learners each. In the other modules, the learning groups were self-formed and each group had five members at most. The activities created for module one were aimed at connecting learners and getting them familiar with the platform. This was good in building social connections in learning groups. A juggling activity was used in the first module. Learners were required to learn how to juggle and the submission required them to make video recordings of themselves juggling. This activity has a game concept which makes learners enjoy and get to know one another with ease. Since the juggling submission is seen by all learners, it helped in enforcing social connection. Activities were designed in such a way that each activity builds on another within the module. For the activities to enhance group work, learners start by presenting individual answers to the group activity. This is then followed by group discussions and handing-in of the assignment. The learners are then given contextualized individual activity which builds on the previous group activity. Finally, there are at least three peer assessments on individual hand-ins. The final individual activity would be peer assessed using a pre-defined rubric which was developed by the course facilitators. In addition to the peer assessment, each assignment would get more feedback from learners through comments. All the submitted activities are accessed by all the learners in the course with the possibility of commenting and responding to comments. This encouraged interaction among online learners and learner support.

3.4.4 Large Online Courses

This study was carried out on large online courses with communication support. The courses include Uncompromised Life, Soulvana and Duality. All of them are paid courses in the area of personal development, such that we can assume high dedication from the side of the learners. It focuses on life skills that regular schooling does not cover, based on the worlds top personal growth authors and brands. The communication possibilities in all three courses were similar, even though the discussion in one course was run in a closed Facebook group, while the other two were run on the Mindvalley platform. The Mindvalley teaching platform features

a discussion area structured like Facebook. Facebook is a social media online platform built with no perceived affordance for teaching and learning. Nevertheless, it has been used for teaching and learning and is promising for increasing interaction in groups [54, 103–105].

The first course, **Uncomprommised Life**, teaches everyday psychology to sort out the day and night things that matter in life. The course runs for eight weeks and learners are taught eight transformations. The following elements are discussed: focus and clarity of mind, mental models, law of attraction, handling change, productivity, daily habits, self-love, and self-confidence. This course is purely run online using the Mindvalley online learning system and the Mindvalley discussion platform. The second course, **Duality**, is related to the duality between energy and reality. It runs for eight weeks and teaches the following aspects: getting fast answers, manifesting the life you want, feeling happy now, stopping the fight against yourself, accelerated healing, perfect relationships, and living your ultimate life. This course is also purely run online using the Mindvalley online learning system with discussions in a closed Facebook group. The third course is **Soulvana**. Soulvana is not a course, but a subscription. It does not have duration, but presents a new teaching every week. Often, the teaching is related to other courses in Mindvalley or given by authors that are connected to Mindvalley. Due to the format, the area is broader than the other two courses. The linking factor of the topics in Soulvana is the focus on spirituality and its use to improve everyday life. Just like the other two courses, this course is run on the Mindvalley platform including discussions.

3.4.5 MUELE Courses

MUELE is a learning management system at Makerere University. This LMS is based on the open source Moodle platform. This was customized for Makerere University and named MUELE. This study used two course units from the business programme run on this LMS. The following courses were used in the study: COX2108 - Information Technology I and COX3107 - Information Technology II. These courses run for a period of one semester (15 weeks) in the first semester of the 2017/2018 academic year. In each course unit, learners were divided into groups of five. This was done randomly through the platform. The learners were able to discuss with one another in the group with support of the forums. Group members in one group were not allowed to see discussions in another group. The students were not required to submit the final answer but to summarize the agreed answer and leave it in the group forums. The facilitator looked through each group discussion strings to assess the individual learners in the learning groups. The learning

group activities in each course lasted for two weeks. Eventually, a survey was done to collect data on the evaluation of the factors and the plugin for Moodle.

3.5 Data Collection

The data collection was mainly done at the evaluation stage of the design science methodology. This is presented in the three research areas; context of online learning groups, learning group processes and learning group tools.

3.5.1 Context of Online Learning Groups

This explored and observed existing courses to understand the context of online learning groups. This was done through a needs assessment survey and observation of existing online learning groups of experienced facilitators.

3.5.1.1 Needs Assessment

The needs assessment study used a survey approach covering five regions in Uganda, namely southern, northern, central, western and eastern. In each of the five regions, one private and one public university, and one tertiary institution (diploma awarding institutions) were randomly selected as follows; Gulu University, Lira University and National Teachers College Unyama in the north; Kyambogo University, Uganda Martyrs University and Kitovu Vocational Institute in te south; Busitema University, Islamic University in Uganda and Kaliro National Teachers college in the east; Mbarara University of Science and Technology, Mountains of the Moon University, and Kabale NTC in the west; Makerere University, Nkumba University and Uganda Institute of Information and Communication Technology (UICT) in the central. From each of the selected institutions, ten participants were purposively chosen from among members who used ICT in their teaching and learning processes. This resulted in 150 responses with 30 respondents from each region. Having representative participation from the entire country in the survey was vital because distance learning students in Uganda are distributed across all regions.

Data was mainly collected using self-administered questionnaires. Self-administered questionnaires were employed because of the diverse geographical distribution of respondents. The questionnaire was designed according to the above-mentioned research questions. They elicited information on socio-demographic characteristics, existence of ICT departments, existence of distance education, implications of integrating ICT in teaching and learning, existence of a learning management

system (LMS), existing capacity building opportunities, existence of quality assurance mechanisms, challenges of using ICT in pedagogy and their corresponding suggestions. Where ICT practices existed, documents/records on the use of ICT in teaching and learning were also employed. This documentary analysis enabled the researcher to understand different ICT infrastructure issues in the different organizations.

3.5.1.2 Online Learning Groups

This online learning group study adopted qualitative methods for data collection and analysis. The qualitative methods consisted of semi-structured interviews and facilitators' observations of students' activities in the Learning Management System (LMS) for previous courses. The respondents were experienced online facilitators at the University of Agder who use learning groups in their courses. A one-hour interview with each of the facilitators to find out their experiences in effectively handling online learning groups was conducted. For observation of students activities two courses were selected; SV-408-1: E-Teaching I - The International Online Tutor Course, and ME-413-1: Research Methods in Development and Planning Studies. Each interview was transcribed immediately and informed the researcher in the next interview. The student interactions observed were also transcribed. The transcriptions were then analyzed by categorizing them into themes from which empirical meaning was derived. The results from the context research area informs the learning group processes research area.

3.5.2 Learning Group Processes

This research area adapted and improved online courses in order to extract online learning group processes. This helped in establishing the methods and factors for effective online learning groups.

3.5.2.1 Blended Distance Course

This blended distance course study adopted qualitative methods for data collection and analysis. The group activity was created in the online course. Interviews and observation of learner interactions were used. The business course was used as case study (COX 3221: Research Methodology). Learners and facilitators were interviewed using structured interviews. Structured interviews were selected because of the need to find out specifically the issues established in the previous study. The

interviews were transcribed. The learner interactions within the online learning system were also transcribed. This helped in getting to know the kind of interventions the facilitator makes and how they affect interaction within the online learning systems. The transcriptions were then analyzed by categorizing them into themes from which empirical meaning was derived.

3.5.2.2 MOOC Course

The MOOC course study was based on a comparative analysis of the course run in the 2015 and 2016 cohorts. The use of both quantitative and qualitative methods helped in data triangulation. Two course surveys that is mid-term and course-end were run. The surveys contained both open ended and closed ended questions. Mainly, the surveys collected quantitative data. I chose survey methods because the learners (respondents) attending the MOOC are distributed in various places of the world.These surveys were responded to by learners on the two MOOC courses. The mid-term survey had 27 respondents in 2015 and 36 respondents in the 2016 while the course-end survey had 61 respondents in 2015 and 66 respondents in 2016. Observation was also done on two online learning groups. The interactions on the forums were also used in the analysis. The qualitative data was analyzed by validating the quantitative data collected. This was the done through the themes created from the quantitative results presented.

3.5.2.3 Large Online Courses

The large online courses were based on three categories of course communications related to discussion, message and creation. The communications in the three online courses were analyzed from autumn 2015 until January 2016. Uncompromised Life and Soulvana messages were extracted from the Mindvalley platform, while Duality course messages were extracted from Facebook. Quantitative methods were used on the three data sets to get the general statistics related to communication and participation within these three courses. For a deeper understanding, content analysis was done by manually categorizing the type of messages being communicated. Then the different categories were analysed statistically to understand what was happening in the online interactions. The chosen categories are based on an a-priori opinion of the kind of messages in the set. This way, some messages could fit more than one category. In these cases, the best fit was chosen.

3.5.3 Learning Group Tools

This research area was mainly used to establish the methods and factors, and their evaluation using existing Moodle platforms.

3.5.3.1 Factors

In the process research area, the study used online learning courses. Based on the findings from the previous research areas, factors were established. The factors were established through thematic analysis. In order to verify the factors, the study adopted a qualitative approach. Interviews and focus group discussions were used. Guided by the factors, a focus group discussion was conducted with the facilitators to verify the factors. This was then followed by interviews with three facilitators for at least one hour each. The data was transcribed and analyzed in connection to the factors. This led to the final factors which are elaborated in Paper F.

3.5.3.2 Design

The study focused on online learning courses. Based on the factors and online courses, scenarios were developed for supporting online learning groups. Then use cases were developed from the scenarios. From the established use cases aspects that support facilitators and group activity were implemented in a group plug-in. Using the plug-in and existing Moodle platform, an evaluation was done on the tools and factors. The evaluation adopted mixed methods. The study used two case studies COX 2108 - Information Technology I and COX 3107 - Information Technology II. Surveys, focus group discussion and observation methods were used. Online surveys were used because of the number of respondents. The survey was conducted online using Google forms. This was majorly a quantitative survey which was analyzed statistically. Focus group discussion was also done for the evaluation of the factors. Observation and focus group discussion were qualitative and were therefore analyzed thematically.

3.6 Ethical Considerations

Research in Norway requires clearance from the research council (NSD). The study research applied for approval from the council and was cleared. The councils main goal was to ensure that the research follows the right standards as acceptable in Norway. They are concerned mostly with how data will be stored and destroyed after it has been used. In addition, they are concerned about how personal data is

protected. The study used consent forms to get permission from the respondents. Upon completion of the study the data will be destroyed. Ensuring ethical behaviors in researching online learning groups can help empower individuals, communities and environments, and offers the potential to increase good practice in the world. Careful integration of ethical concerns in my research project can help produce the desired results. This can help to build trust and confidence among the respondents so that the information they give is free of bias. This is usually possible when the respondents get to know the benefits of the given research.

3.7 Data Analysis and Interpretation

This section describes how data was analyzed and interpreted. This is described in the following subsections; interaction analysis, thematic analysis, content analysis, and statistical analysis.

3.7.1 Interaction Analysis

Interaction analysis is a set of approaches that investigate and understand how people interact with one another and object in their environment [106]. The rationale for its selection was based on the need to understand the interactions within online learning groups. This was used on data collected from the observation of online interactions. The observation was done on different case studies during the research process. Interaction analysis was done through the following steps. First, the online interactions were transcribed into thick description (as is). Then conversational actions from the transcribed interactions were identified. From these actions, conceptual changes in the interaction and points of shared knowledge were found. This helped in understanding how these actions influenced the interactions and learning within the learning groups. These actions were mainly by the facilitators and the more knowledgeable learners.

3.7.2 Thematic Analysis

Thematic analysis is an interpretative form of analysis based on identification of recurrence of themes and patterns of data [107]. This was used on data collected from the three interviews, the two focus group discussions and observation done in the MOOC and MUELE case studies (Figure 3.1). Thematic analysis is common in qualitative data analysis. However, thematic approaches do not have outlined procedures like grounded theory or critical discourse analysis [101]. Nevertheless,

several researchers [101, 108–111] have used it and improvised procedure for its use. This study was done through thick transcriptions (as is) of data. From these transcriptions, the data was examined to extract core themes that could be distinguished within the transcripts. Mainly, the identification is aimed at repetitions of topics or concepts which help in forming themes. This was applied to the transcripts from the interviews and FDGs and observation of extracts from online learning discussion forums. These themes helped in the creation of discussion points which were used when presenting the findings.

3.7.3 Content Analysis

Content analysis involves classifying the data into themes or categories and then studying the frequency of category occurrence [112]. Content analysis is an approach to the analysis of documents and texts that seeks to quantify content in terms of predetermined categories and in a systematic and replicable manner [101], P289. Content analysis was used in quantifying the content in the interactions within the learning groups. For content analysis, the interactions were grouped into codes to understand what kind of content was being shared. Coding was done to ensure the most possible categories in which the text statement will be placed. Tallying was then done on messages on the discussion forums. This was done based on subject and themes or ideas other than just words. This helped in determining the frequencies so that we can determine the ones with highest occurrences. To ensure reliability of the results, more than one person did the categorization. This helped in ensuring inter code reliability since differences could be found to ensure consistence and reliability of the analysis.

3.7.4 Statistical Analysis

Statistical analysis is used mainly when dealing with quantitative data. Descriptive statistics were mainly used. This was used on data collected from online surveys. This was automatically done by the online learning systems since data was electronically filled. The findings were also represented through graphs which were done with MS excel.

Chapter 4

Effective Online Learning Groups

This chapter presents the findings and guidelines from a study on supporting effective online learning groups. In Section 4.1 the preliminary findings for supporting online learning groups are presented. The factors for effective online learning groups are presented in Section 4.2 with the following subsections; institutional policy, supporting institutional technology, quality of online learning group activity, quality of online learning group and quality of online learning group facilitation. In Section 4.3 the methods related to online learning group creation, activity and facilitation are presented. Finally, the online learning group design is presented in section 4.4.

4.1 Preliminary Findings for Supporting Online Learning Groups

In the exploratory study of this work, the preliminary findings for supporting online groups were established. These were identified through a study of experienced online learning facilitators and courses at the University of Agder. The following broad findings for effective online learning courses were established using thematic and interaction analysis (details in paper B): course design, online tutor training, motivation & sustaining interactions, higher levels of interactions and peer assessment based on learning activities. In addition, ICT was identified as important in supporting online learning groups, mostly online learning systems ought to have positive user experience. The online course facilitators stressed the need for a comprehensive study guide and trained online tutors to have an effective online course.

One of the facilitators said that "... online learning requires a comprehensive study guide...". Trained online tutors were seen to be important in motivating and sustaining both the high and low levels of interaction through giving appropriate learning feedback. Another facilitated also said that "training of tutors on how to facilitate online is important for an online course...". This feedback can be given through questioning to provoke learners to do more than they would do without such assistance. This kind of feedback provides reason for training the online tutors. The online facilitators also emphasized the importance of peer assessment based on learning activities. These initial findings played a role in establishing the methods and factors for effective online learning groups as presented in the next sections.

4.2 Factors for Effective Online Learning Groups

The study established five factors for effective online learning groups as shown in Figure 4.1. The use of case studies helped us establish the factors from the preliminary findings. Figure 4.2 shows the connection from the preliminary findings to the factors for effective online learning groups. The course design as a preliminary find-

Figure 4.1: Factors for effective online learning groups

ing helped in identifying supporting institutional policy and quality of online learn-

ing group activity. Equally, group activity was very important in ensuring a better course design. Facilitation as a factor was developed from the preliminary findings of online tutor training, motivation and sustaining interaction and high levels of interaction. These three preliminary findings put emphasis on improving online facilitation. Peer assessment-based activities helped the study in establishing the following two factors: quality of online learning group activity and quality of online learning groups. ICT as a preliminary finding helped in developing supporting institutional technology. The detailed explanation of the factors proceeds in the sections that follow and details are available in papers C, D, E and F. Five factors were

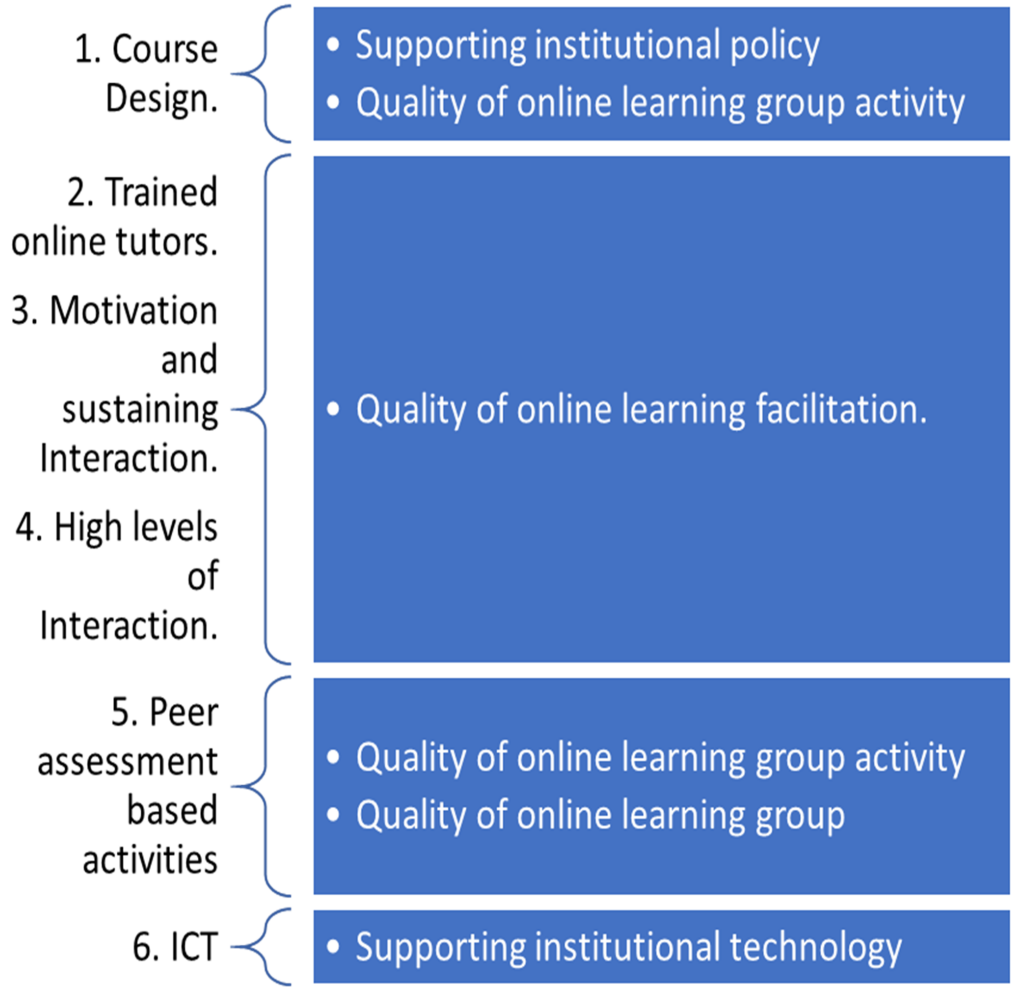

Figure 4.2: Connection of preliminary findings to factors for effective online learning groups.

established, namely: supporting institutional policy, supporting institutional technology, quality of online learning group activity, quality of online learning groups and quality of online learning group facilitation. These factors identify the important elements that can be changed in order to improve online group work. They

lead to guidelines on how to use the factors for the improvement. In the following subsections, each factor is presented, followed by a discussion of the guidelines for the factor.

4.2.1 Supporting Institutional Policies

The factor is related to institutional policies. The guidelines identify which policies are needed to support online learning groups. This is mainly concerned with having policies that enable better online learning groups. Often online courses are run without having supporting institutional policies. This usually create problems in the running of online courses. The supportive institutional policies can help support online learning groups. The following policies were identified to guide the online learning groups:

Supportive formative group assessment policies. Respondents revealed the need of an institutional policy that caters for formative group assessments. One of the respondents said "university does not have guidelines that support formative group assessment ...". Such a policy would address issues related to reward of formative group work. During the focus group discussion, the facilitators at Makerere University advised on the need to include formative group assessment policy in the curriculum. When such policies are not available, administering group work online becomes difficult. The facilitators at the University of Agder emphasized the need of awarding between 40% and 60% on formative assessment. One of the facilitators suggested that " ... students should be awarded between 40% and 60% for formative assessment .... ". Therefore, a policy for ensuring that formative assessment is awarded between 40% and 60% is needed. This helps in rewarding and encouraging the learners to participate in the online group assignment.

Supportive online facilitation and tutoring policies. Facilitation and tutoring must be emphasized to enhance online learning efficiency. With large online classes, there is a need for many online tutors to assist in scaffolding learners. Respondents revealed that facilitators with large classes at Makerere University are not assigned tutors to assist them. This was echoed by one of the facilitator as "i currently teach a large class of approximately 600 undergraduate students alone ....". This is because of the costs involved in paying online tutors. During the focus group discussion one of the respondents said that "lack of online tutors to help online learners creates heavy information load for the facilitators ...". This was true at Makerere University where some classes of up to 600 learners were handled by one online facilitator. Therefore, a policy that stipulates one facilitator/tutor for every 25 online learners for effective learning is very much needed. In addition, the respondents from

especially Makerere University, revealed the need for recruiting and remunerating online tutors for effective online learning group.

4.2.2 Supporting Institutional Technologies

Appropriate technology support enhances effective online learning groups. The technology supports all the other factors. There are many available online learning technologies. Some of these are commercial while others are open source. Preferably, institutions should have single login access points of the learning technological services. A single login access point is where the learners have a single place to login and access multiple services. Currently, at Makerere University you need a password for each technology service. Single login access points help in having a single point of contact of the institution for the support and maintenance of the learning management system (LMS). To have good support for online learning groups, the factors created a basis for the technology needs (details are available in paper E). The guidelines identify which technology requirements are needed to support online learning groups.

Authentication. The LMS ought to allow for users to login and be categorized differently to allow for distinct access. The categorization may include the following: facilitators/tutors, learners, e-Learning administrators, and e-Learning support team. The categories are defined in Table 4.1.

Table 4.1: Description of the user categories

Category	**Description**
Facilitators or tutors	The persons who teach students in the online course(s).
Learners	The persons who are registered in the course(s) to seek knowledge or to learn.
e-Learning Administrator	The persons who administer the LMS by giving technical help to both the teachers, learners and university management.
e-Learning support team	The persons who assist the users to use the LMS.

Systems administration. The LMS should allow system administrators to administer and the possibility to add users and give them different access to the system. The systems administrator should have the possibility to allow facilitators to control their online courses and learners to enable interaction and submission of assignments.

Announcements. The LMS should have the possibility to allow facilitators to send communication about the progress and course status. These communications triggers the learners to actively participate in activities of the course. This can be implemented using the message boards which can be embedded in the users home page.

Discussion. The LMS should have the possibility to support users to interact with one another within groups, both synchronously and asynchronously. This interaction can be implemented using forums. Discussion forums should be designed in such a way that students can discuss within their groups. Discussions can enable learning within the LMS when learners are engaged and communicate. These discussions can be made better when the facilitators guide and scaffold learning through questioning that assists learning.

Co-creation of artifacts. The LMS should have the possibility to support learners to be able to create artifacts collaboratively. Co-creation was emphasized because of the need to jointly create knowledge in a group. Examples are joint programming and writing a document collaboratively. This helps in increasing learning through interaction (more information can be found in paper E).

User support. The LMS technical team should support users (facilitators/tutors and learners) in the use of the system. This support can be embedded within each course such that learners can ask questions related to the technology. Technological experts should be available for every online course unit to provide support.

4.2.3 Quality of Online Learning Group Activity

The group activity ensures that learners interact effectively within the groups. Activities that emphasise interaction are important for online learning. Activity organization used in the online learning environment during this study showed increased interaction among learners in the groups (details of activity organization are available in paper C and D). Figures 4.3 and 4.4 provide an illustration of online learning group activity organization. Figure 4.3 illustrates group structuring that allows the learners to first make an initial submission then allow for peer feedback and final submission based on the feedback (details are explained in paper C). Figure 4.4 illustrates group structuring that allows the individual learners to initially submit their answers so that the deliberation is done with their understanding of the answer (details are explained in paper D). This helps to make the collaboration more meaningful since learners have already provided an answer. In both structures in figure 4.3 and 4.4 there was improved interaction.

It is not only the activities that bring about interaction but other factors like

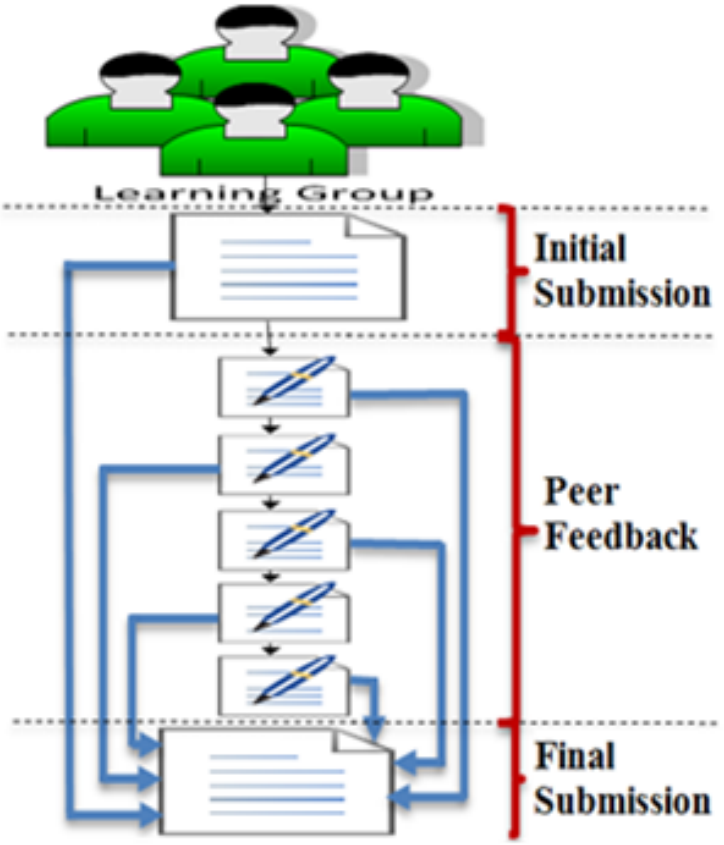

Figure 4.3: Peer assessment based activity

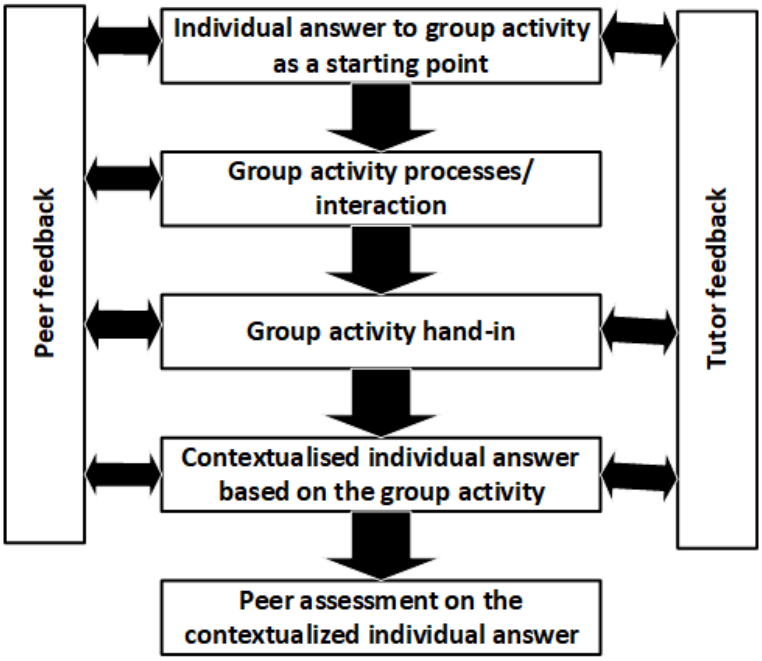

Figure 4.4: Individual initial submission based activity

group formation (this was demonstrated in the MOOC case study where the groups were initially automatically assigned to create a connection among learners and then the learners after getting to know one another in the groups were self-assigned - paper D), group facilitation (this was demonstrated in multiple case studies of blended distance learning courses, MOOC courses and MUELE courses where learner interaction was enhanced by facilitator questioning within the learning group paper C, D, and F) and usability of the LMS also play a role [113, 114]. Since these activities are mainly put up by the facilitators, there is need to know the importance of these activities for effective online learning courses. The following are identified to guide the creation of better online learning group activities [22, 96]: 1) clear and relevant title, 2) clearly marked as a group activity, 3) connected to the course learning outcome, 4) purpose of the group activity is stated clearly and concisely, 5) outlined tasks that the groups will be required to do, 6) simple enough to be completed with ease in the given time for most groups, 7) provides clear instructions, 8) identifies the tools that participants require performing the tasks, 9) clearly states the completion criteria of the task, 10) clearly states the time required for completion, 11) indicates the contribution to the final grade of the course, 12) structured for peer feedback and assessment, and 13) enables facilitator assessment.

4.2.4 Quality of the Online Learning Group

Group composition is important in ensuring effective interaction within the online learning groups. The study suggests that the composition of a group could take into consideration the following: group size, diversity and stability. The details are available in paper F. The study suggests the following guidelines for better online learning groups.

The group should be composed of between two to seven members. The readings did not clearly indicate the exact number of students that are required for an effective learning group, although emphasis on small groups is indicated [115, 116]. This was demonstrated in the study. In one of the courses, five members formed a group and in another course, seven members formed a group. Both showed effective interaction within the groups. While the literature indicates that the groups should be small, it is not clear on how small they should be [69, 117]. Our indication of two to seven members was not extensively empirically studied. More studies might be needed to establish the exact number of learners required in an online learning group. Never-the-less the five to seven members in the group used in the study showed that the groups were effective.

The study suggests that the group composition promotes diversity. Our findings

revealed the need for diversity in the groups. This was arrived at through thematic analysis of the interviews from the facilitators. Diversity within the group sould take into account the various levels of experience, backgrounds, differences in age and gender [69]. This could help that the more knowledgeable peers would scaffold others and also get different perspectives as they learn. It could also help to scaffold peer learning as suggested by Vygotsky [20].

The study suggests that group members be kept in the same groups for a long period. Preferably, learners should be kept in the same group for at least a semester or six months. One of the respondents said that "groups that are kept together for a long time exhibited high levels of interactions...". This was also affirmed by another respondent who said that "in my online class initially I used to change students frequently from one group to another but there was no interaction...until when I kept students in a group for a semester...". Keeping learners within the same group for longer periods allows for better group cohesion and social connection. This can help a group to go through all the different stages of group development (forming, storming, norming, performing and adjourning) as explained in the five-stage model of Tuckman and Jensen [97]. At University of Agder, learners were kept in the same groups for the full semester and this improved group cohesion.

4.2.5 Quality of Online Learning Group Facilitation

Physical class-room teaching has a lot in common with online teaching. In both situations learners require to be guided when interacting within a group. Physical groups allow one to see what the learners are doing in real time. This possibility gives facilitators the opportunity to identify learners with challenges and to assist them immediately. This can help learners to learn better through intervention and scaffolding of the students' learning. The online learning groups can afford this possibility as well.

Also, in online teaching, facilitators are encouraged to be active within the learning environment. Learners should be able to feel the facilitator's presence. When learners within the online system do not see and feel the presence of the teacher, their participation is discouraged. Therefore, it is important to have a manageable number of learners per facilitator. The LMS could also have means to detect problems i.e. non participating learners and warn the facilitator for easier follow up. This can help the facilitator to intervene and offer solutions to learners who need help and guidance. Such intervention will help to increase motivation and group interaction which is a precursor for meaningful learning.

The facilitators play a leading role in motivating and sustaining learner inter-

action within online learning groups. Interventions by facilitators can provoke the students to interact at higher levels of Bloom's taxonomy [118]. This can also be supported through automated intervention by checking the status of groups and the individual students in the groups and sending them emails in case of deviations. The group status can be seen by the number of message exchanges. In case these are minimal, then the group is not active and if there are many exchanges, then the group is active.

The following suggestions provide guidelines for quality online learning group facilitation. *Experience of online facilitation*. This can be achieved through convening online courses for at least multiple cohorts and establishing an online facilitation body of knowledge within the university to help facilitators share experience and learn from one another. This is in line with one of the facilitators' who said that "the more cohorts I facilitate in my online courses the more my online course gets better... ". Having more knowledgeable peers together facilitating online courses can improve the experience of online facilitation.

Learner guidance and scaffolding. Guidance and scaffolding are important for online learning. The facilitators should be able to identify different types of learners for appropriate guidance and scaffolding. The application of questioning by facilitators to assist learning improved interaction levels as suggested by blooms (detailed explanation can be got in paper C and D). This can help the facilitator to give appropriate interventions for effective online learning.

Facilitator presence. Just like in the physical classroom setting, learners in the online environment should feel the facilitators' presence. This gives learners confidence since they know that the facilitator is watching over them. This can be seen through feedback to the learner interactions and communications through announcements.

Feedback and assessment. The feedback and assessment should be timely. One of the facilitators said that "in the evaluation I made at the end of course, the learners appreciated getting timely feedback and assessment...". When the feedback and assessment is provided on time, the learners interaction will increase.

Motivation and sustaining learner interactions. The facilitators should provide positive feedback that motivates online learners to interact. In order to sustain interactions, the facilitator should provide feedback through questioning that assists learning and most especially provoke learners to high levels of cognition. The details are available in papers B, C, D, E, and F.

4.3 Use Cases for Online Learning Groups

The use cases provide answers to RQ6 giving indications on the kind of tools needed for the support of online learning groups. The use cases are based on the methods and five factors for effective online learning groups. Ideally, all the factors should be supported by the LMS. Here it is illustrated how the use case was constructed from the methods and factors to the possible learning group tool. This will be described in two subsections that is high-level and low-level use cases.

4.3.1 High-level Use Cases

Interaction within the group does not just happen. It requires well-structured and organized online learning group activities. The scenario is illustrated in the proceeding statements with highlighted possible use cases.

The facilitator **creates** the online learning group activity. The group then initially **discusses** and finds a solution (**construct**) to the group activity which is **submitted** to the facilitator through an online learning system. Once the initial submission is done, the learners are required to give peer feedback (**assess**) to at least five of the other group members. However, learners are allowed to give additional **comments** to other groups on top of the mandatory peer feedback (**assess**). After peer feedback, the group members reconvene and start **discuss**ing based on the feedback received so that they make their final submission. However, during the online group process, the facilitator also provides feedback (**mediates**) to help in scaffolding the learners through questioning which assists and provokes learning. Each learner is required to contribute to the online group activity. Finally, one of the group members **submits** the group assignment on behalf of the other group members which is then **assessed** by the facilitator. The scenario represents two key stakeholders: facilitator and learner.

The general overview of group interaction from this scenario is shown in Figure 4.5. Which shows the use cases for the interaction between the learners in the group and the facilitator interactions within the group.

For the group interaction the system should support the following use cases for the learner; discuss, coordinate, assess, construct, comment, and submit. These are the use cases mainly performed by the learners as identified from the above scenario. Even though the facilitator has rights to perform those functions, they seldom perform them to give sense of ownership and independence to learners in the groups. The meaning of the use cases is provided in Table 4.2. The assess that appears here unlike the one for the facilitator is peer assessment made by learners. The comment

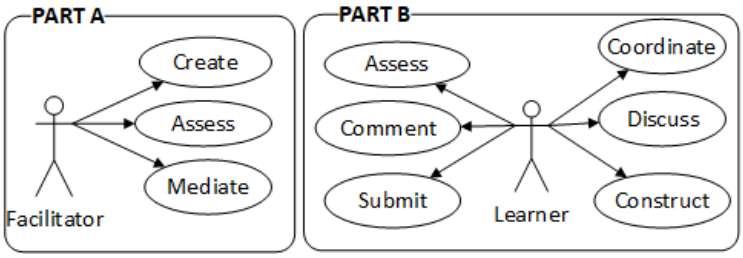

Figure 4.5: Use cases for group interaction

avails the facilitator a possibility of providing feedback within a group interaction.

Table 4.2: Description of the use cases for group interaction

Use case	**Description**
Discuss	Talking about something to reach a decision or to exchange ideas.
Coordinate	Managing the process, the tasks and activities.
Construct	Making something
Comment	Expressing an opinion or reaction
Assess	Providing assessment to another learner or group.
Submit	Handing in compiled work.

In addition to the use cases in Part B, the facilitator can also perform the use cases in Part A; create, assess and mediate. The descriptions of the specific use cases for facilitator interaction are shown in Table 4.3.

Table 4.3: Facilitator specific use cases for interaction

Use case	**Description**
Create	Formation of a learning group.
Assess	Providing assessment to learners or group.
Mediate	Assisting or scaffolding or helping or provoking learners with professional pedagogical feedback (intervention).

During the process of *discuss* and *construct* the groups need to communicate and agree. Communication is important in group discussion both to the learners and facilitators. Even if these communications might be similar for both learner and facilitator, the facilitator has more privileges. For example, the facilitator might have the options of communicating to groups or individuals.

4.3.2 Low-level Use Cases

This section illustrates further the *discuss* use case. Discussion happens between entities and in this case between learner and learner or learner and facilitator. Once the facilitator has created a group activity, discussion will start in the group. This is done through **post**ing responses to an activity in the discussion area. The post is **view**ed by the members in the learning group who then **reply** to the post. This process continues until they come to an agreed answer to the learning group activity which is then weaved and submitted for assessment. However, the facilitator is allowed the possibility to delete a post in the group. This is illustrated in the first part of Figure 4.6 titled use cases for discussion and mediation.

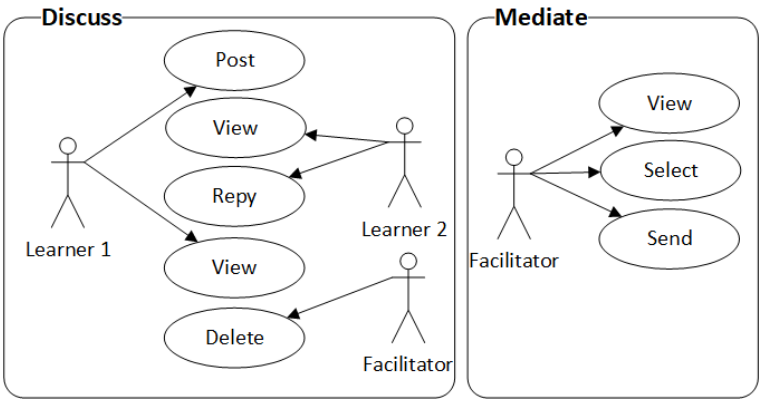

Figure 4.6: Use cases for discussion and mediation

Facilitator mediation/ intervention is illustrated in the second part of Figure 4.6 titled use cases for discussion and mediation. The facilitator views the participation of the learners within the learning groups. Participation is measured through active posting, replying, and submitting messages. This is done by displaying the number of posts or replies a learner has contributed in the group discussion. This is viewed either by learners or groups. This then enables the facilitator to intervene to either the learner or group appropriately. The facilitator is given the possibility of selecting and sending messages either to an individual learner or all group members. The messages are sent using alternative channels (email, messaging, sms, etc) registered in the online learning systems. This helps to trigger their interaction within the online learning platform.

Chapter 5

Evaluation and Discussion

This chapter starts by presenting the PhD contributions in section 5.1. Section 5.2, present, the evaluation of the methods and factors. Finally, the findings are discussed in section 5.3.

5.1 Contributions of the PhD Dissertation

In order to support online facilitators and students to work effectively in groups, this dissertation investigates the possibility of supporting effective online learning groups. The study established factors and under each factor, guidelines are established as methods. To test the applicability of the methods, the study used two online learning courses as case studies. The main contributions to knowledge of this research are summarized as follows.

- A method for the better creation of online learning groups was established. This provides guidelines on what should be followed in the creation of online learning groups. For detailed information go to Section 4.2.4.

- A method for better structuring of online learning group activity was established. Emphasis was placed on structuring that enables online peer feedback and guidance. The detailed explanation can be found in Section 4.2.3.

- A method for the better facilitation of online learning groups was established. Emphasis was placed on facilitator presence that scaffolds learners by questioning them through the levels of Blooms taxonomy. Further explanations can be found in Section 4.2.5.

- Factors for supporting effective online learning groups were established. The factors inform instructional design for online learning courses by providing guidelines to both education technologists and designers of online systems. The technologists and designers can be guided when designing and developing tools that support online group courses. The factors are supporting institutional policy, supporting institutional technology, quality of online learning groups, quality of online learning group activity and quality of online learning group facilitation. The factors also come with guidelines. The detailed explanation can be found in Section 4.2.

5.2 Evaluation of Methods and Factors

Given that the main contributions of this study are methods and factors, this section presents their evaluation. The evaluation shows how the methods and factors are applicable. This is presented in three sub-sections namely: application of methods and factors, application of methods and factors to bring results, and evaluation of factors against research questions.

5.2.1 Application of Methods and Factors

This subsection discusses how the methods and factors can be implemented and applied by facilitators. It majorly deals with how the methods and factors can be applied in authentic online learning courses.

5.2.1.1 Methods and Factors Being Implementable

The study here concerned itself with checking if the methods and factors could be implemented in the tools that support the learning process. This was important in ascertaining the value of the study. Table 5.1 presents the methods, factors and their corresponding implementable tools. The iterative process of establishing the methods and factors shows that they are implementable. The results showed that online learning group creation (section 4.2.4), online group activity structuring (section 4.2.3) and facilitation of online learning groups (section 4.2.5) increased interaction (details in paper C and paper D). Through these processes of establishing the methods and factors, corresponding tools were identified. These are tools mainly from Makerere University Electronic Learning Environment (MUELE) which is built on the Moodle platform and some implemented features of the Moodle group plugin.

However, the factor of supporting institutional policies did not have corresponding supporting tools.

Table 5.1: Overview of tools for the methods and factors

Factors	**Methods**	**Tools (Moodle)**
Supporting Institutional Policies		—
Supporting Institutional Technologies		Authentication (MUELE), Announcements (MUELE), Forums for discussion (MUELE), Co-creation of artifact (External), User support, Synchronous and asynchronous communication (MUELE), Meeting schedules (External).
Quality of Online Learning Group	Creation of online learning groups	Create learning groups (MUELE), Create shell (empty) learning groups (plugin), Register information to help in group formation (plugin), System should set group size between 2 and 7 (MUELE), Group members kept in group for a full semester (not tool but facilitator insures).
Quality of Online Learning Group Activity	Structuring of online learning group activity	Forum for discussion (MUELE), Synchronous and asynchronous implemented through discussion forums (MUELE), Peer feedback through reply or comments (MUELE), Create online learning group activity (MUELE), Submit to facilitator (MUELE), Activity structuring is very important for effective online learning groups.
Quality of online Learning Group Facilitation	Facilitation of online learning groups	Feedback (questioning for assisting and provoking learners), Assess group submission, Select individuals or groups to communicate to (Plugin), Count of participation by individual learners (plugin), Count of participation by groups (plugin), Facilitator intervenes (MUELE, Plugin), Messages are sent using alternative ways registered in the online platform (Plugin), Trigger their interaction within the online learning platform, Allows possibility to preview before you send, Allows possibility to remove persons or groups you had selected earlier, Empty groups can be created, Learners can choose groups, Learners can change groups.

5.2.1.2 Methods and Factors Being Actionable for Facilitators

Given that the methods and factors are established with the involvement of the facilitators and evaluated among authentic online courses showing positive results, this gives indication of them being applicable by the facilitators. Peer assessment activities can be checked against each other for effective interaction within groups. In addition, facilitator feedback can be checked against the type of questioning that assists learning. During the process of establishing the methods and factors, some preliminary results helped in changing existing courses. This change helped in improving the online course, which gives an indication of the methods and factors being applicable by the facilitators. This is evidenced in design science studies which this study applies. This is so because it applies authentic problem cases which are common with design science studies.

5.2.2 Application of Methods and Factors to Bring Results

The methods and factors were checked using two courses run on the bachelor of commerce external programme. The two courses are Information Technology I and Information Technology II which are run by distance mode. These courses ran for 15 weeks and had a total of 98 students. These courses were run using the MUELE at Makerere University. The courses were selected because they were running within the context of the project. The established methods and factors were applied on these authentic online courses for evaluation. The evaluation of the application of the methods and factors confirmed their importance in bringing about results. The application revealed increased interaction within online learning groups which is a precursor for learning. In addition, an evaluation of user satisfaction was measured on the Likert scale for the learning group activity (task), time and support. User satisfaction of the task revealed that 76% agreed that they were satisfied with the task (shown in Figure 5.1). This connects well with the quality of group activity and is revealed as a characteristic of effective online learning groups. Therefore, this indicates that the learners were satisfied with the group activity. The respondents were also asked about the user satisfaction of the time for completing the online learning group assignment which revealed that 67% agreed. This equally relates to the quality of group activity as one of the FEOLG. Finally, user satisfaction of the support revealed that 73% agreed. This support is connected to learner facilitation. The learners felt that they were supported or guided by the facilitator. Facilitator support is a key factor of the FEOLG. This generally reveals that the learners were satisfied with the online learning group.

The specific evaluation of the group activity characteristics revealed the results as shown in Figure 5.2. On average 91% of respondents revealed that positive characteristics on online learning group activity were inherent in the studied online courses. These therefore, are indicators of effective online learning group courses.

5.2.3 Factors Against Research Questions

Answers to research questions provide solutions to the research problem. Since this study established factors, this section provides the connection of research questions to the factors. Table 5.2 presents a summary of the research questions and corresponding factor(s). The factors were found by looking for the answers to the research questions. In the table, research questions are represented as RQn where n is their number as detailed in section 1.3. The supporting institutional policy is denoted as F1, supporting institutional technology is denoted as F2, quality of group

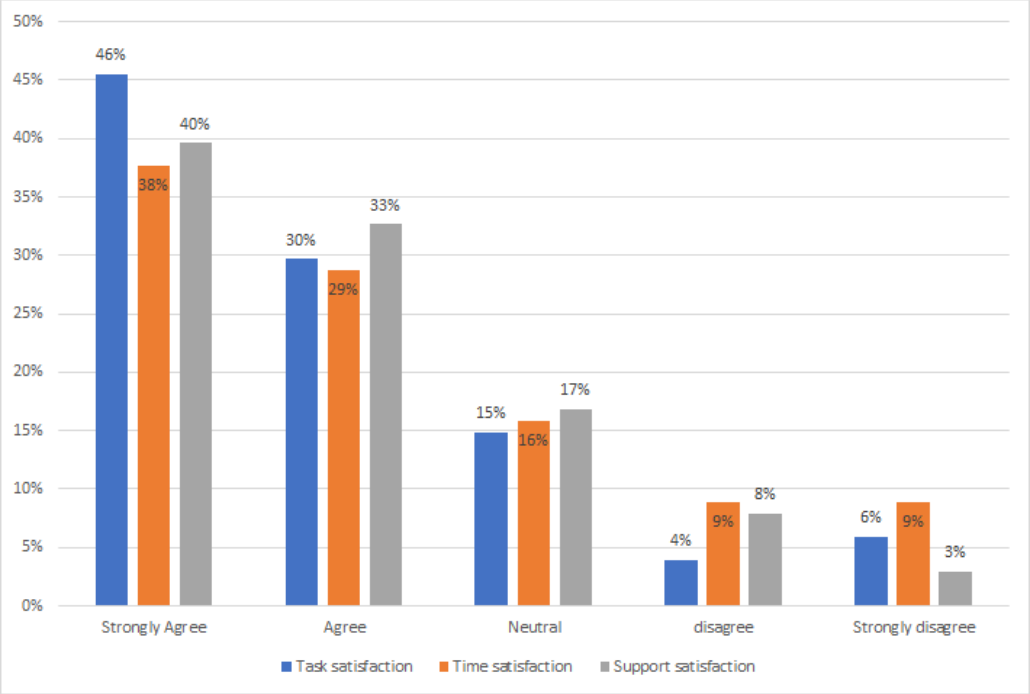

Figure 5.1: User satisfaction

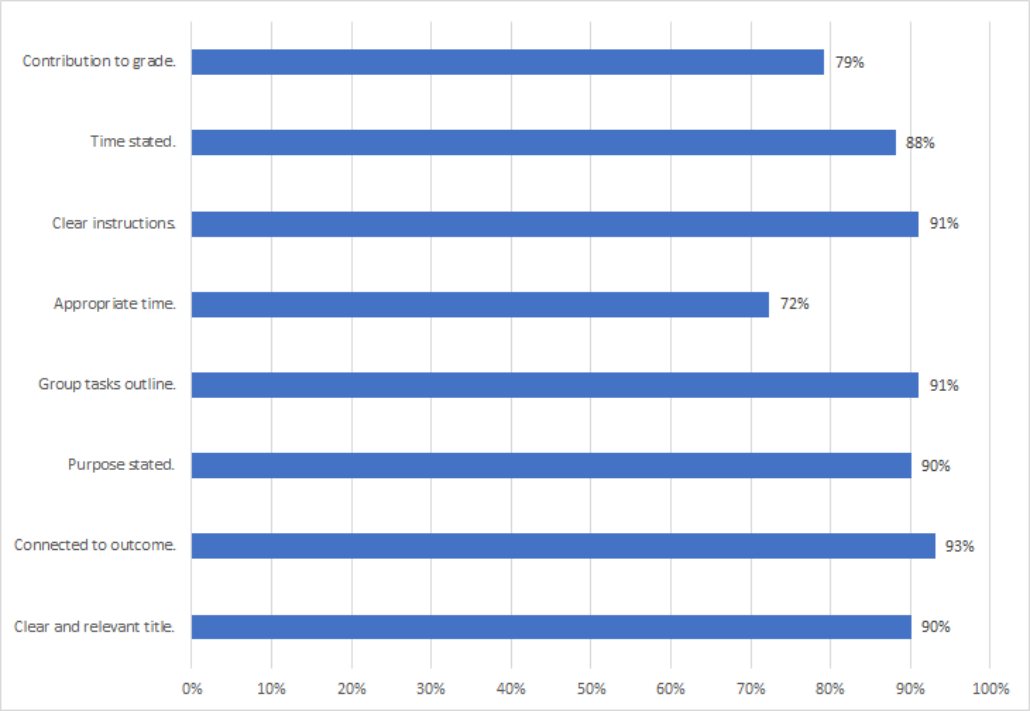

Figure 5.2: Characteristics of effective online group activity

Table 5.2: Research questions and factors

Research Question	**Factors**
RQ1	F1
RQ2	F1, F2, F3, F4 and F5
RQ3	F2 and F4
RQ4	F2, F3 and F5
RQ5	F1, F2, F3, F4 and F5
RQ6	F1, F2, F3, F4 and F5

activity is denoted as F3, quality of group is denoted as F4 and quality of facilitation is denoted as F5. The factors were found to be meaningful in answering multiple research questions.

RQ 1) *What are the online learning needs in Uganda?* To answer this research question, an online learning needs assessment was conducted in Uganda. A survey was conducted in all the five regions of Uganda in mainly higher educational institutions. This helped in identifying the context of online learning. The importance of online learning policies was vividly highlighted in the study. Therefore, the answer to RQ1 helped in establishing factor F1.

RQ 2) *What is an effective online learning group?* This was answered basing on interviews of experienced online facilitators at the University of Agder and observation of online interaction logs of two online course of the same university. Therefore, the answers to RQ2 helped in establishing the factors F1, F2, F3, F4 and F5. Through analysis the following preliminary findings were established; the technologies, policies, activity, learning groups and facilitation. These preliminary findings laid a foundation for the factors.

RQ 3) *How effective online learning groups are formed?* This research question was answered based on two authentic online learning courses. One was run at Makerere University and the other at University of Agder. The Makerere University course was run for 15 weeks and the University of Agder course was run for 10 weeks. The Makerere University course was investigated using both interviews and observation of the online interaction while the University of Agder course was investigated through survey and observation. Therefore, the answer to RQ3 helped in establishing the factors F2 and F4. This was aimed at understanding how groups are formed and which technologies helped in this process.

RQ 4) *How interactions in online learning groups are sustained?* This was equally based on the two a fore mentioned online learning courses at Makerere University and the University of Agder. The answers to this research question found the factors F2, F3 and F5. F2 appears in almost all because the study was carried out on authentic online courses. During the analysis of the interaction logs, facilitator

feedback was analyzed in order to understand how it affected the interaction. The activity structuring helped in ensuring interaction and peer feedback hence sustaining the interaction in online learning groups. It is important to note that facilitation is key to effective online learning groups.

RQ 5) *What principles will guide the design of tools to support effective online learning groups?* To answer this research question, two authentic online courses were evaluated. Therefore, the answer to RQ5 helped in establishing the factors F1, F2, F3, F4 and F5. The factors were evaluated to determine their correctness based on the two authentic online courses and using focus group discussion.

RQ 6) *What tools should be used to support effective online learning groups?* Given that the study was based on authentic online courses, tools were identified that supported the methods and factors. The case studies were used in order to identify the tools (papers C, D and E). Therefore, the answer to RQ6 helped in establishing the factors F1, F2, F3, F4 and F5.

5.2.4 Answers to Research Questions

The research questions were categorized into three research areas. The description of the answers to the research questions will be presented within the research areas.

Context of online learning groups

RQ 1) *What are the online learning needs in Uganda?* Answer: The context of online learning in Uganda was established. The study established the following online learning needs: institutionalization of pedagogical ICTs, improvement of ICT infrastructure, regular improvements in internet connectivity, regular procurement and maintenance of ICTs, continuous staff training, and development and implementation of ICT/eLearning policies (Paper A). The quality of online learning policy was established as an answer to this research question.

RQ 2) *What is an effective online learning group?* Answer: A good online learning group is one whose learners actively interact within the group (Section 4.1). For effective online learning groups, the findings pointed to the need to have appropriate policies, technologies, online activities, learning groups and facilitation. These gave initial indication for the guidelines of effective online learning groups.

Processes to support effective online learning groups

RQ 3) *How effective online learning groups are formed?* Answer: An effective online learning group is the one formed by ensuring that the group size is between two to seven members, the group composition promotes diversity and group members kept together for longer period (Section 4.2.4). This contributed towards the methods for the better creation of online learning groups and factor F4 that guides

the support of effective online learning groups. In the process of establishing the answer, tools for effective online learning group were established.

RQ 4) *How interactions in online learning groups are sustained?* Answer: Sustaining online learning group interactions established structuring of the group activity with emphasis on feedback and interactions (Section 4.2.3), and the facilitator providing feedback through questioning that assist learning (Section 4.2.5). This contributed towards the methods for the better structuring of online learning group activity, methods of better facilitation of online learning groups, quality of online learning group activity (Section 4.2.3), and quality of online learning facilitation (Section 4.2.5). A good online learning group facilitation, requires questioning that assists and scaffolds learners.

Tools to support effective online learning groups

RQ 5) *What principles will guide the design of tools to support effective online learning groups?* Answer: To guide the design of tools to support effective online learning groups, five factors are established. These include; supporting institutional policies, supporting institutional technologies, quality of online learning group activity, quality of the online learning group and quality of online learning group facilitation (section 4.2).

RQ 6) *What tools should be used to support effective online learning groups?* Answer: To support effective online learning groups, use cases for interactive groups are developed. This research question was answered through demonstration of factors within an authentic online learning environment and courses which helped in identifying the tools needed for supporting effective online learning groups. In addition, and based on the methods and factors, use cases of online learning groups were established. These use cases are used by online learning designers and developers in developing effective online learning groups. Based on authentic online courses, tools were identified that supported the factors.

5.3 Discussion

To begin with, the factors are presented to explain the reason for their selection. Then the courses are presented to explain why the particular courses were selected. Finally, the solution to the PhD problem is explained.

5.3.1 Factors

The factors were thematically established to frame the findings of this study. Therefore, factors are chosen to provide systematic structure of presenting the findings.

The factors came out vividly in the data which was collected and analyzed and they resonate well with [22, 40]. For each of the factors, guidelines were suggested. Therefore, the factors and corresponding guidelines act as a guide to facilitators in making online learning groups more effective. The factors are presumed to be easier to follow and facilitators feel that they are closer to them because they provide practical solutions. This is true because the approach to the development of factors is grounded on pragmatism (Design science). The use of authentic online learning courses to evaluate the factors provided evidence for design science.

Given that the study establishes an artifact, design science was appropriate for the study. The study therefore is aligned to the pragmatic thinking given its interest on practice. Practice was within the authentic online learning courses at higher institutions of learning. Which came in given the design science principles. The rigor was majorly influenced by the theories and methodologies used in the study while the relevance was seen from practice with the authentic online learning courses at the University of Agder and Makerere University. Design science was used majorly because need for the studies relevance society. By doing this repetitively using authentic online learning courses the factors became more concrete. The study used the mixed methods which resonates well with pragmatism.

5.3.2 Online Courses

The selection of the online learning courses was purposive. These courses were from the University of Agder and Makerere University given that the PhD was a result of a collaboration between the two universities. The online learning courses that were used to establish the factors are Business Research Methods and Success Unleash Yourself. These courses were non-mathematical which influenced the establishment of factors. In these courses, the group interaction was text based. Perhaps working with learning groups on mathematical online learning courses would produce a slightly different outcome. Equally, during the evaluation of the factors, the authentic online learning courses used were non-mathematical and from Makerere University. The courses selected were Information Technology I and Information Technology II. These courses were selected because they were running online. The courses selected at Makerere University were in the distance learning programmes. The University of Agder courses were selected because I had the opportunity of following them in more than one cohort. The courses were also selected because they were fully online (MOOC). The use of authentic online courses helped in bringing results in the identification of factors.

5.3.3 Did we Solve the Problem?

The research problem is that although learning groups can bring about meaningful learning, learning groups in online learning environments are often not working. The study aimed at making learning group work more effective in online learning environments. In the process of solving the problem, it was identified that establishment of guidelines for effective online learning groups would be appropriate. Therefore, this study established methods and factors for supporting effective online learning groups. These methods and factors are premised on the argument that a good online learning group is one to whose learners actively interact within the group. This is in line with Vygotsky's [20] argument that people learn through engagement with others. The established methods and factors help to solve the problem through guiding the instructional design and facilitation of online learning courses. The methods and factors are elaborated in section 4.2, 4.3 and 5.1. These methods and factors were established using the design science methodology and based on authentic online learning courses. The use of authentic online courses helped in validating the factors for supporting online learning groups. The evaluation of the factors indicated that group interaction increased (Paper C and D). The online learning group activity and facilitation played a key role in ensuring interaction in groups during the evaluation. Therefore, learning group activity structuring creates possibilities for interaction within the groups as the study on the authentic online courses has shown (detailed in Paper C and Paper D). The learner provocation through questioning by the facilitators plays a big role in increasing interaction among learners in the group. Using the proposed factors in designing online courses can increase interaction which is a precursor for learning. Therefore, the factors and associated guidelines provided solutions to the problem.

Chapter 6

Summary and Future Directions

This final chapter presents the summary of the PhD study and points to some future directions.

6.1 Summary

The social constructivist learning theory advocates for learning through interactions. The interactions can be grouped into learner to learner or learner to facilitator. This indicates that learning can happen through interactions in learning groups. However, although learning groups can bring about meaningful learning, learning groups in the online environments are often not working. Therefore, this study intervenes to make learning groups more effective in online learning environments. The rationale is that while many institutions integrate learning groups in online learning activities, most of them lack clear guidelines on how to exploit this opportunity to the benefit of not only the learners, but also the educators. The problem was solved using a systematic study of both e-pedagogy and online learning environments. The study adopted the design science methodology, mixed methods approach, and case studies of online learning courses.

The findings from this thesis indicate that effectiveness of learning groups can be attained by providing proper guidelines. This thesis therefore, establishes factors and guidelines for effective online learning groups as elaborated below.

Guidelines

A. Creation of Online Learning Groups. Creation of groups is important for effective online learning groups. Creation of groups brings learners together in one group.

B. Structuring of Online Learning Group Activity. Structuring of online learning group activity is important for effective interactions. Emphasis was put on the way these activities are structured to encourage interaction and feedback. Outcomes from the evaluation indicate that online facilitators agreed that the online group activity is central to the effectiveness of online groups. Two structures were suggested and used in this study. The first is the peer assessment-based structure and the individual based structure (detailed in Section 4.2.3).

C. Facilitation of Online Learning Group. Facilitation is important for effective online learning groups. The facilitation can be done by facilitators or tutors. For effective facilitation the following should be put into consideration; experience of online facilitation, learner guidance and scaffolding, facilitator presence, feedback and assessment, and motivation and sustaining learner interactions.

Factors

A. Supporting institutional policy aims at ensuring that institutions have supporting policies in line with online learning groups. Majorly, there is need for policies for progressive assessment to assist in ensuring that learners are rewarded for the group work, and institutional acceptance of digital assessment and online facilitation and tutoring. Online facilitation is key to effective online learning groups which calls for the need to ensure appropriate ratios of learners to facilitators and the need for appropriate human resource policies that reward the facilitators for the contribution they make online, most especially regarding promotions.

B. Supporting institutional technology aims at ensuring that institutions acquire appropriate technology for supporting online learning groups. Importantly, channels of messaging, discussion and co-creation of artifacts must be considered. This should enable virtual access and the possibility of online support and feedback. This would help the learners and facilitators in doing group activities and facilitation. Given the importance of the need for peer feedback, this option should be embedded within the online platform. This in a way is aimed at supporting the three factors which are group activity, group formation and group facilitation.

C. Quality of the online learning group aims at ensuring that the composition of groups puts emphasis on diversity. This helps in mixing the more knowledgeable (or aware) peers to assist other in the learning process. Diversity alone does not bring about effectiveness of groups. Therefore, for group cohesion to occur, the group members must be kept in the same group for at least a semester. Small numbers of around two to seven members makes the group more effective.

D. Quality of online learning group activity aims at ensuring that the activity is well structured to enable peer feedback and interaction. The emphasis is put on

organizing the group activity to provide for interaction within the groups. However, the activity should be connected to the learning outcome and have clear instructions. With the work involved during the group activity, rewards should be enabled for the group activity/tasks. These rewards should clearly be indicated on the group activity. By ensuring that the group activity adheres to all the characteristics of a quality group, online courses become more effective.

E. Quality of online learning group facilitation aims at ensuring that learners feel the presence of the facilitators in the online learning groups. Mainly, the facilitators should provide feedback that helps in scaffolding learners within a group. For this to be effective, we suggest that each facilitator or tutor should be allocated a maximum of 25 online learners. This can bring about better facilitator presence and engagement within the online learning groups. Use of questioning as a way of assisting learning can help the learners to interact more within the groups. This helps to provoke the learners to do more than what they could have done without the kind of questioning that mediate learning.

This research also had some limitations. To begin with, all the case studies used in this study were limited to non-mathematical courses. This creates a limitation on the results were they to be applied to mathematical courses. As such, the results are applicable to non-mathematical courses. The study is based on the case studies of selected courses at the University of Agder and Makerere University. Therefore, the study is limited by the cases within which we established the findings. Secondly, we used different students in the case courses in our research design.

When applying the guidelines for this study, we should put into perspective the challenges associated with online learning. First, online learning has challenges of lack of training or knowledge in online teaching and learning. Many times, the experience in traditional classroom does not automatically translate into effective online teaching and learning. Online teaching requires additional knowledge and experience to facilitate effectively. Secondly, there is lack of supporting digital policies. Thirdly, there are challenges associated with use of multiple technologies lumped together. The technology industry is exponentially growing with many tools out there to support learning groups. However, some technologies are particularly good for supporting virtual collaboration where students can remotely co-create knowledge. Shared Google environments provide opportunity for shared environments. Currently we are witnessing the emergence of tele-conferencing tools that enable synchronous lecture/training. These tools come with some challenges associated with limited bandwidth and incompatibility issues, most especially in developing countries.

Interaction design for learning platforms is an important issue when designing these environments most especially user experience. In this study, interaction design was not extensively studied but is an area that should be examined further.

6.2 Future Directions

This thesis addresses the challenge of working in online learning groups by providing methods and factors that guide and support effective online learning groups. Although this study used online courses as case studies, the limited time and resources did not allow for long term studies or complete implementation of systems. In order to further explore learning groups the following areas could be considered.

Informal Learning Groups. During this study, we realized that online learning groups in addition to the classroom groups are formed, the members create their own groups where they talk more freely than the institutional or classroom groups. There is need to understand how these groups influence learning.

Deep Learning. Interaction brings about learning. Learning will differ depending on the quality of interaction. The more you guide interactions in groups the better the quality of learning which is synonymous with deep learning. However, there is need to do detailed studies among the learners in groups to synthesis deep learning partners. This then can guide appropriate automated responses that bring about deep learning.

Usability and User Experience Studies. Usability and user experience are important aspects of online systems. Given that online learning groups have both the human side and mechanical side, online systems that support groups require careful understanding of the human side of online learning groups. It would be interesting to look further into online systems to detect errors automatically by system interpretation of the text interaction with emphasis on usability and use experience.

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PART II

A

Paper A

Title: Online Learning Needs Assessment in Uganda.

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Online Learning Needs Assessment in Uganda

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Abstract — **In this chapter, we report on findings of an online learning needs survey which was carried out in Uganda in 2014. The survey was carried out in five regions of Uganda, namely: North, South, East, West and Central. Data was collected from each institution using questionnaires. Fifty-nine percent (59%) of the respondents indicated that their institutions had no Learning Management System (LMS) in place due to absence of adequate ICT facilities, ICT illiteracy, and connectivity problems. The survey revealed that 80% of the institutions implementing distance learning programs were using print and face-to-face delivery channels (first generation distance education). The survey established the following needs: institutionalization of pedagogical ICTs, improvement of the ICT infrastructure, regular improvements in Internet connectivity, regular procurement and maintenance of ICTs, continuous staff training and development and implementation of ICT/eLearning policies. Overall, the survey revealed the need to systematically integrate ICTs in different pedagogical processes, hence calling for the need to embed different ICTs into different educational activities.**

Keywords—Online Learning, Distance Learning, Needs Assessment.

1 Introduction

There is a proliferation of the use of online learning in higher institutions of learning [1]. Online learning is the use of Internet technology for teaching and learning. Different technologies have been suggested worldwide for teaching and learning. New-Media-Consortium [2] suggested the different directions online learning will take in the next one to two years, including the growing ubiquity of social media and integration of online, hybrid, and collaborative learning. In three to five years, data driven assessment will be used and students will be seen as knowledge creators rather than knowledge consumers. In Africa and indeed elsewhere, there is need for use of online learning, especially in distance learning programmes. In countries such as Uganda, the need for online learning in distance education is being manifested in the adoption of non-traditional online learning devices such as mobile phones because of limited access to a tethered ICT infrastructure [3–5]. However,

the present integration is ad hoc and at the whims of ICT savvy staff. Integration of ICTs in pedagogical processes requires adequate planning and rethinking for cognitive development to occur in any mode of delivery.

Distance learning is increasingly advocated as a new form of education that can help to increase access to flexible education especially in developing countries [6]. Distance learning offers modes of delivery where the teacher and the learners are separated in time and space [7]. At Makerere University in Uganda, only five distance learning programmes host approximately 6000 students. The programmes which are offered by the Department of Open and Distance Learning are: Bachelor of Education, Bachelor of Commerce, Bachelor of Science, Bachelor of Agricultural and Rural Innovation and Diploma in Youth and Development Work. Being a dual mode University, these distance learning programmes are run concurrently with conventional on-campus programmes, commonly known as internal programmes. The total student population, inclusive of distance learners, is over 35000 students.

Increasingly, diff erent departments at Makerere University and other universities are demanding their internal programmes be converted into distance learning programmes. This is coming as a result of the increasing population growth rate, which is making the brick-and-mortar infrastructure inadequate to meet the growing demand for higher education. Research has indicated that distance learning provisions can offer possibilities for the increasing number of students to have access to education [7, 8]. The snag in most universities in developing countries is that the distance learning programmes they off er are still of first generation order dominated mainly by print and face-to-face. Modern distance learning institutions are increasingly adopting ICT in the provision of teaching and learning at a distance. Universities in developing countries need to leapfrog if they are to compete favorably in the global education market. The current Web metrics that rank universities according to performance in the region largely base on the online presence of the universitys activities where online innovations in teaching and learning would make such universities competitive [7].

The Department of Open and Distance Learning at Makerere University, in partnership with the Department Information and Communication Technology at the University of Agder, is running a project to transform the current 1st generation distance learning delivery at Makerere University into 4th and 5th generation distance learning delivery. With funding support from the Norwegian Agency for Development Cooperation (NORAD), under the Norwegian Programme for Capacity Development in Higher Education and Research for Development (NORHED), the

project is titled Leapfrogging 1st Generation Distance Education into 4th and 5th Generation Distance Education: A Strategy for Enhancing ICT Pedagogical Integration and Increasing Access to Education in Africa. Hereafter, it is referred to as the Distance Education Leapfrogging Project (DELP).

Distance education is going through a series of generations as learning technology evolves. The first generation distance education is dominated by print technologies and face-to-face sessions. The second generation employs the multimedia model characterized by print, audiotape, videotape, computer-based learning and interactive video. The third generation employs the tele-learning model characterized by audio tele-conferencing, video-conferencing, audio-graphic communication and broadcast TV/radio. The fourth generation employs a flexible learning model characterized by interactive multimedia online, Internet-based access to Web resources, and computer-mediated communication. The fifth generation is characterized by an intelligent flexible learning model with characteristic features such as interactive multimedia online, Internet-based access to Web resources, computer-mediated communication using automated response systems, campus portal access to institutional processes and resources. Simply leapfrogging from first generation to fourth and fifth generation distance education is not enough. In her book, Laurillard [9] argues that eLearning will be successful if we begin with an understanding of how students learn, and design learning technologies putting students learning capabilities in consideration. Hence, an online learning needs survey is necessary for DELP to have a chance of success.

The online learning needs survey was carried out as the preliminary stage of the DELP project. The survey aimed at determining the online learning needs of Uganda in order to get a better understanding of how students could learn, the kind of learning technologies they have at their disposal, which policies are determining their learning, and the human capacities available. Th e survey answered the following research questions: i) What are the current ICT infrastructures in the higher education institutions in Uganda? ii) What are the current modes of delivery of distance learning in higher education institutions in Uganda? iii) What is the level of ICT integration in the teaching and learning in higher education institutions? iv) What are the challenges hindering the use of ICT in the teaching and learning in higher education institutions in Uganda? Th is chapter reports on the findings from these research questions. The rest of the chapter presents the methodology used to undertake the study, findings of the study, discussion of findings, summary and conclusion.

2 METHODOLOGY

The study adopted a survey approach covering five regions in Uganda, namely: South, North, Central, West and East. In each of the five regions, one private and one public university and one tertiary institution (diploma awarding institutions) were randomly selected as follows: in the North: Gulu University, Lira University, National Teachers College Unyama; South: Kyambogo University, Uganda Martyrs University, Kitovu Vocational Institute; East: Busitema University, Islamic University in Uganda, Kaliro National Teachers college; West: Mbarara University of Science and Technology, Mountains of the Moon University, Kabale NTC; Central: Makerere University, Nkumba University, Uganda Institute of Information and Communication Technology (UICT). From each of the selected institutions, ten participants were purposefully chosen based on identifying members who used ICT in their teaching and learning processes. This resulted in 150 responses with 30 respondents from each region. Having a representative participation from the entire country in the survey was vital because distance learning students in Uganda are distributed across all regions.

Data was mainly collected using self-administered questionnaires. Self-administered questionnaires were employed because of the diverse geographical distribution of respondents. Th e questionnaire was designed according to the above mentioned research questions. They elicited information on socio-demographic characteristics, existence of ICT department, existence of distance education, implications of integrating ICT in teaching and learning, existence of a learning management system (LMS), existing capacity building opportunities, existence of quality assurance mechanisms, challenges of using ICT in pedagogy and their corresponding suggestions. Where ICT practices existed, documents/records on use of ICT in teaching and learning were also employed. This documentary analysis enabled the researchers to understand different ICT infrastructure issues in the different organizations.

3 FINDINGS

The survey results are presented in the following sub-sections: social demographic characteristics, ICT infrastructure in higher education institutions, modes of delivery of distance learning in higher education institutions, ICT integration in the teaching and learning in higher education institutions, awareness of learning management system, opportunities for capacity building, quality assurance, and challenges and suggestions in the use of ICT in teaching and learning in higher education institutions in Uganda.

3.1 Social Demographic Characteristics

Figure 1 Part A shows that the majority (69%) of the higher education institutions

were government-owned while 31% were private. Figure 1 Part B shows that 56% of the respondents perceived their higher education institutions as being located in urban centers while 44% felt theirs were in rural areas.

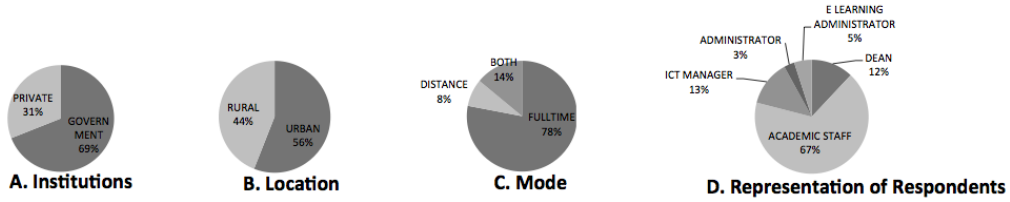

Figure A.1: What is the role of the ICT unit/department in your institution?

The results indicated that (78%) of higher education institutions delivered education through full-time, face-to-face instruction modes, 8% by distance and 14% by both full-time and distance mode (dual mode) as shown in Figure 1 Part C. With respect to study time, the survey findings discovered that 74% of the higher education institutions opened during daytime, 2% during evening and 24% during other times (except day and evening). Figure 1 Part D shows the roles played by the respondents in the higher education institutions: most (67%) were engaged in academic work, ICT managers (13%), deans (11%), eLearning administrators (5%) and administrators (3%). This percentage distribution portrays that majority of the institutions did not have clear established ICT units and therefore the roles of ICT were mostly managed by selected academic staff with some knowledge in ICT.

3.2 ICT Infrastructures in the Higher Education Institutions in Uganda

Existence of an ICT unit and its role: Findings revealed that all the higher education institutions had an ICT unit charged with, among other roles, managing and maintaining ICT infrastructure, planning lectures and teaching, ICT policy formulation and implementation and e-resource centers. These findings were promising for the integration of ICT in teaching and learning since most institutions had people responsible for the institutionalization of ICT activities. Figure 2 shows the extent to which the various roles were completed. For example, the role of ICT units for Internet management standing only at about 2% is an indication that the level of Internet connectivity in most institutions was still too low.

To propel online learning, this attribute will need to be greatly increased. Th is can be done through institutionalizing the ICT units and its corresponding roles by ensuring that there are budgets for ICT infrastructure management and maintenance, increased Internet connectivity, ICT policies development and continuous training for the staff in the ICT units.

To understand how capable the ICT units were in terms of hardware, personnel

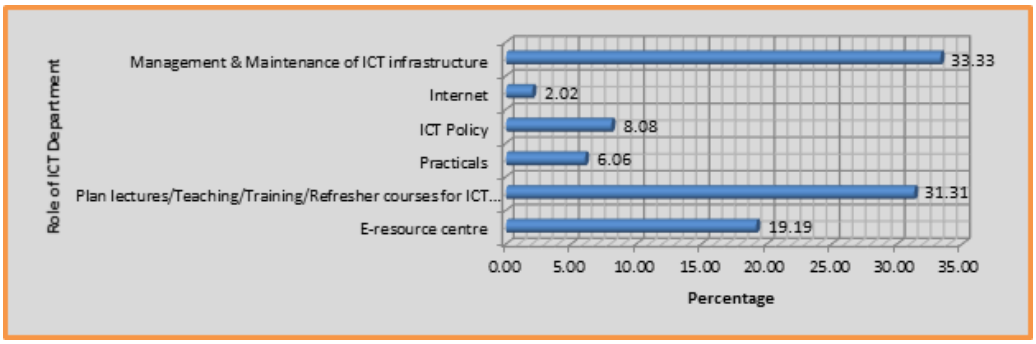

Figure A.2: What is the role of the ICT unit/department in your institution?

skills and motivation, software and support, respondents were asked to give an indication on a Likert scale. Results revealed that 58% of the respondents perceived their higher education institutions to be well resourced, 40% felt their universities/institutions were poorly resourced and 12% did not have any idea. Respondents also described their ICT units to be more involved in academics and supportive roles than administration (see Figure 3).

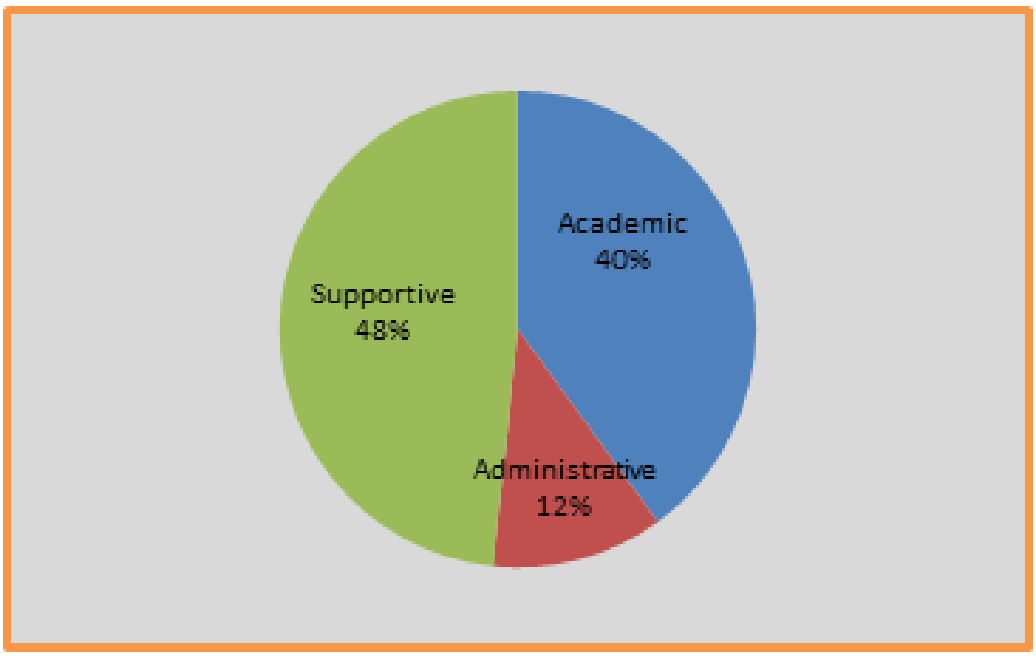

Figure A.3: How best would you describe the ICT unit/department?

This indicates that ICT is mainly used for academic and support purposes, although we did not find out what exact components of ICT were used by academic and support for teaching and learning. Therefore, there is a need to further strengthen ICT integration in teaching and learning to improve and upscale education provision in Uganda.

Connectivity: Eighty-two percent (82%) of the respondents agreed that their higher education institutions were connected to the Internet through fiber optic cables (38%), modem (34%) and leased lines (26%). However, several challenges of connectivity were cited as shown in Figure 4.

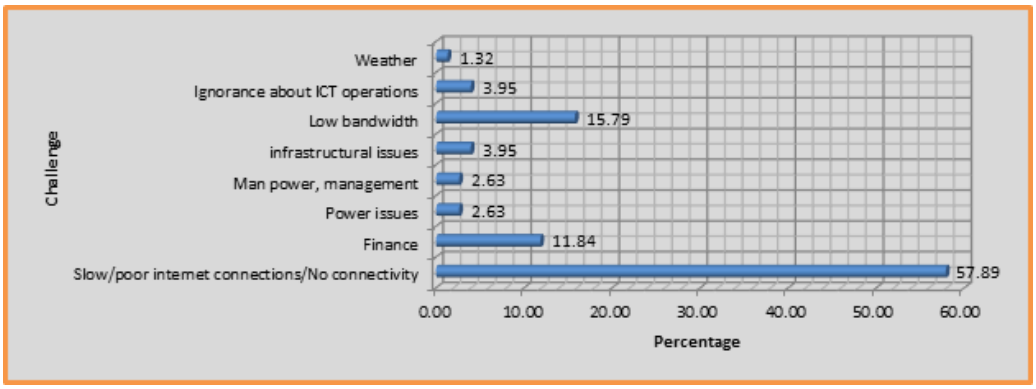

Figure A.4: What challenges does your institution face in connectivity?

Fifty-eight percent (58%) of respondents associated the challenges to slow connectivity/ poor Internet connectivity/no connectivity. This was true for rural based institutions since good connectivity is still available in the Central region.

Connectivity is an integral attribute of online learning. With the coming of the optic sub-sea cable for Internet in East Africa we are hoping for increased Internet connectivity in Ugandan higher education institutions. However, higher education institutions should budget and pay for bandwidth to increase ICT use in teaching and learning. Th ere is also need for more investment into the infrastructure of optic cable in Uganda to effectively implement online learning platforms. When asked what they used ICT for, respondents made indications to the various uses provided. Figure 5 below presents the findings:

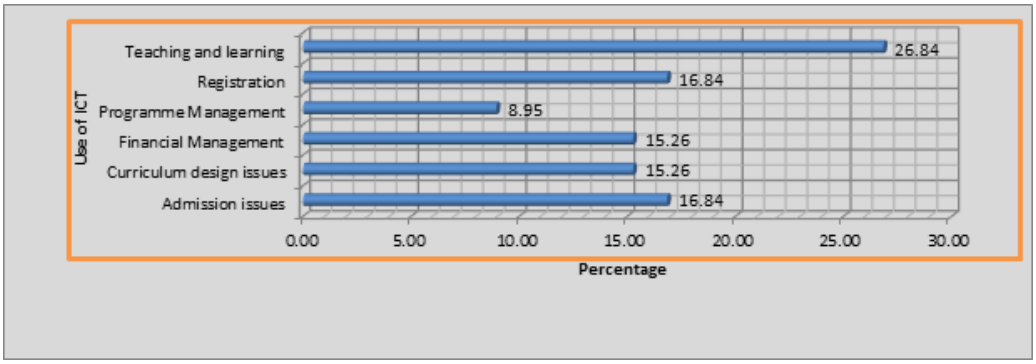

Figure A.5: What do you use ICT for?

Figure 5 shows that ICT was used for various interventions ranging from teaching and learning (26.84%), registration and admission (16.84% each), financial

management and curriculum design issues (15.26% each) and program management (8.95%). All the above uses affected in a distinct fashion the way students used them. Half of the respondents were positively impacted by helpful influence on school operations, research and record keeping while other respondents felt they were negatively impacted through the inability to access Internet and the low usage levels of the available ICT resources. This leads to time wastage and contributes to illiteracy/poor ICT skills. The positive indication of use of ICT in teaching at 26.84% is an encouragement of supporting online learning. Such results give a promising direction to focus on when leapfrogging distance education at Makerere University. Accordingly, more emphasis will be needed in supporting admission issues, curriculum design issues, and registration, which are key components of supporting distance learning students.

Th e survey also sought to establish the frequency of use of ICT and the respondents participation in usage of ICT. Findings are presented on the Likert scales in Tables 1 and 2 below.

Table A.1: Frequency use of ICTs in day to day work (survey data)

ICTs	**Never**	**Irregularly**	**Once a week**	**2 - 3 times a week**	**4 times a week**	**5 & above times a week**	**Daily**
	%age	**%age**	**%age**	**%age**	**%age**	**%age**	**%age**
Internet	11.9	18.6	1.7	1.7	3.4	5.1	57.6
Mobile Phone	3.4	8.6	0.0	0.0	0.0	3.4	84.5
E-mail	6.7	13.3	10.0	5.0	3.3	11.7	50.0
CD ROMs	20.0	45.5	10.9	3.6	3.6	5.5	10.9
Computer based office applications e.g. Word	7.0	8.8	3.5	5.3	0.0	14.0	61.4
Radio	21.8	27.3	9.1	7.3	1.8	1.8	30.9
TV	21.8	14.5	1.8	0.0	1.8	10.9	49.1
Projectors	9.1	36.4	7.3	12.7	10.9	3.6	20.0
Smart boards	64.2	24.5	0.0	3.8	1.9	1.9	3.8
Average	**18.4**	**21.9**	**4.9**	**4.4**	**3.0**	**6.4**	**40.9**

Table 1 shows that on average, more than half of the respondents had used ICT more than once in a week against 18.4% with no mention of any ICT used. Mobile phones are the most used on a daily basis (84.5%) which is in confirmation of the increased use of mobile phones in education by students today [3, 5, 10]. Internet on a daily basis was used by 57.6% of the respondents. However, the majority of the Internet users were from urban higher education institutions. Many respondents (64%) have never used smart boards, which was more worrying since these are

new technologies used in teaching and learning. There is a need to train and buy the smart board infrastructure to encourage the use of technology in teaching and learning. Fifty-five percent (55%) of the respondents use projectors at least once a week; a positive indication of integrating ICT in teaching and learning. This shows that projectors are being integrated in teaching and learning in higher education institutions.

Table A.2: Participation in ICT usage (survey results)

	Strongly disagree	**Disagree**	**Agree**	**Strongly agree**
	%age	**%age**	**%age**	**%age**
My university regularly organizes ICT training courses	13.11	49.18	34.43	3.28
My university adequately publicizes any basic ICT refresher training courses on offer	18.97	48.28	31.03	1.72
I usually apply for ICT refresher training courses advertised by my University	28.57	46.43	17.86	7.14
I usually attend ICT refresher training courses organized by my University	17.54	38.60	35.09	8.77
I usually apply for ICT refresher courses advertised by agencies other than my University	17.24	37.93	29.31	15.52
I usually attend ICT refresher courses organized by agencies other than my University	16.95	28.81	40.68	13.56
Should my University organize an ICT training courses within the next 12 months, I will attend it	1.72	3.45	27.59	67.24
Should an agency other than my university organize an ICT training course within the next 12 months, I will attend	1.72	8.62	36.21	53.45
I am willing to incur the costs of undertaking an ICT course that I deem necessary for my work or career	1.72	8.62	50.00	39.66
Average	**13.06**	**29.99**	**33.58**	**23.37**

Table 2 indicates that the majority of the respondents do not get training on ICT courses and their universities do not organize ICT trainings. Almost all (95%) agreed that they would attend training of ICT if it is organized by the University within twelve months, and the majority (90%) would attend if it is organized by other agencies. Most respondents (90%) were willing to incur the cost of undertaking the ICT courses. This shows that there is strong interest from scholars for training and retraining but there is need to provide training opportunities for all staff to multi-skill and up-skill their ICT competence. Teaching and learning in the 21st century require teachers and learners to be ICT competent in order to counter demands and challenges of this era [11]. Such willingness among staff is a big motivation for online learning in Uganda, and a move towards achieving the 21st

century skills.

Existence of ICT guides: Respondents were also asked of what guided the use of ICT in their higher education institutions. Th e majority (41%) revealed that their higher education institutions had guidelines in place, followed by policy (37%) and individual computer laboratory attendants (22%). Figure 6 presents details of key issues addressed by the guide.

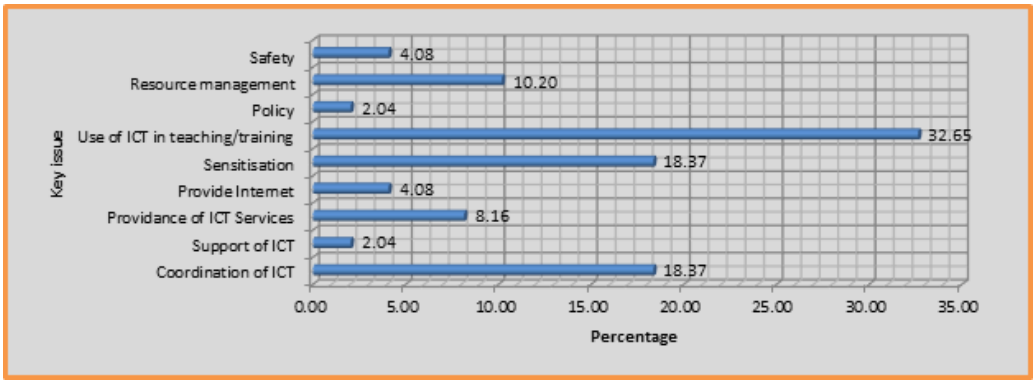

Figure A.6: Key issues addressed by the guide

Opinion on the use of online learning Respondents were required to give their thoughts on the use of online learning environment with regard to expanding curriculum to students, providing remedial courses, increasing class size and flexibility. Analysis using the Likert scale revealed that on average, 86% of the respondents agreed to the statements deducing online learning to be a good strategy to address academic improvement initiatives. This elevates necessity to avail online learning courses by the DELP project in the region.

3.3 Modes of Delivery of Distance Learning in Higher Education Institutions in Uganda

Presence of Distance Education programmes Findings pointed out that 68% of the universities/institutions did not have distance education programs. In the 32% of the universities/institutions where distance education programs were said to run, the delivery mode was mainly through accessing module notes (50%), holding face-to-face sessions (30%), and e-learning sessions (10%). Respondents also exhibited uncertainty about knowledge of the exact numbers of distance education programs at their universities, thereby making it hard to state with assurance the various student populations for each of the distance education programs. This points to the increasing number of distance education programs in many higher education institutions in Uganda. By implication therefore, ICT through distance mode of delivery can be the best option to increase education access in the region.

Content Creator and Method of delivery An investigation into the few uni-

versities/ institutions where distance education programs were in operation revealed that respondents (who were largely academic staff and ICT managers) did not clearly consider themselves as content creators. However, there were a variety of delivery methods with majority (35%) of the respondents asserting that correspondence and multimedia were ways through which created content was delivered. Sixteen percent (16%) declared interactive flexible learning mode as an additional delivery method for created content. Th is can be an indication of the lack of capacity in creating online content for distance education programs.

3.4 ICT Integration in the Teaching and Learning

To date, ICT inclusion is considered an indispensable part of the academic improvement plan for many universitiesinstitutions. In the same way, the survey was interested in establishing the status of ICT inclusion, how important ICT was in impacting on academic programs as well as changing the way students learn, and seeking views of respondents on increased use of ICT in teaching and learning.

ICT inclusion and its impact: Results revealed that 87% of the respondents agreed that ICT inclusion was part of their institutions academic improvement plans backed up by the fact that 98% of the respondents attested to ICT usefulness in their learning processes. Th e usefulness had been in the form of an improved learning environment (46%), information access (19%), research enhancement (14%) and accessibility (9%) among others. Figure 9 below details the importance of ICT usage to the institutions academic programs. What is clear was that some institutions were still inadequately facilitated and in some instances, ICT illiteracy still prevailed (7%).

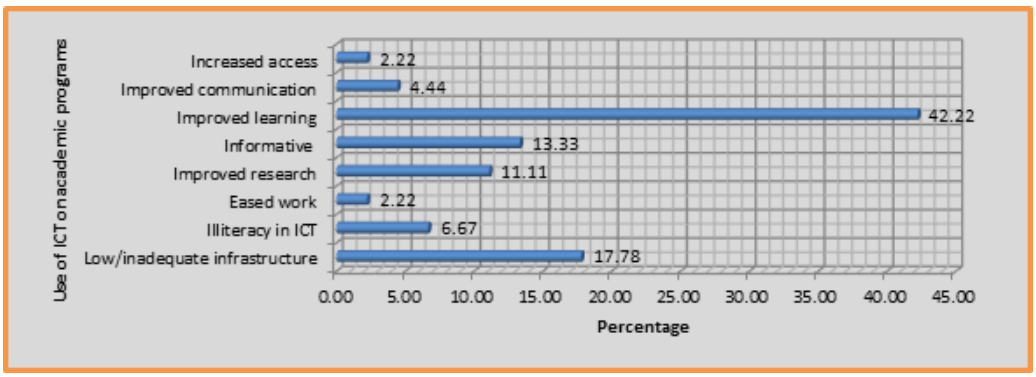

Figure A.7: ICT importance in academic programs and perceived hindrances

ICT was perceived to greatly change the students way of learning through the use of innovative approaches that offered easy learning and teaching in an interactive environment. The Internet was also used to ease research and access to information.

Views on increasing the use of ICT in teaching and learning Respondents agreed to support and increase ICT use in teaching and learning. Th is support was based on the current global trends in ICT and the fact that ICT was a better mode of delivery in enhancing access to more information in a timely manner.

On how ICT would be integrated in the curriculum design, respondents advised that provision of accessible and affordable ICT infrastructure is needed to take center stage. Th is being an ICT era, the need to undertake ICT training and ensure that there is availability of freeaffordable connectivity is paramount.

Th e majority of the respondents (85%) testified how ICT use had changed the way students learn, as well as transformed teaching at their universitiesinstitutions. The respondents further advocated for increased use of ICT in learning and teaching as well as its increased integration in curriculum design as shown in Table 3.

Table A.3: Use of ICT and its impact (survey results)

Use	**Strongly agree**	**Agree**	**Not sure**	**Disagree**	**Strongly disagree**
	%age	**%age**	**%age**	**%age**	**%age**
The use of ICT in the university has changed the way students learn	37.29	38.98	18.64	5.08	0.00
The use of ICT in the university has transformed the way teaching is done	27.27	43.64	20.00	7.27	1.82
There should be increased use of ICT in learning and teaching	71.43	26.79	3.57	0.00	1.79
There should be increased integration of ICT in curriculum design	61.54	34.62	7.69	1.92	1.92
Average	**49.38**	**36.01**	**12.48**	**3.57**	**1.38**

3.5 Awareness of Learning Management System (LMS)

Understanding: Results revealed that while half of the respondents claimed to understand the LMS concept, there was little or no knowledge of which LMSs and course units prevailed in their institutions. Fifty-nine percent (59%) of the respondents portrayed that their institutions had no LMS and this was perceived to be attributed to the absence of adequate ICT facilities, ICT illiteracy and connectivity problems. This points to the lack of streamlined ICT budgeting in such institutions, coupled with no policy adoption regarding ICT use.

Among those who knew and used the LMS, the majority (81%) of the respondents declared that they used it for purposes of accessing notes and coursework (62%), registration (14%), administration (14%) and communication (10%).

Frequency, Mode and Convenience: Eighty-two percent (82%) of the respondents reported to access the LMS anytime on a daily basis during the course of their work. These felt more comfortable to access the LMS during the morning and

afternoon sessions of the day rather than the night.

Challenges: In using the LMS, some of the respondents had faced several challenges with the most established being slow/unpredictable Internet. Other notable challenges were illiteracy levels due to insufficient training, low bandwidth, unstable power supply and poor attitude towards embracing ICT interventions.

Suggestions: Respondents advised that increasing training and refresher courses for students and staff , ICT infrastructure and bandwidth, coupled with provision of Internet and power generators would go a long way in improving the LMS.

3.6 Opportunities for Capacity Building

In order to establish if institutions surveyed had proficiently trained staff, respondents were required to indicate their perception on the role of content development, participation in ICT training, preferred method of training and motivational factors to participate in ICT training.

Using a Likert scale, findings revealed that 71% of the respondents generally agreed that their ICT education staff play roles that cut across disciplinary lines through being content developers, graphic designers, support staff , quality assurance and teaching staff . Few (16%) were in doubt while 13% disagreed. Nonetheless, capacity-building gaps still existed as 64% of the respondents reported the lack of ICT professional capacity building programs. Th is fact is further explained by the high desire of over 90% of respondents to participate in various ICT training courses like ICT skills competence course, Internet and e-mail, use of technology for teaching and learning, e-learning applications and computer aided design. Figure 8 below presents the various levels of desire to participate in ICT training.

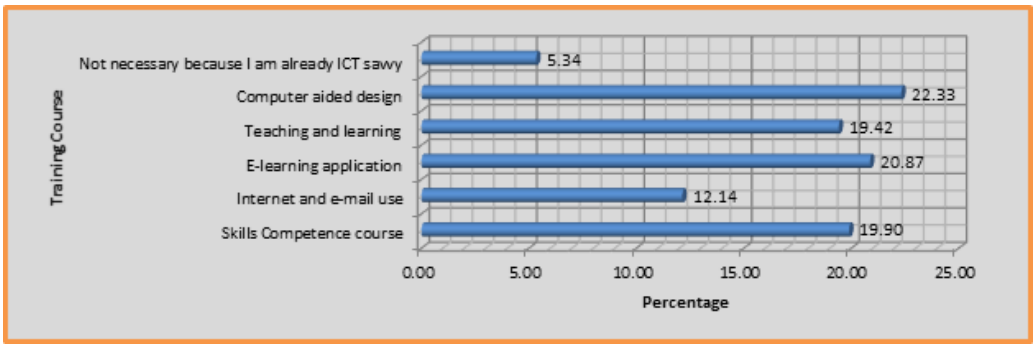

Figure A.8: ICT training courses respondents wished to participate and train

On asking respondents what method of teaching they preferred, results indicated that 39% loved the blended learning approach followed by face-to-face training (25%), workshops/seminars (23%), full online (8%) and lastly distance education (5%). Respondents also mentioned that their motivation to engage in ICT training courses was driven by among others, the desire to learn more, the global village

effect, prior knowledge of ICT basics, relevancy of the course, adequacy of ICT infrastructure and personal interest.

3.7 Challenges and suggestions in the use of ICT in teaching and learning

Under this category, the survey sought to establish the obstacles to online learning in various learning institutions as well as possible ways to improve ICT use in education.

Based on the statements contained in Table 4, respondents were asked to best describe how various obstacles limited the use of online learning.

Table A.4: Obstacles limiting use of online learning

Obstacle	**Strongly agree**	**Agree**	**Not sure**	**Disagree**	**Strongly disagree**
	%age	**%age**	**%age**	**%age**	**%age**
Lack of familiarity with distance learning technologies	45.76	30.51	6.78	8.47	8.47
Appropriateness of course content for a web based course	30.36	37.50	19.64	12.50	0.00
Lack of technical support	42.59	33.33	11.11	9.26	3.70
Time to develop course	16.67	38.89	11.11	31.48	1.85
Intellectual property issues	17.31	28.85	21.15	30.77	1.92
Time commitment compared to traditional lecture course	32.08	37.74	9.43	15.09	5.66
Lack of encouragement by administrators	33.93	26.79	10.71	19.64	8.93
Lack of appropriate hardware	35.09	38.60	7.02	15.79	3.51
Lack of appropriate software	35.09	38.60	5.26	19.30	1.75
Don't know how to grade	20.69	10.34	24.14	27.59	17.24
Average	**30.96**	**32.11**	**12.64**	**18.99**	**5.30**

Table 4 shows that 63 of the respondents agreed to the statements therein while 24% disagreed and 12% were not sure. Other striking obstacles mentioned included inadequacy of ICT infrastructure, slow network, limited time, the high costs involved, illiteracy as well as absence of adequate numbers of trainers.

On the question of how to address these hurdles, respondents suggested to improve ICT infrastructure to adequate standards, regularly improve on the Internet connectivity, develop a policy for online learning, incorporate ICT in schools curriculum, and avail ICT training for all staff . Structures to sensitize and mobilize masses need to be developed if the use of ICT in education is to be improved.

4 DISCUSSION

This section describes the key findings for enhancing online learning in Uganda. This discussion connects to the DELP projects aim of transforming first generation distance learning into 4th and 5th generation distance learning. The following are

the key issues that need to be addressed for effective use of ICT in teaching and learning processes.

Institutionalizing 4th and 5th generation distance learning. Th e demand for higher education in most developing countries exceeds what educational provisions can provide. This is witnessed by the high numbers of applicants joining university education [7]. Distance learning can off er possibilities to support the overwhelming numbers of students.

However, the current state of affairs puts distance learning in a very difficult position to operate. Th ere are no policies that can help the operationalization of distance learning in these higher education institutions. Th e higher education institutions in Uganda not only lack distance learning policies but also lack policies on ICT which are key to the operation of 4th and 5th generation distance learning mode. Th ere is need for other policies in the university to have special recognition of distance learning. For example, by promoting policies of distance learning, practitioners and developers of distance learning content could solve the current demand for higher education amid limited infrastructure.

Connectivity. For online learning to be effective, there is need for constant and good connection to the Internet. Currently there is little done in terms of connectivity infrastructures and bandwidth. Higher education institutions should invest in connectivity infrastructure and bandwidth. Makerere University has secured funding to work in this direction of improving the infrastructure, although more focus is needed for maintenance of these infrastructures.

Staff development. Online learning needs well-trained staff in the provisions of the online learning environments. Th ere is need to train technical, administrative and academic staff in the provision of online learning in Uganda. Higher education institutions should provide funding for these trainings.

Learning management system. Th ere is need to introduce units that manage the learning management systems. Many of the institutions do not have these units and those with the units are not well positioned in institutions established structures.

ICT integration into teaching and learning. Th ere is need to systematically integrate ICT into the teaching and learning in higher education institutions. Staff need training in the provisioning of ICT into teaching and learning. ICT contextual considerations should be emphasized to avoid moving with the hype that might not work in the Ugandan context. Th ere is need to develop appropriate tools to support collaborative work of learners considering their ICT context.

Academic staff motivation. Th e survey shows that academic staff s are highly motivated regarding the integration of ICT in teaching and learning. Th is was

shown in the survey where 86% of the respondents agreed that online learning would be a good strategy for the current and future academic initiatives. Th is is an interesting trend that we need to exploit in integrating online learning in the higher education institutions in Uganda.

Th e present integration is ad hoc, while integration of ICT in pedagogical processes requires adequate planning and rethinking for cognitive development to occur in any mode of delivery including distance learning.

5 Summary and Conclusion

Online learning and its integration into the teaching and learning curriculum is very much rooted in the constructivist school of thought, where learners active participation is emphasized. It is presumed that learners are active contributors of knowledge and help in creating and designing instructional artifacts that aid learning. From the needs assessment survey, active participation in ICT integration in teaching and learning processes was minimal in most universities. And yet, if such integration is not well streamlined, online learning in Uganda will remain a dream. Inadequate levels of ICT infrastructure, poor or no Internet connectivity, high illiteracy levels, absence of adequate numbers of ICT trainers, limited financial resources allocated to ICT in teaching and learning, and financial resource limitations are the most striking challenges pointed out by the survey. Considerable efforts should therefore be geared towards addressing these challenges so as to partake in online learning benefits.

Educational technology specialists believe that the use of technology in education is increasingly being perceived as a major catalyst in changing the way universities perform their core functions [9, 12, 13]). Universities in Uganda need to fast track the change in teaching styles, change in students approaches to learning and change in the way information and educational materials are accessed.

Universities therefore have the duty to guarantee an academic culture that promotes the use of ICT in teaching and learning. Th is process calls for increased ICT training to fight ICT illiteracy, creation of distance education programs, break away from the traditional chalk and talk method of teaching to a more blended online method that would facilitate ICT integration into instruction and learning.

Th e survey findings confirm that the DELP project is timely and essential for Makerere University. Among other activities, the project will develop online courses, increase staff competences through training and refresher courses (lecturers and ICT support team), update ICT equipment, as well as facilitate policy development in ICT and distance learning in the University. All these will contribute to a

better learning in higher education institutions. Because the DELP project is scaling to meet many educational needs of youths and adults, availing distance education programmes will help many multi-skill and up-skill to meet the global educational demands and work towards achieving broader 21st century skills.

6 ACKNOWLEDGMENTS

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Paper B

Title: Supporting Learning Groups in Online Learning Environment.

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Supporting Learning Groups in Online Learning Environment

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Abstract — **In this paper, we report on the initial findings on how to effectively support learning groups in online learning environments. Based on the idea that learning groups can enhance effective learning in online learning environments, we used qualitative research methods to study learning groups (interviews and observation of learning group interactions in online learning environments) and their facilitators. Preliminary results reveal that in order to have effective learning groups you need to take care of the following online design issues: develop comprehensive study guides, train online tutors, motivate learners through feedback, and foster high cognitive levels of interaction through questioning, rubrics, and peer assessment. We conclude that well thought through online learning group with appropriate questioning and feedback from facilitators and online tutors can enhance meaningful interaction and learning.**

Keywords—Online Learning, Learning Groups, Distance Learning, Collaborative Learning.

1 INTRODUCTION

The high rate of population growth in Uganda has increased demand for higher education. The demand is not commensurate with the number of higher education institutions and corresponding infrastructure in Uganda. Distance learning can cater for the increased demand for higher education. Distance learning is a mode of study where students have minimal face-to-face contact with their facilitators; the learners learn on their own, away from the institutions, most of the time. Distance learning in Uganda is dominated by the first generation model which is characterised by blending print study materials with occasional face-to-face sessions. Learners are given hard copy self-instructional study materials and regularly attend two-week face-to-face sessions at the university twice each semester. At most times, the students study independently from their workplaces or homes, using the print materials. Despite using this learning model, distance learning practitioners use learning group

activities such as group assignments to enhance collaborative and cooperative learning. In distance learning, learning group activities can be achieved if learners are compelled to come together physically or some form of ICTs are used to virtually connect group members to learn collaboratively.

Collaborative learning hinges on the belief that knowledge is socially constructed although each learner has control over his/her own learning. Collaborative learning is underpinned by the social constructivist learning theory [1]. The proliferation of ICT in teaching and learning has created new possibilities for supporting collaborative and cooperative learning in distance learning [2]. Learning groups have been preferred for propelling interaction and learning. Vygotsky [1] argues that a persons learning may be enhanced through engagement with others. Use of computer supported collaborative learning can offer possibilities of students interactions. Because many distance learners are working adults who are not colocated, computer supported collaborative learning can offer possibilities for effective online learning groups. However, motivating and sustaining effective student interactions is not easy to achieve. That requires planning, coordination and implementation of curriculum, pedagogy and technology [3].

In cooperative online learning, learners share a common knowledge pool for accomplishing individual assignments [2].

Learning groups have been advocated for increasing interaction in the learning process [4]. These have been widely used in distance learning to enhance learning. They do this by giving group assignments to help in the initiation of learning groups. However, in first generation distance learning, the difficulty of co-locating students comes with the difficulty of determining participation of each group member in the group assignment. It is common to find group assignments contributed to by few group members and the remaining members attaching their names on the assignment. This hinders meaningful interaction which is a pre-cursor for meaningful learning. Lack of meaningful learning is the number one cause for high failure and dropout rates in first generation distance learning [5]. Fifth generation distance learning is praised for introducing virtual interaction and collaborative or cooperative learning amongst distance learners. It is our intention to find out how to make students more effective in online learning groups. We want to propose a model for effective online learning groups. Based on this model, a human-centred design process can be applied to develop an interactive system that supports effective online learning groups.

Section 2 of this paper reviews the literature defining and analysing collaborative learning, interaction processes in online learning groups, and interaction analysis

in online learning environments. In section 3, we present the research directions and our research methods. Section 4 presents the preliminary results of our work. Finally, the paper is summarised in section 5.

2 Literature Review

2.1 Collaborative Learning

Collaborative learning refers to instructional methods that encourage students to work together to find a common solution for a given task [6]. Collaborative learning involves joint intellectual effort by groups of students who are mutually searching for meanings, understanding or solutions through negotiation [3, 7]. This is what should happen in effective learning groups. This approach is learner-centred rather than teacher-centred; views knowledge as a social construct, facilitated by peer interaction, evaluation and cooperation; and learning as not only active but interactive [1, 8]. Anderson in his online learning framework argues that learning can happen through student-teacher; student-student; student-content interactions [9]. Stahl, Koschmann [3] also asserts that learning takes place through student-student interactions. Ludvigsen and Morch [10] found out that students effectively develop deep learning when supported by computer supported collaborative learning. Therefore, fourth and fifth generation distance learning can enable student-student interaction. Careful integration of computer supported interaction can play a big role in increasing interaction among distance learners using learning groups.

Collaborative learning is based on consensus building through interaction by group members, in contrast to competition. This can be very helpful for distance learners, who are typically adults. Educational Psychologists influenced by Vygotsky [1] claim that students working in small groups can share and evaluate ideas, and develop their critical thinking [11–14]. Collaborative activities are essential to encourage information sharing, knowledge acquisition, and skill development [15]. Different technology tools have been adopted for collaboration in distance learning. This points to the need to systematically integrate technology into supporting learning groups for deep and meaningful learning.

2.2 Interaction Processes in Online Learning Groups

Dascalu, Bodea [16] argue that to have effective discussion groups we need to have a friendly environment where students feel free and comfortable enough to express their ideas. The characteristics that bring success of groups is categorized into personal and organizational attributes [17]. Personal attributes comprise learners trust, learners self-awareness, learners motivation, learners commitment, and learners willingness to share experiences. Organisational attributes comprise group size,

similarity of learners experience (age) or status, learners geographical proximity, agreed clear aims and ground rules, flexibility to tailor a group to learners needs, non-hierarchical structures, autonomy from external authorities, planning ahead, clarity of decision making and regular review and feedback [17]. Learners motivation is a key attribute in encouraging interaction in learning groups.

Use of marks to motivate students has been widely used in online learning environments. Marks encourage students to contribute in online discussion forums. However, Bullen [18]; Palmer, Holt [19] believe that marks do not help to develop higher order thinking skills in Blooms Taxonomy. Once a student submits the mandatory posts or comments and is certain that s/he has scored the required marks, s/he is not obliged to contribute any further. Online facilitators have used guidelines of setting number of posts as a way of encouraging students to participate in online learning groups. However, Murphy and Coleman [20] found that the quality of the discussion declined when students were forced by the course requirement to post messages in relation to a number of posting. The facilitator should supplement this with feedback that mediates learning. In learner-centred approaches the facilitators should minimally contribute in the online learning groups. The minimum contributions should be strategic in assisting learning. Unfortunately, learners would prefer the facilitator to give constant feedback. However, Arend [21] found out that in forums that exhibited lower level of critical thinking, the instructors were very active in the online discussions, sometimes responding to nearly every student post. Jones [22] found out that if students are introduced to topics that interest them, they are more likely to be motivated to contribute in the learning groups. Asking students to peer review one anothers work can help increase deep interaction in online learning environments. Peer facilitation motivated learners to contribute in online discussions [17]. This is more common in the massive open online courses (MOOC) where class sizes are enormous and based on the community of practice theory as is espoused in Wenger [23].

2.3 Interaction Analysis in Online Learning Environment

Quantitative methods cannot be solely depended on in analysing the quality of interactions in online learning groups. However, they may help in trying to create a ground for deeper content analysis by directing you to the specific group to look at in detail. Fugelli, Lahn [24] used both social network analysis (SNA) and content analysis where SNA helped them to know the peripheral and nucleus participants in the community of practice. During the content analysis they picked peripheral groups and nucleus groups for further study. During an online class environment SNA can provide a quick understanding of the status of the learning groups. This

can help give the facilitators prompt information on status so that the facilitator can intervene appropriately. The facilitators intervention can help to assist learning or motivate learners to interact through questioning and feedback. However, the introduction of interaction analysis in analysing the quality of interactions has seen deeper understanding of the learners interactions [25]. Gunawardena, Lowe [26] developed an interaction analysis model used in collaborative learning. This model was developed to help in assessing the critical thinking, social and cognitive presence, problem solving, emotion expression and knowledge construction. Interaction analysis can help both the learners and facilitators to improve the quality of interactions and activities respectively. It was developed with different phases of knowledge construction and with more emphasis on a qualitative approach. This can easily be achieved through learning groups since learners can construct their own learning. Research into interaction analysis has revealed that teachers who do not provoke learners into the high cognitive levels will end at the lower levels of Blooms taxonomy [26].

3 Research Directions and Methods

In order to answer the overall question on how to effectively support learning groups in online environments, we focus on three research areas: effectiveness of learning groups, processes of effective learning groups and tools for supporting effective learning groups. We want to answer the following research questions.

- What are the characteristics of an effective learning group?
- How to form effective learning groups?
- How can effective learning groups be sustained in online learning environment?
- What principles can guide the creation of a model of effective online learning groups?
- How can the learning group support model measure to the quality standards of an effective online learning group?
- What tools should be used for effective online learning groups.

These research questions will be answered through the following research directions.

3.1 Effectiveness of Learning Groups

This research direction seeks to understand the characteristics of an effective online learning group. This can be done keeping in mind the three sub directions: motivation, interaction sustainability, and interaction levels. To achieve these directions we shall seek to understand the teaching and learning methods that the facilitator should use to have an effective online learning group. We shall then be able to identify the interventions which the facilitators should do to: motivate learners interactions, sustain learners interactions and have high level cognitive learners interactions as mentioned in Blooms taxonomy [27].

To achieve this, we shall do theoretical studies to get comprehensive understanding on how to measure effectiveness of learning groups. However, we shall further collect data from online facilitators from the University of Agder to learn the best practices in use for effective online learning groups. In the light of what precedes, we shall develop guidelines to inform the quality of learning groups. This research direction will be aimed at answering what is an effective learning group.

3.2 Processes of Effective Online Learning Groups

This research direction seeks to understand the formation and operation processes of an effective online learning group. Effective learning groups can be influenced at both the formational and operational level. Therefore, we shall seek to establish the processes that inform the formation and operation of effective online learning groups. This will guide us in establishing the actions taken by both the learners and facilitators to ensure an effective online learning group. These actions can be looked at with the following three dimensions in mind: motivation, sustainability and level of interaction.

To alleviate this problem, we propose to establish the actions by stakeholders that lead to formation and operation of effective online learning groups. We shall follow selected courses at both the University of Agder and Makerere University with the aim of establishing the formational and operational processes in effective online learning groups. We shall use the following methods of data collection: interview the facilitators of the selected courses, observe the learners in both face to face and online learning groups, collect data from learners through both interview and questionnaires, and use interaction analysis to establish the levels of interactions from the data interaction logs of the online learning groups. This will guide us to get the actions required for both facilitators and learners for effective online learning groups. With this information we shall then design scenarios for the processes for formation and operation of learning groups for both face-to-face and online. These scenarios will then be discussed with the learners in a focus group discussion in

order to validate it and come up with the most comprehensive scenarios. However, we shall also engage with the facilitators through interviews to understand their roles in the formation and operation of learning groups. This will be centred on the activities the facilitator gives in a course. By comparing with existing frameworks, theories or models, we shall be able to suggest the most befitting characteristics for effective learning groups, differentiating clearly effective processes by the learners and facilitators. This research direction will be aimed at answering two questions: how to form effective online learning groups and how to keep the quality of the operation of effective online learning groups.

3.3 Tools for Supporting Effective Online Learning Groups in eLearning

This research direction will seek to design a model which will inform development of ICT based tools for supporting effective online learning groups. The scenarios developed in the direction above will critically be analysed to inform the development of a model for effective online learning groups. We shall then develop a proof of concept (POC) interactive system to be used in the evaluation of the model. The human-centred design process will be applied to design an appropriate system for effective online learning groups. This research direction will be aimed at answering three questions: what principles will guide the design of tools to support effective online learning groups, how the developed model measure to the quality standards of an effective online learning group and what tools should be used for effective online learning groups.

3.4 Methods

Qualitative methods were used in the data collection and analysis. Those consist of semi-structured interviews and tutors observations of students activities in the Learning Management System (LMS) for earlier courses. The respondents were Qualitative methods were used in the data collection and analysis. Those consist of semi-structured interviews and tutors observations of students activities in the Learning Management System (LMS) for earlier courses. The respondents were purposively selected from experienced online facilitators at the University of Agder who use learning groups in their courses. We conducted a one-hour interview with each of the facilitators to find out their experiences in effectively handling online learning groups. Each interview was transcribed immediately and informed the researcher in the next interview. The transcriptions were then analysed by categorising them into themes from which empirical meaning was derived. A similar research approach shall be adopted in the main study at Makerere University beginning August 2015. Preliminary results/themes from the University of Agder are described and discussed in the next section.

4 Preliminary Results and Discussion

These are results of a study on best practices for effective online learning groups at the University of Agder. These results will be used in formulating the hypothesis that guides subsequent parts of the research. The findings fall into five categories shown in Figure 1.

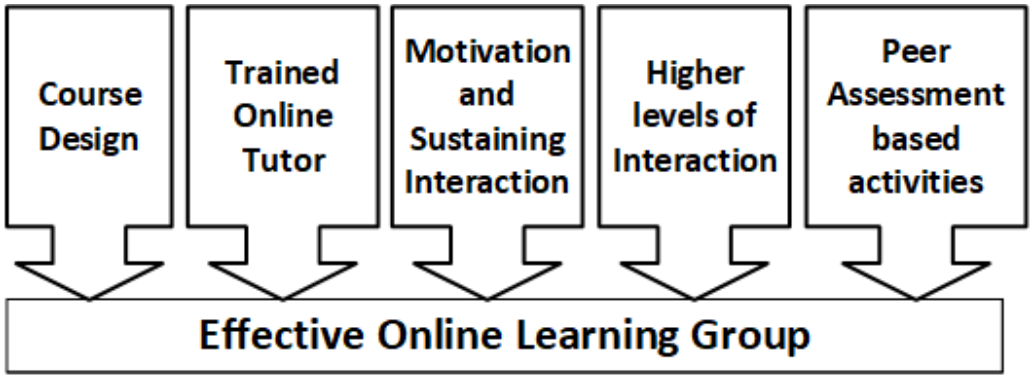

Figure B.1: Salient elements in making effective learning groups.

4.1 Course Design

The online course facilitators stressed that there is need for comprehensive study guide and trained online tutors in order to have an effective online course. The necessity of trained online tutors indicates the need for mediation of learning in online courses. For mediation to occur there is a need to read and give appropriate feedback of questioning that assist learning. The study guide should include the detailed required activities with corresponding needed resources. These resources can range from ICT resources, library resources, etc. The LMS facilitators further suggested that for online tutors to be effective each tutor should be assigned not more than 25 learners. However, this is in contrast with the MOOC phenomenon which emphasises that the more knowledgeable peers will scaffold the others in a community of practice environment [23]. This gives an indication about the need to mediate, guide, scaffold and assist learning for meaningful learning in groups. In one of our papers, where learners were using Facebook as means to mediate interaction and learning, learners felt that they needed the presence of facilitator [28]. If you chose to use tutors in a MOOC, the cost will not be manageable since MOOCs are free and yet online tutors have to be paid.

4.2 Trained Online Tutors

Online tutors are trained to give appropriate feedback and questioning that assist learning groups. Online tutor forms learning groups with five students per group.

The emphasis is put on heterogeneous learning groups. The reason for heterogeneous learning groups was to get different experiential perspectives from different contexts. This was because learners were taking a course in global studies. However, there is need to understand how heterogeneity affects learning. In each group activity one student is selected by the tutor to become the weaver of the group. A weaver is a peer facilitator or group leader. His/her role is to direct the discussion and summarise at the end. This can help the group to have a sense of being together since the peer is the one directing the discussions and students will feel free to participate or interact. Nevertheless, online tutors and facilitators watch closely the interactions and can advise whenever needed.

4.3 Motivation and Sustaining Interactions

The online facilitators motivate learners through allocating marks on the participation in group activities. For LMS the number of students is relatively small compared to MOOCs. Facilitators give clear rubric on how marks will be assigned with emphasis on letting the learners know the type of interaction which will give them more marks. This is followed during the grading where the online tutor categorizes and reads all the contribution and awards marks on the quality of participation. In limited participation courses, each online tutor is allocated a maximum of 25 students. That gives possibility to read and grade all comments. The facilitators also said that they motivated learners by giving feedback which encouraged additional participation within the groups. However, this contrasts the MOOC where marks do not make a lot of meaning to the learners. Motivating learners through giving feedback in MOOC can be very challenging since the class size is usually enormous. However, MOOCs have seen the use of badges to motivate the learners.

4.4 High Levels of Interaction

In order to develop high order cognitive skills through interaction, the online tutor and facilitator apply questioning as a method of assisting learning. Questioning is a method that assists cognitive levels of learning although facilitators may confuse assessment questions with assistive questions. Assessment questions are aimed at finding out the ability of the learner to perform without assistance, whereas assistive questions are used to provoke the thinking of the learner to the level s/he would not have attained by himself/herself [29]. The tutors are trained in how to handle this. That systematic questioning provokes the learner to read deep in the literature and start giving their own opinion based on literature. They also use feedback that is aimed at encouraging interaction among the students. Some examples of feedback given by the facilitator include; that is a wonderful contribution, that is a good approach, fantastic knowledge, reading Ethans contribution can reinforce your good

thought, etc. At some point when a particular student is not participating, the tutor will politely ask other students to find out if s/he has some problems. Sometimes, the tutor will follow up the missing student with a call and/or an email. This can be very complicated in a MOOC environment because there are very many learners.

4.5 Peer Assessment based Activities

The MOOC facilitator emphasised the use of peer assessment as a way of motivating learners to contribute in learning groups. The MOOC course unit was facilitated by five facilitators and observers. The course setting involves group work and each group is restricted to a maximum of 5 members. Unlike in the limited participation online courses, groups in MOOC are created by the learners themselves. In every module students do a group assignment and submit as a group submission. After that, each student is supposed to submit an individual assignment from his/her context. However, the students are encouraged to interact with one another during the making of the individual assignment. At the end of the module each student is required to peer assess five individual assignments. That means each students work is peer assessed five times. Because of the large number of students the facilitator is not able to effectively apply questioning and feedback as a way of assisting learning. However, he is able to check on some groups.

5 Summary

Online learning groups can help foster meaningful learning. This is supported by the literature on collaborative learning and we discussed how it can work effectively. We have presented preliminary findings on the best practices for effective online learning groups from the University of Agder. The main elements to be considered include course design, the availability of trained online tutors, learners motivation and sustaining interaction, development of high levels of interaction, and peer assessment based activities. It was found that there is need to provide a comprehensive study guide and online tutors with a ratio of 25 learners per tutor. Effective learning groups can be achieved with appropriate intervention from the facilitators through questioning and feedback to assist learning in the online learning environment. This shows that scaffolding and guidance are propellers to meaningful learning within online learning groups. However, there should be a mechanism to automatically inform online facilitators whenever the learning groups are in critical states that need intervention.

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Paper C

Title:	Peer Assessment Based Assignment to Enhance Interactions in Online Learning Groups
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Peer Assessment Based Assignment to Enhance Interactions in Online Learning Groups

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***Abstract* — In this paper, we report on the findings from our PhD work on how peer assessment based assignment method can enhance interaction in online learning groups.The method is explored and tried out on the research methods course on the Bachelor of Commerce Programme which is run in distance learning mode at Makerere University. Based on the idea that learning groups can enhance effective learning in online learning environments, we used the affordance eLearning framework to design the peer assessment based assignment task and then qualitative methods collect and report on data. The results reveal that there was increased interaction through peer feedback. Students were motivated because of the marks that the assignment carried. The quality of the final submission improved. The quality of peer feedback improved through the interactions. We conclude that peer assessment based assignment can increase interaction and easily help in monitoring individual students participation in the online learning groups. Since each group receives at least five peer feedbacks then the interaction is quality assured.**

Keywords—Learning groups; Peer assessement; Facebook.

I. Introduction

The high rate of population growth in Uganda has increased demand for higher education. The demand is not commensurate with the number of higher education institutions and corresponding infrastructure in Uganda. Distance learning can cater for the increased demand for higher education. Distance learning is a mode of study where students have minimal face-to-face contact with their facilitators; the learners learn on their own, away from the institutions, most of the time. Distance learning in Uganda is dominated by the first generation model which is characterized by blending print study materials with occasional face-to-face sessions. Learners are given hard copy self-instructional study materials and regularly attend two-weeks face-to-face sessions at the university twice each semester. At most times, the students

study independently from their workplaces or homes, using the print materials. Despite using this learning model, distance learning practitioners use learning group activities such as group assignments to enhance collaborative and cooperative learning. In distance learning, learning group activities can be achieved if learners are compelled to come together physically or some form of ICTs are used to virtually connect group members to learn collaboratively.

Collaborative learning hinges on the belief that knowledge is socially constructed although each learner has control over his/her own learning. The proliferation of ICT in teaching and learning has created new possibilities for supporting collaborative and cooperative learning in distance learning [1]. Learning groups have been preferred for propelling interaction and learning. Vygotsky [2] argues that a persons learning may be enhanced through engagement with others. Because many distance learners are working adults who are not co-located, computer supported collaborative learning can offer possibilities for effective online learning groups. However, motivating and sustaining effective student interactions is not easy to achieve. That requires planning, coordination and implementation of curriculum, pedagogy and technology [3].

Learning groups have been widely used in distance learning to enhance learning. They do this by giving group assignments to help in the initiation of learning groups. However, there are challenges of co-locating students and participation of each group member in the group assignment. This brings about some students not participating on the group assignment but their names are attached. This brings about high failure rates at the end during summative assessment, since many students did not engage with the course materials to do the group assignment [4].Given the rich experience and knowledge from the individual learners, those who do not participate, fail to harness the benefits of the rich learning experiences from group members. Therefore, effective ways of engaging learners online can offer possibilities of enhanced interactions among students in learning groups. This study was carried out among students on the business research methods course offered through distance education at Makerere University on the Bachelor of Commerce external programme. Our educational goal was to increase interaction in learning groups of distance learning students studying business research methods. The research question we answered was how to increase interaction of students during online learning group process? Interaction is usually encouraged so as increase learners engagement when completing group assignments.

The rest of this paper is organized in four more sections. Section 2 of this paper reviews the literature defining and analyzing collaborative learning. In section 3,

we present the approaches and our research methods. Section 4 presents the results of our work. Finally, the paper is concluded in section 5.

II. Literature

A. Collaborative Learning

Collaborative learning refers to instructional methods that encourage students to work together to find a common solution for a given task [5]. Collaborative learning involves effort by groups of students who are mutually searching for meanings, understanding or solutions through negotiation [3,6]. Collaborative learning occurs where there are interactions. Anderson in his online learning framework argues that for meaningful learning to happen, there must be student-teacher; student-student and student-content interactions [7]. Stahl, Koschmann [3] also asserts that learning takes place through student-student interactions. Ludvigsen and Mrch [8] found out that students effectively develop deep learning when supported by computer supported collaborative learning. Therefore, use of peer assessment based assignment in computer supported distance learning can enable student-student interactions.

Collaborative learning is based on consensus building through interaction by group members, in contrast to competition. Collaborative activities are essential to encourage information sharing, knowledge acquisition, and skill development [9]. This set up of peer assessment based assignment can enhance interactions in online learning groups hence meaningful learning.

III. Approaches and Methods

A. Introduction

We used the affordance eLearning framework [10] to determine the task/activity and match the affordances requirement of the task to the available affordances of the tool. This helped us to design an appropriate eLearning task/activity. The study was among students of business research methods course. The class size was 46 students. The class was divided into five groups. Each group was asked to search and identify a journal paper on research methods of 8 to 12 pages and then submit it to the facilitator for approval. Once the paper was approved, it was uploaded in the Facebook research methods course group area. Each group was required to critically discuss the methodology used, identify gaps and suggest possibilities with references. Each group was required to collaboratively work together and post one page of their findings on their group area. The group submission was submitted as a comment on the uploaded journal paper for the group. Thereafter each student provided comments for at least five other group submissions. Once comments were

made, the group members reconvened and used the comments provided to improve their submission and resubmit the final version. The final submission was sent by e-mail to the facilitator. Each student earned marks for commenting on the five group submissions from other groups. Each group also earned a group mark for the final and preliminary submissions made by the group. However, students were encouraged to give more comments or react to the comments from their peers. This activity was done for two weeks. Qualitative methods (structured interviews and observation) were used to evaluate the learning approach used. Data was analyzed through transcriptions and categorization to understand the effectiveness of learning group processes. The learning group interactions were analyzed using interaction analyses [7] and affordance eLearning framework methodology [10]. In the next section we undertake an affordance analysis of the task (providing solutions to a group assignment) and its requirements. However an understanding of the affordance analysis methodology is vital.

B. Affordance analysis e-Learning design methodology

The affordances analysis e-Learning design methodology framework illustrates how learning tasks can be matched to learning technologies. Figure 1 below shows this framework. From Figure 1 above, we describe the steps below in coming up with

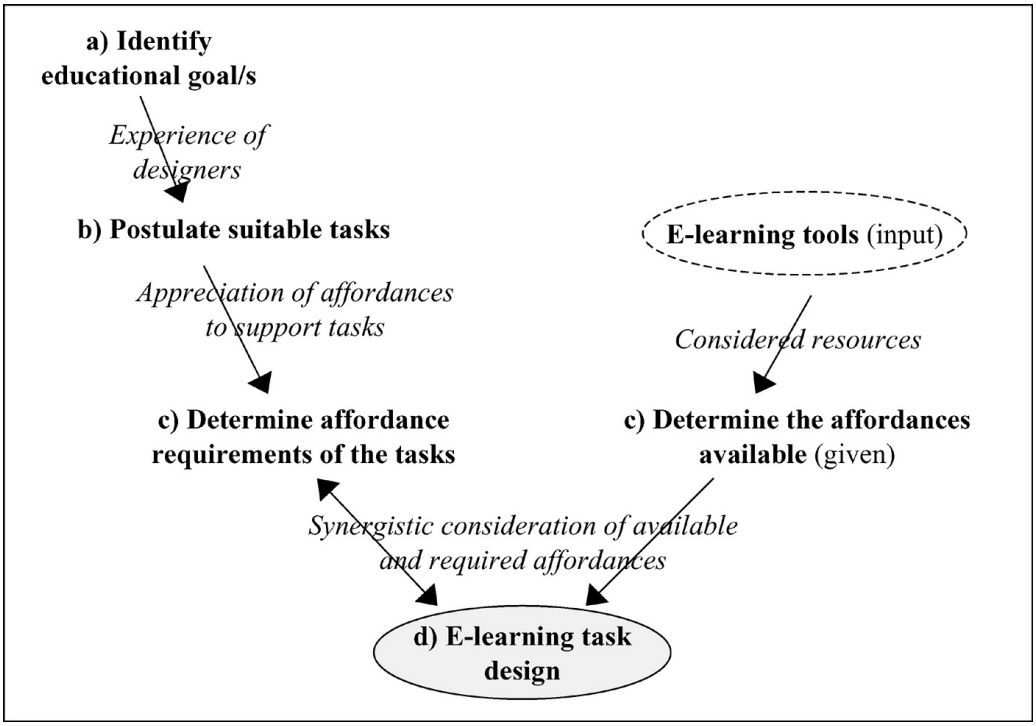

Figure C.1: The affordance analysis e-Learning design methodology matching tasks with technologies to construct e-Learning designs.

the e-learning task design.

Initially we start by identifying the educational goal. In this paper, our educational goal was to enhance interactions among students in the learning groups. The educational challenge was non participation by individual group members in group assignments. Usually, a few do the group assignment and just include other members names. This deters meaningful learning since many students do not participate in the group assignments.

Secondly, we postulate suitable learning tasks from the experiences of the designer you come up with the task which is in line with the educational goal of enhanced interaction.

Thirdly, we determine the affordance requirements of the tasks. Here we basically come up with requirements which will support the task.

Forth, we determine the affordances available depending on the technologies available establish affordances of the technologies. This helps in contextualizing the available technology to be used for the task.

Finally, we come up with e-learning task design by matching the affordances of the task and tool and come up with an elearning task design. Each media type has its strengths and weaknesses. Using the media whose affordances mismatch the intended learning task can be frustrating to the learners [11].

C. Task

Students were required to form groups of 8 using their earlier groups or based on the regions were they came from the groups were self-created. In groups of 8 students, each group was required to identify a business related research methodology journal paper and submit to the facilitator for approval. Once the facilitator approved the paper, it was uploaded on the Facebook group page which was created by the facilitator of the course. A group was required to critically discuss the methodology used, identifying gaps and suggesting possibilities with references. It was a requirement that each group writes one post of one page on the Facebook group page after 5 days of the commencement of the task and each student was required to critically comment on any other 5 groups post. Finally, the group leader was required to submit the final two paged essay by email to the course facilitator based on the inputs and from the comments. The group assignment contributed 15% of the final course mark. Each student earned marks for commenting on the five group submissions from other groups. The group also earned a group mark for the final and preliminary submissions made by the group. However, students were encouraged to give more comments or react to the comments from their peers. Individual students earned marks for peer feedback contributed 5%, students earned group mark of preliminary submission 5% and final submission 5%. For this course unit, this group

assignment contributed 15% of the final mark. They also completed a test which contributed 15%. The test score (15%) plus the group assignment score (15%) contributed 30% as a continuous assessment mark. The final examination assessment carried 70% which was then added to the 30% from the continuous assessment to give 100%.

D. Affordance requirements of the task and tool

Using Bower's [10] affordances analysis framework discussed in this paper, Table 1 below is illustrates the different affordances of the requirement of task considering the educational goal. In order for students to be able to do this task, text read-ability and write-ability was essential. Viewability and draw-ability affordances were required when students needed to represent information in picture form. Listen-ability, speak-ability, watch-ability, video-produceability were not very important for this task. Also resize-ability and move-ability were not required since resizing and moving of objects was not a requirement for the task. Accessibility was important since the learners were distributed across the country and there was need to access content from anywhere and anytime. Playback-ability, record-ability, combine-ability and integrate-ability were not required to do the task. Synchronous-ability was required since synchronous and asynchronous learning was required for the task. Browse-ability, searchability, data-manipulation-ability, link-ability, highlight-ability, focus-ability, permission-ability, share-ability were required for the task. The summary of the affordances that applied to the task are illustrated in the Table 1 below where the shaded area shows the applicable affordances of the requirements of the task which were in line with the educational goal of interaction. We also have the shaded part on the column of technology affordances for Facebook. The rest of the affordances of the requirements of task are afforded by the tool apart from drawability, data-manipulation-ability and highlight-ability. Since many of the required affordances of the task were also afforded by the tool, then Facebook was the right tool matching with the educational goal.

The affordance requirement of the above task was to enhance interactions among learners in the learning groups. The affordance of the requirements of the tool was that it enabled students to interact in the context of low bandwidth tools. Given that Facebook could be accessed using mobile phones and over 98% of students had mobile phones [12–14], it was singled out as the number one tool to use in the experiment. This gave the students the possibility of accessing learning resources from anywhere and anytime allowing the students to access Facebook even if they were distributed across the country in places were Internet connectivity was not forthcoming. Also, Facebook was not bandwidth hungry. Further, learners that were

Table C.1: Showing the affordances of the task requirements and affordances of the tool

		Task Affordances	Technology Affordances
Affordances of the requirements of the task		Enhancing Interaction	Facebook
read-ability	Text		
view-ability	Images		
listen-ability	Audio		
watch-ability	video		
write-ability	Text		
draw-ability	Images		
speak-ability	Audio		
video-produce-ability	video		
resize-ability	Increase and reduce size of elements		
move-ability	Moving elements from one place to another		
playback-ability	Played back		
accessibility	Any time any where		
record-ability	Recording		
synchronous-ability	Synchronous versus asynchronous		
browse-ability	Move back and forward		
search-ability	Searching		
data-manipulation-ability	Sort and sequence		
link-ability	Connecting to other pages		
highlight-ability	Highlight aspects of a resources		
focus-ability	Direct attention of text		
combine-ability	Combining tools together		
integrate-ability	Integrating		
permission-ability	Capacity to allow or deny		
share-ability	Collaboration-one-one, one-many, many-many		

employed could access Face book through their organizations Internet facilities.

Two months into the online learning group activity, the course was evaluated. Findings are presented and discussed in the section that follows.

IV. Findings and Discussions

This section presents and discusses the findings of the set up used during the online group activity. The findings are presented in five sections - i) enhanced engagement with course literature, ii) motivation, iii) improved quality of peer feedback, iv) improved quality of submission and v) enhanced interactions. Findings are presented using interview and interaction excerpts.

A. Learning group setup

This illustrates the group set up used in this study. Figure 2 shows the learning group mechanisms that guided our peer assessment based activity. The initial submission shows what the group does and submits before getting peer feedback. Peer feedback is received from individual students from other groups. The final submission uses the inputs from the initial submissions and peer feedbacks as shown in the blue arrows pointing to the final submission.

B. Enhanced engagement with course literature

This setup helped to engage the learners to participate with the course literature. This was realized because of the connection between the assignments and course materials. This worked appropriately since the facilitator had already given a presentation about the methodology module in the course. Since the step was made around the course literature, the feedback prompted the group members to read the papers and course materials. For the learners to provide peer feedback they had to read both the initial group submission and earlier peer feedback already submitted. This increased engagement around course materials as the interactions were proceeding and helped the learners to understand the course materials better.Learners also revealed the following benefits they got from this peer assessment activity based assignment; provided better reader ability and understanding of papers, increasing reasoning, it gave them opportunity to read again in the notes since some methodologies were not written directly in the paper and a learner said that it helped me understand methodology chapter. During the interaction one of the learners asked about the questionnaires in the paper the group had read, that is, ... how did you know that the researcher used the questionnaires? Show the paragraph. . One of the group members responded by saying check on page 107, 108, and 109, specifically check between lines in 2.2 ”sample of research” heading, and in 2.3 ”instruments and procedures” the last paragraph which talks about a pilot

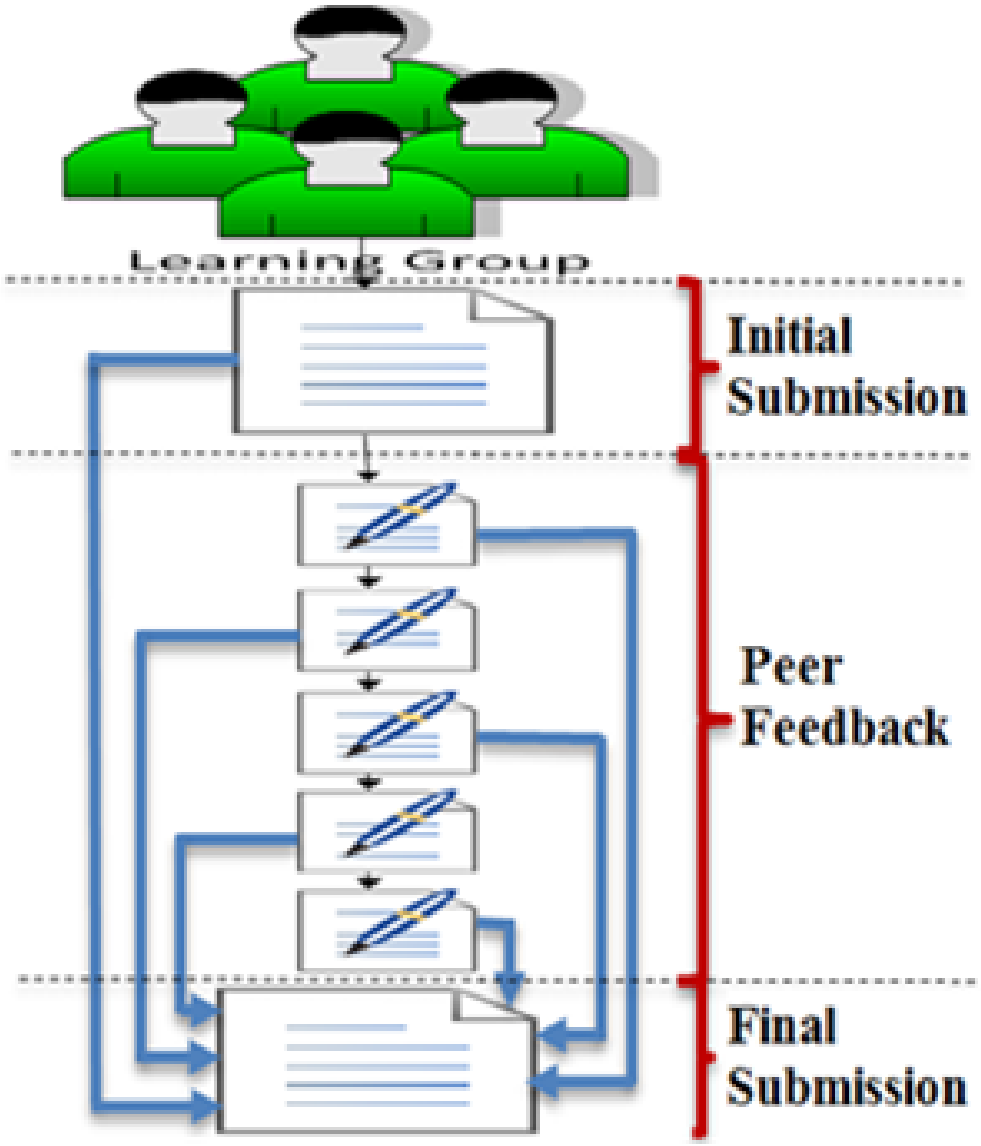

Figure C.2: Learning group setup

study, it goes on to talk about questionnaires.. This gives an indication of content engagement because the question directs the learner to re-read the paper and content before he/she can engage in arguments. Here the student responded by providing the exact place where the information was located in the paper. Similarly, one of the students said, you talked about not using quantitative data yet in the study there are tables and figures which indicate that the researcher used such data. One of the group members responds by prompting the other learner by saying that Tables and figures do not mean that the researcher used the quantitative data. This brings about a conversation of interaction which is based on papers and course literature.

C. Motivation

The course was within the context of formal classroom. Because of their interest in finishing the course, the students were motivated by the marks associated with the assignments. The awarding of marks to individuals peer feedback motivated the students to contribute in the learning groups. Students revealed that marks played a big part to motivate their contributions. Given that the individual learners within the group got individual marks, this motivated the learners to give peer feedback. Learners felt that since their individual participation contributed to the completion of successful and quality submission also motivated them. The learners also felt that they were motivated by the setup of the course since it was related to the research methodology course and easily linked to the materials.

D. Improved Quality of peer feedback

Given that the interactions were around the paper and course literature, the quality of feedback improved. This happened since students were required to give feedback to at least five feedbacks. When students found some feedback on their posts, they read both the paper and feedback so as to give meaningful feedback hence improved quality. Since the students knew that marks were awarded on their feedback they ensured that they read and gave quality input. The quality of peer feedback provided improved through the interactions. Consequently, there was improvement in final submission. This was brought about by learners reading the paper again to give a better quality submission. Learners revealed the peer feedback helped them improve their final submission papers.

E. Enhanced interactions

Within this peer assessment activity, there was increased interaction among learners. This helped to ensure the participation of each learner within the interaction. In addition to the mandatory peer feedback, additional interactions were generated. Eight students were able to comment on each others post. Though it was requirement to just make one post and one comment, the comments generated more comments hence increased interaction among students. The facilitator helped in provoking additional feedback when heshe gave questioning feedback which generated more interactions. The learners revealed that this step increased their interaction with other learners. The learners also said that Facebook did not give them opportunity to express their contributions using audio & diagram but only using text.

V. CONCLUSION

We conclude that peer assessment can help increase student interactions and monitor individual student participation in learning groups. Since marks are awarded to individual students participation, this can increase interaction. With the setup of

the peer assessment based assignment, there was enhanced engagement with course literature because each group receives a multiplicity of peer feedbacks which makes the interaction quality assured.

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Paper D

Title:	Learning Groups in MOOCs: Lessons for Online Learning in Higher Education.
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Learning Groups in MOOCs Lessons for Online Learning in Higher Education

Godfrey Mayende, Andreas Prinz, Ghislain Maurice Norbert Isabwe, and Paul Birevu Muyinda

***Abstract* — when there is interaction within online learning groups, meaningful learning is achieved. Motivating and sustaining effective student interactions requires planning, coordination and implementation of curriculum, pedagogy and technology. For our aim to understand online learning group processes through identification of effective online learning group mechanisms, comparative analysis was used on a massive open online course $MOOC$ run in 2015 and 2016. Qualitative $interactionontheplatform$ and quantitative $survey$ methods were used. The findings revealed several possible ways to improve online learning group processes. This paper concludes that course organization helped in increasing individual participation in the groups. Motivation by peers helped to increase sustainability of interaction in the learning groups. Applying these mechanisms in higher education can help making online learning groups effective.**

Keywords—Online Learning, MOOC, Higher Education, Learning Groups, Online Learning Groups.

I. Introduction

The proliferation of ICT in teaching and learning has created new possibilities for supporting collaborative and cooperative learning in distance education [1]. Collaborative learning hinges on the belief that knowledge is socially constructed although each learner has control over his/her own learning. Vygotsky argues that a persons learning may be enhanced through engagement with others. Learning groups have been preferred for propelling interaction and learning. However, motivating and sustaining effective student interactions are not easy to achieve. That requires planning, coordination and implementation of curriculum, pedagogy and technology [2].

Learning groups have been widely used to enhance learning in higher education and more specifically in distance learning. This is done by giving group assignments to help in the initiation of learning groups. However, challenges of co-locating

learners and participation of each group member lead to some learners not contributing on the group assignment. Often, their names are still attached to the work. This causes high failure rates at the end during summative assessment [3], since the learners that do not participate, fail to harness the benefits of the rich learning experiences from group members. Therefore, effective ways of engaging learners online can offer possibilities of enhanced interactions among learners in learning groups.

This study was carried out on a MOOC titled Success - Unleash Yourself run by the University of Agder using the NovoEd platform (https://novoed.com/successagder-2016). The course has been run twice in 2015 and 2016 each from January to March. Our study is aimed at understanding online learning group processes to identify effective online learning group mechanisms. Online Learning groups can help to bring distributed learners together to work. The goal was to establish processes of effective online learning groups in the MOOC. The research questions to be answered are how to form effective learning groups and how to sustain effective online learning groups processes. Further on, we answered the question of how to increase interaction of learners during online learning group process. Interaction is usually encouraged to increase learners engagement when completing group assignments.

Collaborative learning refers to instructional methods that encourage learners to work together to find a common solution for a given task [4]. Collaborative learning involves effort by groups of learners who are mutually searching for meanings, understanding or solutions through negotiation [2, 5]. Collaborative learning occurs where there are interactions. Anderson in his online learning framework argues that for meaningful learning to happen, there must be high interaction in either student-teacher; student-student and student-content interactions [6]. Mayende, Muyinda [7] and Stahl, Koschmann [2] also asserts that learning takes place through studentstudent interactions. Ludvigsen and Mrch [8], found out that learners effectively develop deep learning when supported by computer supported collaborative learning. Therefore, a well-structured course to enhance group work can enable student-student interactions in computer supported distance learning [9]. Collaborative learning is based on consensus building through interaction by group members, in contrast to competition. Collaborative activities are essential to encourage information sharing, knowledge acquisition, and skill development [10].

The rest of this paper is organized in four sections. Section 2 presents the approaches and our research methods. In section 3, presents the findings of our work and discussions. Finally, the paper is concluded in section 4.

II. Approaches and methods

This section describes the course design for learning groups and the research

methods used. This is described in the following subsections: modules, learning groups, learner support and methods.

2.1 Modules

The course was composed of four modules with specified tasks and activities, paced per course calendar. Learners were expected to complete all modules. The first module takes two weeks to establish the background and to connect the learners. This helps in establishing social connection among learners so that forming learning groups becomes easy. After that there are three modules that last for two weeks each and all of them follow the same basic structure (see table 1 below). The last week is used to wrap up the course and to sketch the way ahead.

Table D.1: Basic timeline for a module

Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu
0		1			2	3	4		5	6			7		8		9

Table 1 shows the timelines for a module with the following activities.

- At point 0 the module content and the tasks for the first week are announced.
- At point 1 the first task is reading of the theory presented. This helped the learners to underpin their discussions in the open forums on the module theories.
- At point 2 submission of individual learners answer to the group activity as a starting point. This helped initiating learners into the group activity. Each learner comes into the group with their opinion about the group activity. This helps to increase participation in the learning group.
- At point 3 the reading is concluded with a quiz. This helped to assess the learners on the theories of the module. The quiz is developed in such a way that the learner can attempt the quiz three times. In each attempt the learner is given detailed feedback which enhances more learning about the theories.
- At point 4 tasks for the second week are announced.
- At point 5 the deadline for group hand-in is reached. This hand-in is based on the groups discussion and individual student answer to group task. It is during the group deliberations that the groups agree on final submission and the member who submits.
- At point 6 learners start working on individual hand-in with emphasis on group support. The team members are encouraged to consult their teams

when working on the individual activity which is connected to the group activity but contextualized for everyone. Since learners have already worked on the group activity it is easy for the learners to consult one another when working on their individual submission.

- At point 7 soft deadline for individual hand-in.
- At point 8 hard deadline for individual hand-in; peer assessment of individual hand-ins begins.
- Finally, point 9 has the soft deadline for peer assessment of individual hand-ins (hard deadline on Friday that proceeds). The tasks for each week are displayed on top of the platform every time your login. This is an important affordance of the NovoEd tool.

2.2 Learning Groups

In the first module, there were auto-assigned learning groups of around 30 learners each. In the other modules, the learning groups were self-formed and each group had at most 5 members. The activities created for module one was aimed at connecting learners and getting familiar with the platform. This was good in building social connections in learning groups. A juggling activity was used in the first module. Learners were required to learn how to juggle and the submission required them to make video recording when they are juggling. This activity has a game concept which makes learners enjoy and get to know one another with ease. Since the juggling submission is seen by all learners, it helped in enforcing social connection. Activities were designed in such a way that each activity could build on another one within the module. For the activities to enhance group work, learners start with presenting individual answers to group activity. This is then followed by group discussion and hand-in. The learners are then given contextualized individual activity which is built on the previous group activity. Finally, there are at least three peer assessments on individual hand-ins. The final individual activity would be peer assessed using a pre-defined rubric which was developed by the course facilitators. In addition to the peer assessment, each assignment would get more feedback from learners through comments. All the submitted activities are accessed by all the learners in the course with possibility to comment and respond to comment. This encouraged interaction among learners online and learner support.

2.3 Learner Support and Peer Feedback

Learner support is important for online learning courses. Forums were created on the platform to help in giving or receiving feedback from the learners or facilitators.

They were created to harness the experiences and knowledge from the community of participants. The learner support ranged from technical to subject matter. This was developed with the aim of allowing feedback to come from the learners themselves given the learner numbers in the MOOC. This fit well with the growing numbers of learners in higher education.

Peer feedback was encouraged since all the submissions were accessed by the learners in the MOOC. This allowed learners opportunity to give peer feedback through comments. Each submission received at least one feedback.

2.4 Differences in the MOOC

Most of the content of the course were the same. However, there was an emphasis on participation in the announcement for the MOOC of 2016. The announcement placed on the platform clearly stated that this is not a usual MOOC, because it is designed for active learners. You must pay for taking it by putting in at least 10 hours of your time each week. The course features only a few videos, and the learning outcome is achieved by working on the tasks. This is perceived to have played a significant role in improving the course. In this course deadlines were changed from hard to soft. This seemed to have had a good impact on the learners participation in the course. There was also flexibility on limits of the group size. In the 2015 MOOC, there was fixed limit of five (5) members per group. However, in 2016 MOOC limits of Group size were changed to seven (7) members. This usually happened when learners from the someplace or region wanted to be together in one group.

2.5 Methods

This paper is based on a comparative analysis of the course for 2015 and 2016. Qualitative and quantitative methods were used in collecting data and analysis. This helped in data triangulation. Two course surveys that is mid-term and course-end were run. The surveys contained both open ended and closed ended question. These surveys were responded to by learners on the two MOOC courses. Mid-term survey had 27 respondents for 2015 and 36 respondents for the 2016. Course-end survey had 61 respondents for 2015 and 66 respondents for 2016. Observation was also done on two online learning groups. The interactions on the forums were also used in the analysis. The qualitative data was analyzed by validating the quantitative data collected. This was the done through the themes created from the quantitative results presented.

III. Findings and Discussions

The course design helped learners to engage with course literature. At the end 1.44% of the learners received statements of accomplishment in the 2015 MOOC

and 5.04% of the learners received statements of accomplishment in the 2016 MOOC. This is agreement with MOOC completion rates [11–13]. The findings are presented in the following subsections: course organization, do groups reduce structure, what helped with learning, are learning groups working, what did the group help with, and what collaboration tools were used.

3.1 Course Organization

This subsection describes the course organization. The organization determines the success and interactions of the learning group. This agrees with Mayende, Isabwe [9], who established that peer based assessment organization increased interaction and learning among group members. The course organization which puts emphasis on learning group is shown in figure 1. Initially, the learners within the groups would submit individual work for the group activity. This helps to initiate the learners to the learning group activity and each learner to contribute to the learning group discussion. The points of disagreement from individual viewpoints increased the learners meaningful learning. An individual submission is open to the entire class to give feedback which helps in the interaction and learning processes. The individual answer to the group activity helps in the learning group discussions/ processes. The learners discuss/find solution for group activity online either synchronously or asynchronously. Once the group answer has been arrived at it is submitted/handed-in. However, group hand-in is accessed by all the learners on the MOOC with affordances of peer feedback. The learners are encouraged to give feedback to other group submissions. After submission of the group work, the learners work on the contextualized individual answer which is based on the group activity. The learners are encouraged to consult with group members when working on this individual answer. Then the submission is peer assessed by at least three learners using the rubric developed by the facilitators of the MOOC. This course organization made group formations very easy and encouraged interaction among learners.

3.2 Do Groups reduce structure?

The learners were asked to reveal their perception about the course organization by asking the participants to indicate their levels of agreement to the statements regarding course organization. This was aimed to finding out if groups reduced the course structures. Figure 2 below indicates the percentage agreement with the statements for the MOOC of 2015 and 2016. In both MOOCs, the learners perceived the courses to be well structured, activities to be well organized and assessment rubrics to be very clear. This is important in ensuring that online courses in higher education are successful. This is in agreement with our earlier study which indicated

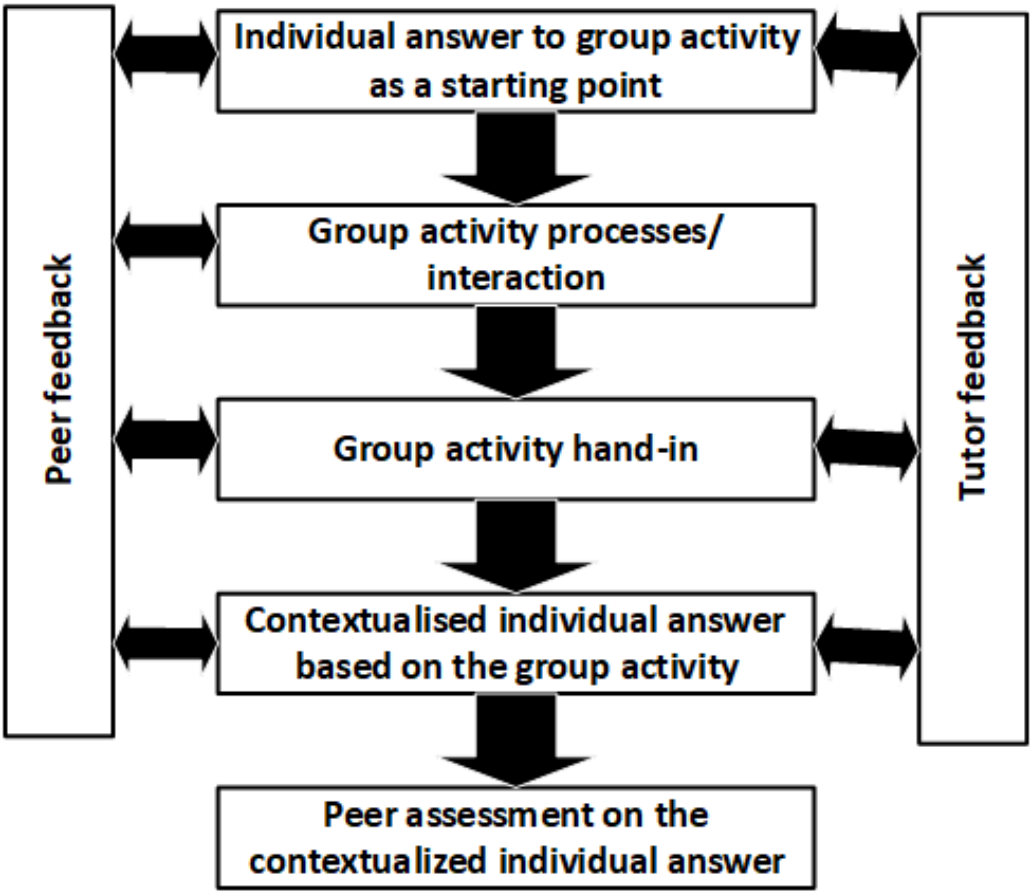

Figure D.1: Course organisation

that a well-designed detailed course guide can lead to an effective online learning group [14]. The learners also perceived that they achieved their learning expectations in 2016. This could be reason for better completion rate for the course.

In both MOOCs learners agreed that group activities were clearly described with enough time allocation to the activities. This is important for online courses since these types of learners are doing many things in additional to studying. These are typical of distance learners who are working and studying at the same time, which is common for the learners of today. If the group activities are not clearly described this can lead to higher dropout rate especially for the online courses. This can also apply in higher education. It is important for online courses in higher education to ensure that the group activities are clearly described with enough time allocation to the activities. The learners also agreed that the activities were connected to the overall course objective. With activities, which are connected to the course objective, this will help to ensure that the learning outcomes are met.

Generally, learners in both MOOCs agreed that they did not need to be at cam-

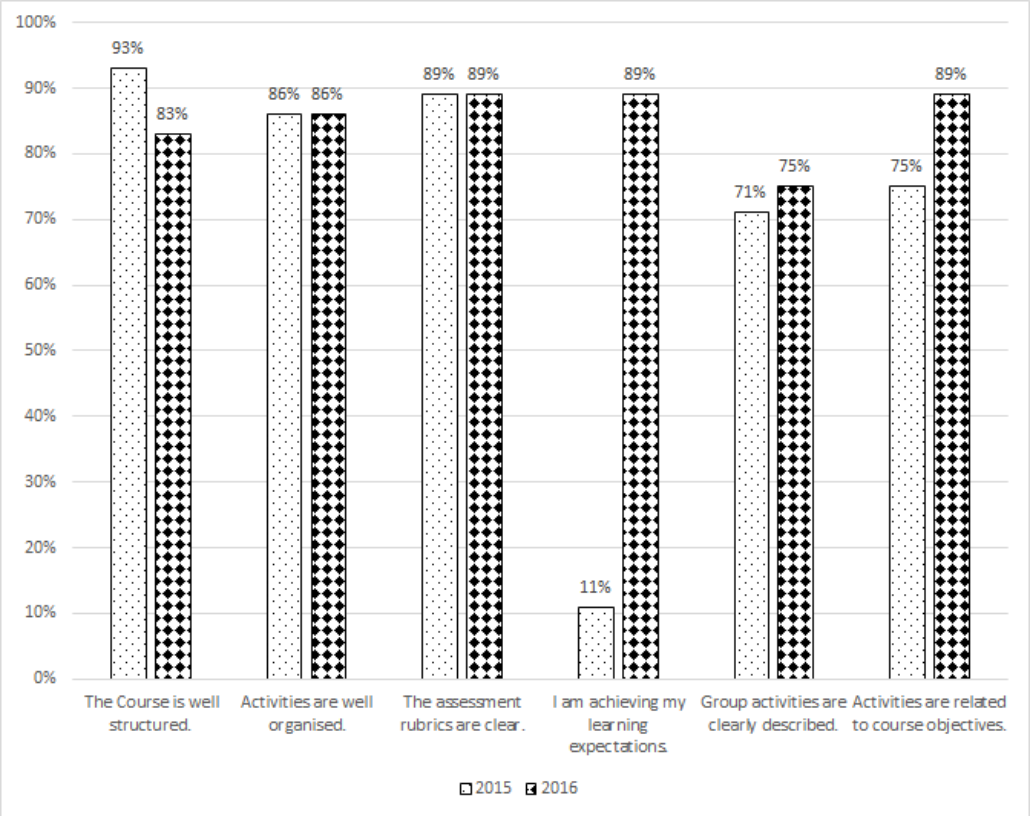

Figure D.2: Do groups reduce structure?

pus to study this course efficiently. This agrees with already distance learning programmes which are offered at the same competence level. Participants also revealed the importance of forums; 46% believed that forum discussions were essential in the course in 2015 and 69% in 2016; 39% agreed that cafeteria forums helped in getting to know the members of the group in 2015 and 61% in 2016. This indicates that there was more interaction in the forums in 2016 than in 2015 which would be another cause for the better completion rate in 2016.

Therefore, use of learning groups in higher education can reduce online learning course structure. Knowing that online learning groups reduced structure, the next section explores what helped with learning.

3.3 What helped with learning?

Learners revealed that the following teaching resource contributed to learning outcome as shown in figure 3. The respondents perceived quizzes to support learning in the 2016 MOOC. The quizzes were designed with aim of helping learners understand the theories of the course. The quizzes were compulsory and highly dependent on theories of the course. This indicates that the 2016 MOOC benefited more as compared to the 2015 MOOC. This shows that the participants in the 2015

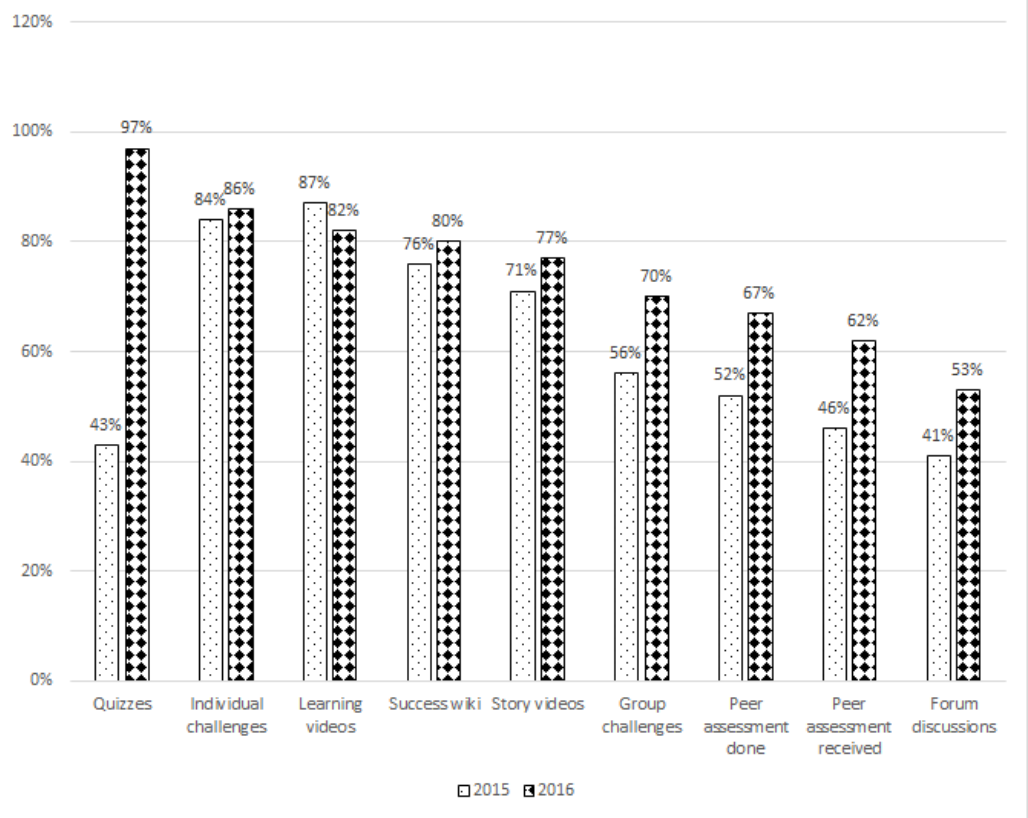

Figure D.3: What helped with learning?

MOOC didnt give enough time to the course literature which was a foundation for the course. Hence the difference in completion differences. The findings also revealed the importance of individual challenges, learning videos, success wiki and story video. Story videos were important because they connected well to the theory by giving authentic examples which helped learners to learn with easy.

The findings reveal differences in group challenges, peer assessment done and peer assessment received with advantage skewed towards the MOOC of 2016. There is need to boost group assignments contribution so that more completion rates can be achieved. This can be done by the facilitators increasing on the feedback they give to the learners. This is not possible in the MOOC since usually the numbers are very high. However, this can be done in high education courses by increasing the online tutors to help in providing learner support and feedback.

Peer feedback played a significant role in ensuring interactions with the course platform. Since all the submissions were assessed through the platform the learners interacted and helped peers get more feedback on their submissions.

Peer assessment was done on final contextualized individual answer. The facilitators developed rubrics that assisted the learners to asses other learners submis-

sions. It was emphasized that each learner should give assessment to at least three other learners. The peer assessment was viewed by the learners to help them know how they have been assessed which will help better understanding of the concepts missed out. Learning happens both during provision of peer assessment and receiving peer assessment.

The learners also felt that the course resources helped them in doing the group activity with 68% for 2015 MOOC and 83% for 2016 MOOC. Having course resources that are connected to group activity can help in ensuring effectiveness of the online learning group. Though having indicative course resources to do group activity is important, learners should be allowed to be innovative and bring in new course resources when doing their assignments. This is possible with an online learning community. The learners of the MOOC of 2016 (72%) agreed to the roles and processes for problem solving more than the MOOC of 2015 (43%). This shows that there are better group dynamics in 2016 as compared to 2015 which can be one of the reason for the better completion rate. For purposes of effective social group connection, it is important for the group members to agree on the roles and processes within the group. However, groups build cohesion over time of interactions. This time element should be incorporated in the course structure. This is a very important aspect that can be adopted in higher education to have effective online learning groups. Results also revealed that only a few participants in both MOOCs were frustrated with one or more group members and the group size was big and distracted the group. The group size of five (5) members can bring about effective interaction and group deliberations. Since group size was five that is the reason they felt that they were not distracted by the group size and frustrated with one or more group members. This group size is easy to monitor and the members feel a sense of belonging.

Learners were also asked about the effectiveness of the online learning groups. Forty four percent (44%) felt that it was 70% and above effective, 40% felt that it was 40% - 60% effective, 16% felt it was below 40% effective. This reveals an indication to the right direction with 84% feeling that the effectiveness of the learning groups was above 40%. The organization of the course played a significant role in the effectiveness of the online learning groups. However, this should also be coupled with appropriate online learning groups and activities. This then brought us to question if learning groups were working as elaborated in the next section.

3.4 Are learning groups working?

Learners were asked their perception of online learning groups. Figure 4 shows the percentage of respondents who perceived the statements to be true about their on-

line learning groups in both MOOCs. On average 55% of respondents agreed with

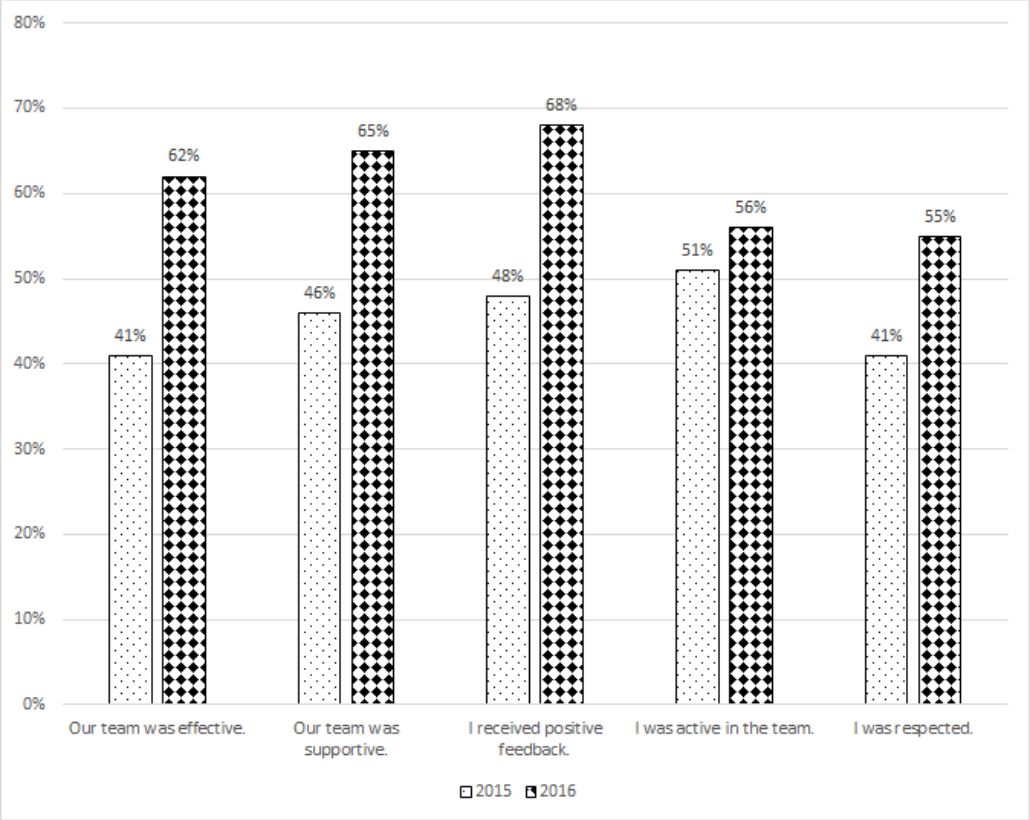

Figure D.4: Are learning groups working?

positive statement about learning groups in 2016 and 40% in 2015. The statements included the following Our team members were supportive and encouraging each other, I received positive feedback from my peers. Our team members respected my opinions. The above statements indicated high percentage of agreement. These helps in motivating and sustaining interaction within learning groups. However, learners never reached levels of sharing jokes during their group discussion which is indication that the groups had not got to high levels of group dynamics as indicated in the Tuckman five stage model [15]. Learners shared jokes in the 2016 MOOC (21%) compared to the 2015 MOOC (13%). These elements are very important aspects of effective online learning groups in helping to motivate members. In higher education, it should be encouraged to let learners know that support, encouragement, positive feedback, respecting opinions from group members are important aspects for effective online learning groups.

Motivation is important for sustainable online learning groups. Motivation is not one-off event but a continuous process throughout the learning group life. Learners agreed that they were motivated by their peers interaction within the group. One

of the learners said, The more you get quick feedback on your submissions definitely the more you get motivated. Eighty six percent (86%) agreed with the above statements in 2016 and 50% in 2015. For effective online learning groups in higher education group members should be motivated within the group by their peers and facilitators. Gallimore and Tharp [16], suggested that positive feedback encourages learner participation.

Student interactions are important in increasing learning [6]. Interactions are encouraged through course organization. The organization allowed open feedback on all submissions by all the learners. The learners received feedback through comments on their submissions. Though the cafeteria forum was meant for social discussions, it generated a lot of content-related interactions. Learners interacted with classmates using questioning which generated a lot of discussions. Questioning that provoke other learners to think more or read content can help in assisting learning [16]. Some of the examples picked from the forums that used questioning: - I agree with your thoughts on being successful in learning regardless of the type - good or bad - of experience. Do you think that almost everyone wants to be successful in learning? and ”Not achievingfinishing a task is not always failure; sometimes it is success delayed. What do you think? This encouraged many learners to interact with classmates through these forums. This therefore is indication that learning groups are working and in the next section we elaborate what did the group help with.

3.5 What did the group help with?

The learners were also asked about how group members helped each other. Figure 5 shows the details of the findings. As indicated in figure 5 learners felt motivated by team commitments and group feedback. This agrees with educational psychologists who believe that positive rewards play a significant role in encouraging participation and interaction [16]. Learners were given guidelines on how to respond within the groups e.g. encouragement to give positive feedback. Guidelines on how learners should behave are very important to the motivation of learners in online learning groups. This is equally important for higher education. Therefore, encouraging learners to give positive feedback will help in motivating the learning group members. When interactions or commitment within the group are high, the other learners will fear to let down their team members. Motivation is vital in sustaining interactions and learning in learning groups.

Learners were asked their perception of their interactions in learning groups. The percentage of respondents who perceived the statement to be true about their interactions in the learning groups. The statements were required to understand

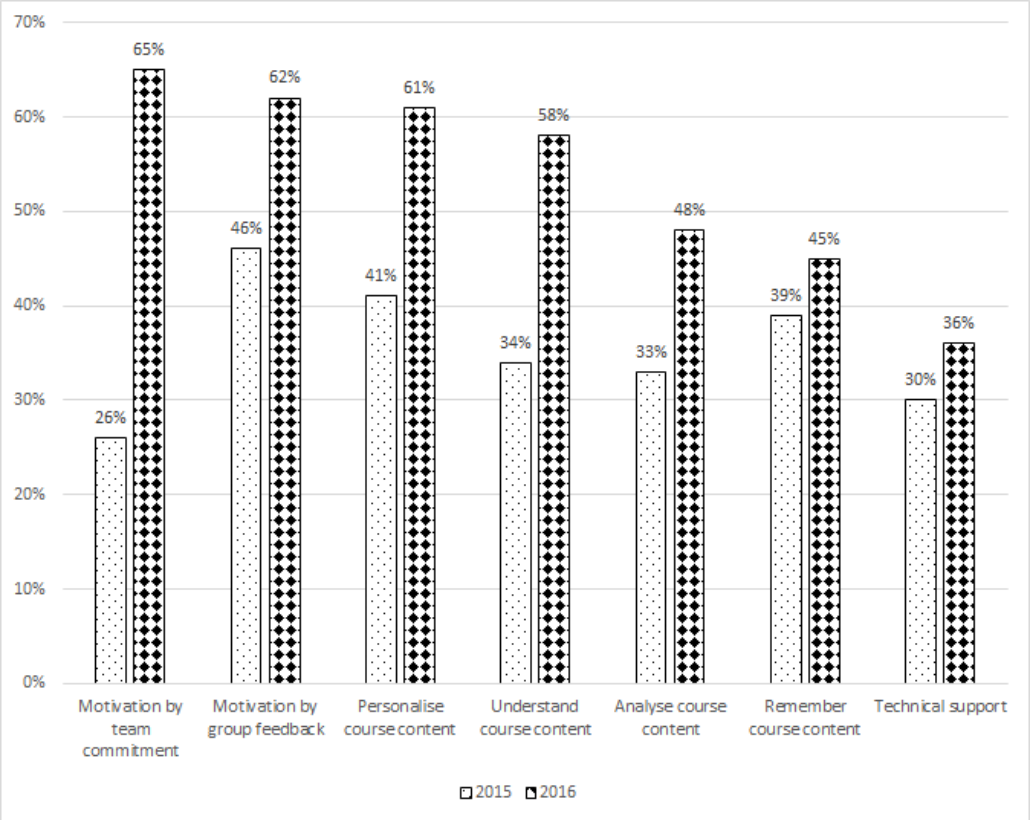

Figure D.5: What did the group help with?

the level of interactions in the groups based on Blooms taxonomy. The interaction questions were based on the verbs remember, understand and analyze. Remember is based on recalling facts and basic concepts, understand is based on explaining ideas or concepts and analyze is based on drawing connections among ideas. On average 52% of the respondents in 2016 MOOC perceived their interaction to lower levels of remembering and understanding while 37% of respondents in 2015 MOOC. This can be improved by facilitators getting involved in the interaction to provoke for higher level cognitive interactions. However, it is not easy for MOOCs given that the numbers of learners are usually very high. This can be done in higher education by the facilitators provoking learners during their interactions in the groups. Respondents also revealed that they used individual experiences when discussing the course concepts. This helps learners get new knowledge from authentic examples from more knowledgeable peers. The interaction was due to the design of the course which allowed peer feedback and assessment.

There were also forums created with the aim of supporting learners on both technical problems and content. These forums equally received a lot of posts and comments which helped the learners in getting support from other learners and tu-

tors. Because forum interactions are open to all learners and tutors, the interactions were quality assured since corrections are made in case some person gives wrong comment. Learners felt that they can improve their ability to express thoughts online. In 2016, 89% responded in agreement that they could improve their ability to express themselves while there was 50% for 2015 MOOC. This shows that the learners started finding interaction interesting and easy which could be an indication difference in completion rate. Equally the experiences that the learners came with in the course helped others to learn from them. This helps the knowledgeable peers to scaffolding other learners given their firsthand experiences from their work or previous work. The next section explains the tools used by the online learning groups.

3.6 Which tools were used?

This course was run on NovoEd platform but with flexibility to allow learners use other collaborative tools. Though there are so many technologies that can be used for collaboration student revealed that they used the following tools as shown in figure 6. NovoEd was the most used tool, because this was the platform that the

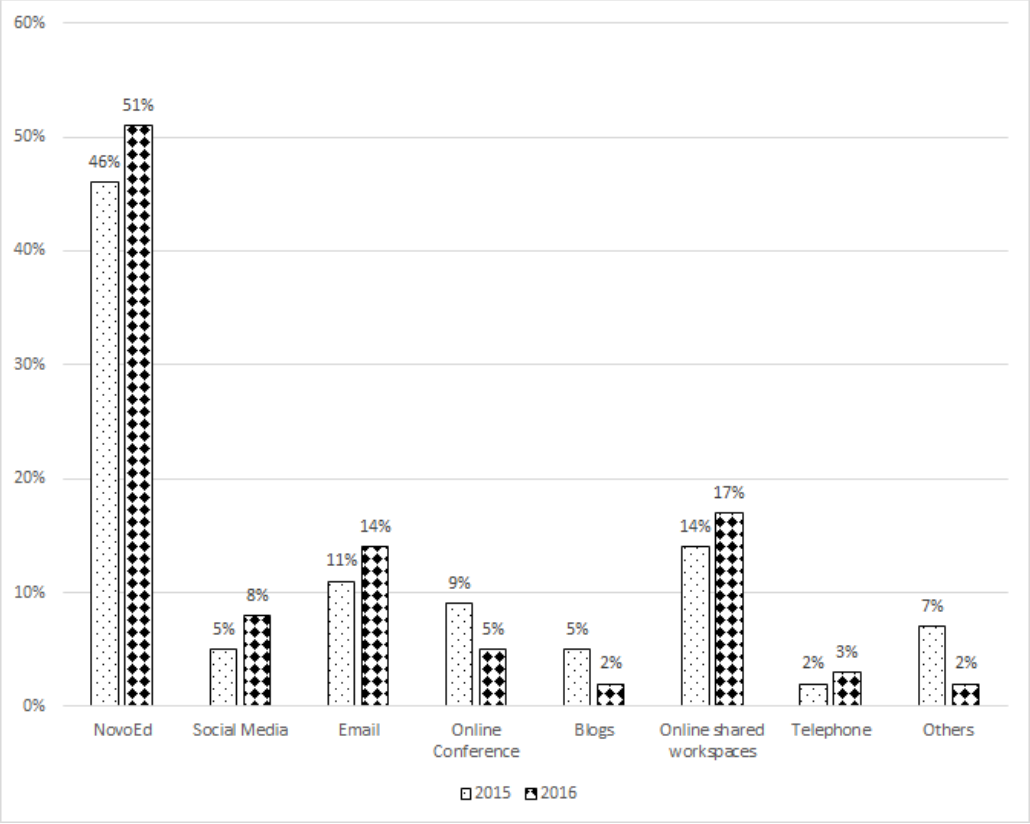

Figure D.6: Which tools were used?

course was run. Mostly, the NovoEd tool was used in the collaboration of the learn-

ing groups. However, other collaboration tools were also occasionally used.

Eighty two percent (82%) of the respondents felt that they sometimes got lost in the platform and failed to find what they wanted in the 2015 MOOC while 31% for 2016 MOOC. This shows that learners in the second MOOC were more comfortable using the platform than the first MOOC. This has a significant bearing on the effectiveness of a learning group. Likewise, 89% of the respondents in 2015 MOOC also felt that it was difficult for them to learn how to use NovoEd unlike 11% for 2016 MOOC. This might have been because many of the learners who attended 2016 also come back from the 2015 MOOC. This makes them have fewer challenges using the platform. Fewer respondents 14% felt that they were comfortable seeking help via the forum while the 2016 MOOC had 75% who would get help from the forum.

Table D.2: Effective collaboration tools

Statement	**2015**	**2016**
Our team has used collaborative tools outside NovEd.	13%	30%
In team interaction, it was sometimes frustrating to use technology.	30%	20%
NovoEd was an effective tool for team work.	46%	62%
Google hangout was an effective tool for team work.	20%	21%

The table 2 shows how learners felt about the effectiveness of the collaboration tools used. It was indicated that tool support in the 2015 MOOC was 29% and 2016 MOOC represented 36%. Participates also revealed about provision of technical support during group work with 13% for the 2015 MOOC and 30% for the 2016 MOOC. Tool usability is important for the success of online learning group.

IV. Conclusion

We conclude that the course organization structured for online learning groups has the potential to increase individual participation in groups. As such the course organization, can be an effective mechanism for facilitating online learning group activities in higher education. The course organization removes the known burden of supporting large student numbers reminiscent of MOOCs as it increases interaction among participants. The course organization help in providing clear sets of activities well aligned to the learning goals and resources. The increased feedback mechanism within the course organization is good pre-cursor to participation motivation which leads to low levels of dropout. Therefore, for an effective online learning group the following must be emphasized; well-structured course organization that supports group work, well-structured group activities that have the affordances of online collaboration and connected to the goals of the course, guiding

learners on how to motivate others through feedback and questioning, encouraging interaction within a learning group, learning group tool usability and features that have the affordance of group processes and online technical support.

V. ACKNOWLEDGMENT

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Paper E

Title:	Improving Communication in Online Learning Systems
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Improving Communication in Online Learning Systems

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Abstract — **In this paper, we study communication in online learning systems using both quantitative and qualitative research methods. Quantitative methods provide the interaction statistics, while qualitative content analysis was used for categorization of the messages. It turns out that 20% of the active participants dominate the online learning interactions, and more than 80% are passive consumers. From the categorization, we learned that most of the communication is not related to learning, but to technical problems (26%), small talk (29%), sharing experience (16%), and encouragement (11%). Only 10% are related to the content. For improved communication, it is therefore important to use the right communication tools in the online learning systems. Especially, learning by content creation should be provided.**

Keywords— Online Learning, Communication, Collaborative Learning, Online Learning Systems

I. Introduction

Distance learning is a mode of study where students have minimal face-to-face contact with their facilitators; the learners learn on their own, away from the institutions, most of the time [1]. Nevertheless, [2] argues that a persons learning may be enhanced through engagement with others. Use of computer supported collaborative learning can offer possibilities of students interactions [3]. In particular, technology can help virtually form learning such that learners can learn collaboratively [4]. However, motivating and sustaining effective student interactions requires planning, coordination and implementation of curriculum, pedagogy and technology [5].

Online learning systems often include a way to support learner interaction, either by integrating with Facebook or using an own system for that purpose. We look into three large online courses with communication support, namely Uncompromised Life, Soulvana and Duality. All of them are paid courses in the area of personal

development, such that we can assume high dedication from the side of the learners. The communication possibilities in all three courses were similar, even though one of the courses uses Facebook, while the other two use a separate platform.

Engagement in online learning systems is achieved through active participation on these communication platforms. It is our intention to find out how to make learners more engaged in online courses. We hope this will in turn bring about meaningful learning. This is based on the view that active participation in a course by communicating is associated with better learning output.

The paper continues in section 2 with reviewing the collaborative learning. Section 3 describes the courses we have studied, while section 4 presents the approaches and research methods. The finding are presented in section 5 and good practice for online course design in section 6. Finally, the paper is concluded in section 7.

II. Collaborative Learning

Collaborative learning refers to instructional methods that encourage students to work together to find a common solution [6]. collaborative learning involves joint intellectual effort by groups of students who are mutually searching for meanings, understanding or solutions through negotiation [5, 7]. This approach is learner-centred rather than teacher-centred; views knowledge as a social construct, facilitated by peer interaction, evaluation and cooperation; and learning as not only active but interactive [2]. This interaction is in line with Andersons online learning framework which argues that learning can be achieved through student-teacher, student-student, and student-content interactions [8]. This is also apt with [5] who asserts that learning takes place through student-student interactions. Students effectively develop deep learning when using computer supported collaborative learning [9]. Therefore, careful integration of computer supported interaction can heavily increase learning in online learning systems.

Collaborative learning is based on consensus building through interaction by group members, in contrast to competition. This can be very helpful for distance learners, who are typically adults. Collaborative activities are essential to encourage information sharing, knowledge acquisition, and skill development [10]. Different technology tools have been adopted for collaboration in distance learning.

Collaborative learning hinges on the belief that knowledge is socially constructed although each learner has control over his/her own learning. Online learning systems offer possibility for these collaborations to be achieved through communication among learners. Collaborative learning is underpinned by the social constructivist learning theory [2]. This is used in the online courses studied and described in the section below.

III. Three Online Courses

We study three online courses, which are offered by Mindvalley in the personal development area. They are paid and use the Mindvalley platform for the course material. For one course, the discussion is run in a closed Facebook group, while for the other two the Mindvalley discussion platform is used. For the sake of this article, the discussion functionality in Mindvalley is designed like Facebook.

Mindvalley is an online teaching company in the personal development area. It focuses on life skills that regular schooling does not cover, based on the world's top personal growth authors and brands. The Mindvalley teaching platform features a discussion area structured like Facebook.

Facebook is a social media online platform built with no perceived affordance for teaching and learning. Nevertheless, many studies have used it for teaching and learning and it is promising for increasing interaction in groups [11–13].

3.1 Uncomprommised Life

This course teaches everyday psychology to sort out the day and night things that matter in life. The course runs for eight weeks and learners are taught eight transformations. The following elements are discussed: focus and clarity of mind, mental models, law of attraction, handling change, productivity, daily habits, self-love, and self-confidence. This course is purely run online using the Mindvalley online learning system and the Mindvalley discussion platform.

3.2 Duality

This Mindvalley course is related to the duality between energy and reality. It runs for eight weeks and teaches the following seven improvements: getting fast answers, manifesting the life you want, feeling happy now, stopping the fight against yourself, accelerated healing, perfect relationships, and living your ultimate life. This course is purely run online using the Mindvalley online learning system with discussions in a closed Facebook group.

3.2 Soulvana

Soulvana is not a course, but a subscription. It does not have duration, but presents a new teaching every week. Often, the teaching is related to other courses in Mindvalley, or given by authors that are connected to Mindvalley. Due to the format, the area is broader than the other two courses. The connection between the topics in Soulvana is the focus on spirituality and its use to improve everyday life. Just like the other two this course is run on the Mindvalley platform including discussions.

IV. Approaches and Methods

4.1 Communication in a Course

This paper uses three categories of course communication: discussion, message and creation.

Discussion is a transient exchange of information. The Cambridge dictionary defines discussion as the activity in which people talk about something and tell each other their ideas or opinions [14]. This communication can be both verbal or non-verbal, sychronous or asychronous. Discussions are often supported within online learning systems using text based asychronous discussion threads.

Message is a one-way information exchange. The Cambridge dictionary defines a message as a short piece of information that you give to a person when you cannot speak to them directly [14]. This communication can be both verbal or non-verbal. Messages are important when communicating to the students about something in the online learning systems. A typical way to send messages is email communication, or course messages.

Creation is communication with the purpose of creating something. An example is the creation of a poem by a group of students. Here, the communication does not directly lead to the end results, but rather supports it. This part can be available in online learning systems as co-creation of artifacts, group projects, pair programming, debate and wiki. In our three selected courses, creation was not available.

4.2 Methods

The communications in the three online courses were analysed from the autumn 2015 until January 2016. Uncompromised Life and Soulvana messages were extracted from the Mindvalley platform, while Duality course messages were extracted from Facebook. Quantitative methods were used on the three data sets to get the general statistics related to communication and participation within these three courses.

For a deeper understanding, content analysis was done by manually categorizing the type of messages being communicated. Then the different categories were analysed statistically to understand what was happening in the online interactions. The chosen categories are based on an a-priori opinion of the kind of messages in the set. This way, some messages could fit more than one category. In these cases, the best fit was chosen.

V. Findings

This section describes the findings of the study. It is divided into three parts; the general participation of the online courses, interaction in the online courses and communication needs for online learning systems.

5.1 General Participation

This part describes the general statistics of the findings from the three online courses, divided into enrollments in the online courses, participation in the discussions and discussion threads in the online courses.

5.1.1 Enrolment in the Online Courses

The three online courses had large class sizes. Each of the courses had at least 3,000 partcipants enrolled, with Uncompromised Life, Soulvana and Duality having 3,385, 3,464 and 3,000 participants, respectively. The number for Duality is an educated guess, as there was no accurate number of participants in Duality available. These numbers are comparable to enrolment of MOOCs [15–17]. Far less participated with sending at least one message on the platforms, namely 625 (18%) for Uncompromised Life, 638 (18%) for Soulvana and 350 (12%) for Duality. We see that most of the participants were passive consumers of content. The lower participation for Duality is probably due to the manual enrolment into the Facebook group, while the other two courses had automatic enrolment into the Mindvalley discussion platform.

5.1.2 Participation in the Discussions

This shows the active participation on online course. In this study active participation is communicating by sending atleast one message. The percentage of active participation in the courses were 18%, 18% and 12% for Uncompromised life, Soulvana and Duality respectively. The active participants were also active in starting own discussion threads, and not only answering to the existing threads. Own discussion threads were started by 57%, 43% and 65% of the active participants in Uncompromised Life, Soulvana and Duality, respectively.

The Pareto principle which maintains that 80% of output from a given situation or system is determined by 20% of input, applies for the messages. This is so because twenty percent (20%) of the active participants contributed almost 80% of the total messages. Another interesting statistics is the ratio of messages by the teaching team. On the Mindvalley platform, the teachers contributed 18% of the messages, in contrast to only 3% in the Facebook group. Finally, there was always one very active person, contributing around 10% of all the messages alone.

5.1.3 Analysis of Discussion Threads

Figure 1 shows the analysis of discussion threads. We remember that threads were started by around 50% of the active participants. We found that the threads are mostly discussions. They have on average a relatively small number of messages in them (5, 4, and 8), and their life span is short (2.5, 1.2, and 1.3 days).

This indicates that the platforms are not suited for long-time interactions. In

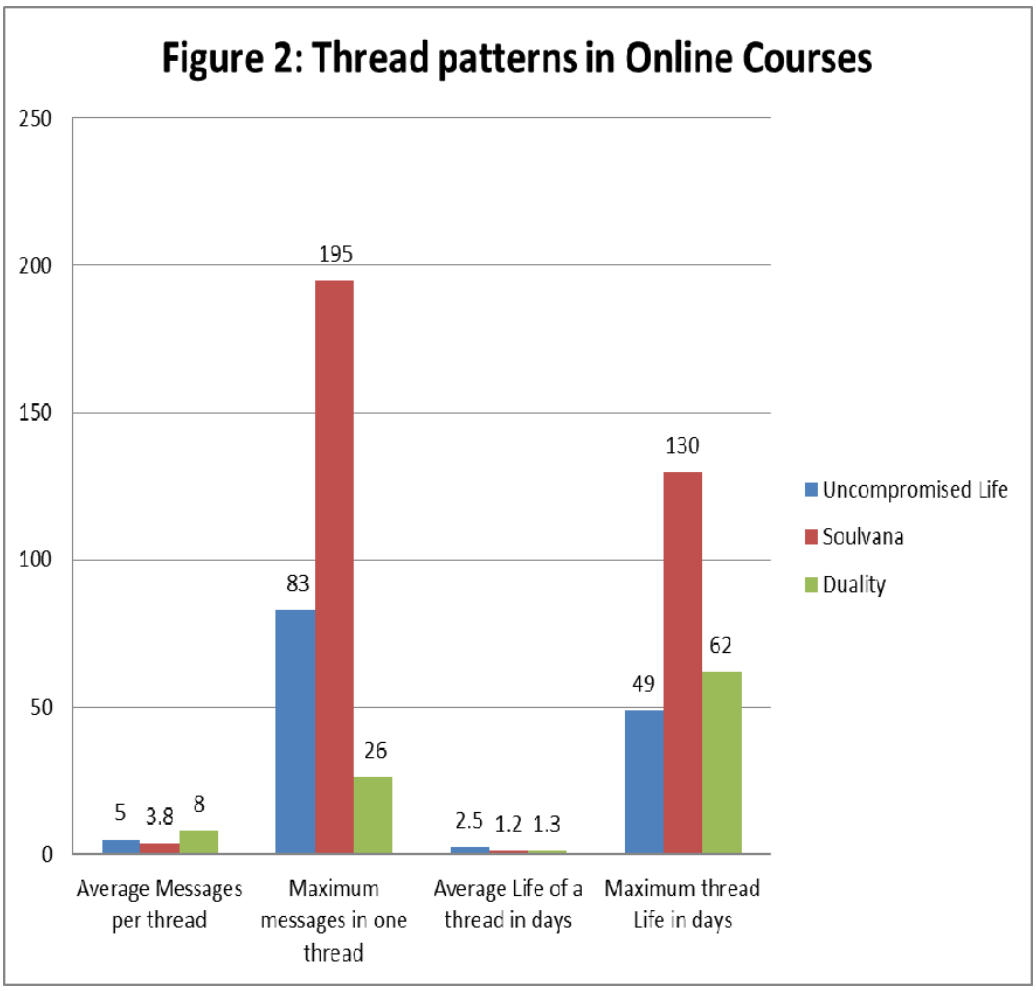

Figure E.1: Thread patterns in online courses.

both platforms, threads pop up higher in the ranking when they are active. This way it is possible that few threads have a long life (maximum 130 days with 195 messages in Soulvana). For comparison, Uncompromised Life has maximum 49 days with 83 messages, while Duality has maximum 62 days with 26 messages.

That analysis indicates that there was minimal learning taking place in the discussions, which is examined more closely in the next part.

5.2 Interactions in the Online Courses

Interaction is very important in online learning systems. Therefore, we want to understand the kind of interactions going on in the online learning systems. As explained in Section 4.2, we analysed the content of the messages. Categories were defined a priori and the messages were sorted into the categories. Table 1 shows the result of the sorting. A major part of the communication is geared around technical problems (26%). These were questions aimed at asking for help on how to use the online learning system. It turned out that the discussion platform was not a good place to handle such problems, as the same questions and answers used to turn up in regular intervals. It was impossible to find out if the same question was asked before and it was even difficult to find the correct answer if it was in the same thread. Most of these interactions were more of a message kind, and a discussion kind.

Table E.1: Interaction messages being communicated.

Major Category	Sub category	%	%
Technical problems	Technical questions	14%	26%
	Answers to technical questions	12%	
Smalltalk	Introduction of People	4%	29%
	Welcomes	5%	
	Thanks	18%	
	General smalltalk	2%	
Content	Content questions	4%	10%
	Answers to content questions	6%	
Sharing experience	Sharing experience	11%	16%
	Agreement with experience	5%	
Encouragement	Encouragement	11%	11%
Others	Connection between people	2%	8%
	Creating something jointly	0%	
	Empty and unrelated	18%	

The second major category was smalltalk messages contributing with 29%. Smalltalk is very important in group dynamics since groups of these students have to go through the different phases of the group for it to be effective, from Tuckman five stage model [18].

Ten percent (10%) of the messages were related to content: asking questions and getting responses to the questions. The content interactions are closest to the

idea of learning by communication, as they directly involve the material taught.

The second major learning related interaction is the sharing experiences with 16% of the messages. Sharing is important in personal growth courses, as learning is exactly about own experiences. Still, learning in this case happens outside the system, and only the result are reflected in the platform.

In a similar way, encouragement helps with motivation for the learning, but is not related to the learning itself. Encouragement contributed 11% of the messages.

The remaining messages are largely not categorized, including empty and unrelated posts. However, there are two categories that deserve mention: there are 2% of messages related to connection between people, mostly based on same language and/or same location. This indicates that people are interested in communication in their own language and face to face. Finally, there are 13 messages where some participants attempted to create something jointly, which is marginally related to the total number of messages.

Considering only the teachers, the situation is as follows: 15% content answers, 35% technical answers, 16% encouragement, 10% thanks, and 16% welcome plus few uncategorized posts.

The kind of interactions changed over time, this is shown in the differences in focus from December to January.

- technical questions 31% - 22%
- smalltalk 21% - 3%
- thanks 15% - 21%
- content 5% - 14%
- sharing 22% - 31%
- rest 6% - 9%

This indicates that the participants get more focused and experienced with the platform which brings a shift from smalltalk and technical questions to content and sharing experience.

A general observation is that the interactions are full of recurring questions, both related to content and technical questions, sometimes even in the same thread. This indicates that the systems are designed for discussions, where it is not planned to go back to previous arguments. In a discussion, the interactions are only the background, and they do not have a life on their own. This is in contrast to messages,

which are important on their own and need to be searchable and easily accessible. This is even more important with large numbers of participants.

5.3 Communication Needs

Based on the findings in the previous section and knowing that engagement can be achieved through communication, the following communication needs are derived from the analysis. The three different forms of communication (discussion, message and creating) are used as a basis for the needs.

Announcements communicate course status and progress. They can trigger learner engagement and improve the feeling of teacher presence within the online learning systems. This is basically a message communication. The best way to implement announcements is by using a message board, which can be embedded in the users home page. The systems analyzed in this paper do not properly support this component, and use discussions instead.

Course administration information is related to the course structure and in this way an equally vital one-way communication message. The best way of implementing them starts already outside the online system with a clear structure and description of the course. Then it can be shown with clean pages followed by good help pages. The systems analyzed here again used discussions for this component, which is not appropriate.

Course material refers to the content of the course, including text, videos, and audios. This is message communication, and as the course administration information, a clear structure that is visible in the course is the best way to implement it. This component is very important because it feeds into other communication types of discussion and creation. The main point here is to have a good description of the activities that connects well to the course materials, which can motivate learners to engage with course materials. This is further discussed in the next section.

Sharing, support, and encouragement can be done in both small and big groups because they help in motivating learners in the online learning systems. This is a discussion, where the result is created during the interaction, and the thread itself is auxiliary. It is important to establish a code of conduct for the discussion groups, including privacy (non-disclosure). Dunbar's number suggests that 150 is the cognitive limit to the number of people with whom one can maintain stable social relationships [19]. These are relationships in which an individual knows who each person is and how each person relates to every other person. Above that number, groups will give a feeling of anonymity, which could help to share some more embarrassing information [20]. For group discussions in your course, a group size of five would be more effective [4].

Discussion and clarification are used when dealing with course content. These are discussion interactions and they do not produce results, but are just auxiliary. If well planned and organised they lead to changes in the content and learning. Usually, if they are triggered by activities around the content they can enhance engagement and learning.

VI. Good Practices for Online Course Design

6.1 Communication in Online Learning Systems

Based on the findings we suggest ways to improve communication in online learning systems. There are several areas where learning happens in online or traditional settings, which are not currently used in the studied courses. These kinds of communication are related to more active modes of learning, like discussion groups, practice by doing and teaching others/immediate use as shown in the figure 2.

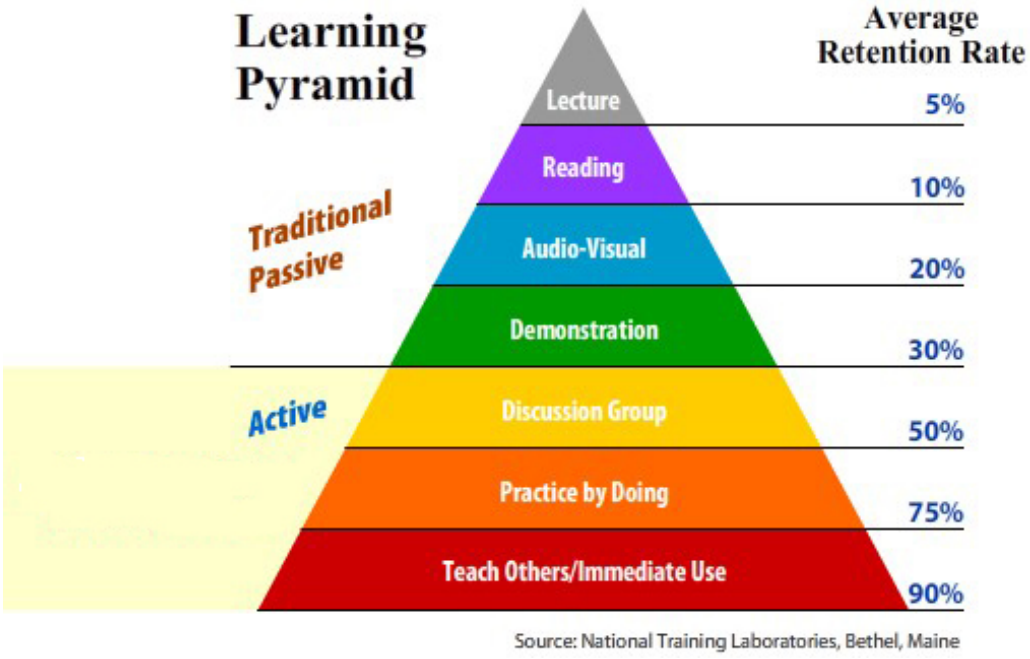

Figure E.2: Learning pyramid.

It is important to be clear that the modes of communication used here are most often not discussions. We collect the recommendations below:

Individual content allows users to store content related to their learning, probably somewhere in the user area related to the course. It is not limited to individually complete questionnaires, quizzes, and reflections. These are in the category of (one-way) message, but here they belong to the user.

Joint content is content that is created by groups of learners, maybe all learners in a course. It helps to create content jointly; good examples are wiki pages and

google docs. These fall into the category of creation, and do not exist in the studied online learning systems. A discussion might be associated to the joint content.

Learning groups are important for dedicated and meaningful learning. These groups are connected to a joint task, for example discussing a statement or creating something. In terms of communication, this is a combination of discussion and joint or individual content. The discussion is used in order to create, but disappears later. It is also possible that nothing is created apart from learning.

Mentoring (coaching) for groups provides input to the individual or the group process. This is very important for learning groups as the groups tend to get stuck once in a while. By mediating learning, the mentors can provoke learners to discuss issues that they would not have discussed otherwise. The mentoring often does not result in an artifact, but it may contribute to an improved artifact.

Peer-to-peer evaluation and assessment. In a learning setting, peer-to-peer evaluation is a feedback message mechanism supporting learning. It can be embedded into the learning process at several places, not only at the end. Peer assessment can be based on groups or on individuals. When well embedded within the course structure improved learning can be achieved [21, 22].

6.2 Synchronous Communication and Physical Contact

Communication in online learning often lends itself to an asynchronous mode, because learners may have different time zones and different times to access the learning environment. There is a general trend to rely more on virtual connection than physical ones [23]. However, from a learning perspective, this is not the best option. For improved learning, also synchronous communication should be considered.

Mehrabian found that 7% of any message is conveyed through words, 38% through certain vocal elements, and 55% through nonverbal elements (facial expressions, gestures, posture, etc) [24]. Typical discussion forums like in Mindvalley and Facebook use only the 7% part, and therefore miss out much on the other components.

At the University of Agder online courses, we arrange a physical meeting with the course participants which is then used as a basis for the asynchronous and online communication. This improves engagement a lot. Equally at Makerere University we arrange physical meetings of two weeks twice a semester which improves engagement when studying the courses.

Experiences with lecture streaming and capture at University of Agder indicate that the (perceived) live event of a lecture is much more valuable than the playback. In particular, this leads to the fact that students follow what is said more closely.

It seems that the important aspect is the synchronous communication, and in particular the life presence of the students (not necessarily the teacher). Based on this experience, it is not a good idea to run video lectures as non-timed playback, but rather organize several time slots where the students meet at the same time.

Life communication in a large group of participants (more than 10) will typically be restricted to statistical interaction (raise your hands) and can be implemented using Kahoot (https://getkahoot.com/). However, group processes in learning (learning by discussing) are typically connected to synchronous meetings. These have to be in smaller groups (around 5).

Of course, after knowing that synchronous communication is good, and physical meetings are even better for learning, the question is how to facilitate that for an online learning system. Here are some suggestions.

Synchronous communication can be planned into a course by setting time slots for some of the video lectures. Typically, two time slots per day are enough to cater for all time zones. It is essential in this case to embed also synchronous communication into the video itself, in particular activities for the students, like polls. Moreover, in many cases online courses have a geographical clustering of the participants, such that occasional face to face meetings are possible. A clever move in this context is to motivate the students to invite their friends and family into the course such that physical meetings can work out more easily.

Of course, synchronous communication has to be planned for in the course design, such that as a result the retention rate for the learning really is improved above the one-way messages.

Finally, introducing synchronous communication would also introduce a need to teach about how to handle such discussions in a learning context. Effective work in groups needs special processes to check into the group (presenting your personal status), both in a face-to-face and in an online synchronous setting.

VII. Conclusion

From the online communication patterns identified from the online learning courses studied in this paper, the following conclusions have been arrived at. First, in online learning systems, the first message to be sent is the most difficult one. So it might be a good idea to focus on the first message specifically. Second, 20% of the participants contribute about 80% to the message traffic. This means there has to be enough traffic in total to allow students to be active even if they are not among the most active 20%. Third, Facebook and similar systems are optimized towards discussions with short time horizon and small number of exchanged messages. They

are not equally good at other forms of communication like one-way communication or co-creation. Fourth, a good communication for learning needs both a joint discussion area for all learners, and a learning group communication area for smaller learning groups. Fifth, synchronous communication should also be emphasized in the platforms and more importantly in the course design.

Creation can lead to meaningful learning within learning groups. Many online learning discussion platforms are built in a Facebook like setup, which makes it difficult for learners to create knowledge. A proper way to support co-creation of artifacts and of knowledge will advance online learning systems a lot.

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Paper F

Title:	Towards Technology for Supporting Effective Online Learning Groups
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Towards Technology for Supporting Effective Online Learning Groups

Godfrey Mayende, Andreas Prinz, Paul Birevu Muyinda, and Ghislain Maurice Norbert Isabwe

Abstract — **Group learning has been advocated for increasing active learning among distance learners. However, there is limited understanding on how to engage learners in online courses. Following the design science methodology, we iteratively developed guiding factors for supporting effective online learning groups. The factors for effective online learning groups cover five key dimensions, namely institutional policies, institutional technology, group activity, group composition, and facilitation. The factors are validated through repetitive evaluation using authentic online learning courses, as well as using a focus group discussion with experienced online facilitators. This way, the factors provide pedagogical and technological guidelines for introducing online course groups. Moreover, they give requirements for online learning systems supporting effective online learning groups.**

Keywords—Online Learning, Learning Groups, Online Learning Systems

I. Introduction

Distance learning is a mode of study where students have minimal face-to-face contact with their facilitators; the learners learn on their own, away from the institutions, most of the time. Recently, distance learning has adopted the use of group assignments with the aim of encouraging students to work together to bridge the distance between the online students. Group work requires students coming together either physically or virtually through technology. A typical risk in group assignments is that a few students do the group assignments and just include other students names. This causes high failure rates during summative assessment, since not all students engage with the course materials during the group assignment. Those students fail to harness the benefits of working in groups. On the positive side, group work leads to better and faster learning [1]. To bring those benefits to online courses, effective ways of supporting online learning groups are essential for interactions. When there is interaction within online learning groups, meaningful learning is achieved. However, motivating and sustaining effective student interactions requires planning, coordination and implementation of curriculum, pedagogy

and technology. Therefore, the creation of guidelines for introducing online learning groups can create possibilities of effective online learning.

The aim of this paper is to develop guidelines for introducing online course groups. The guidelines are informed by both e-pedagogy and online learning systems. They will help in ensuring that online learning groups are effectively supported within the online learning systems through answering the two research questions; What principles should guide the design of tools to support effective online learning groups? and What tools should be used for effective online learning groups?

The rest of this paper is organized in five sections. As a background, Section 2 provides an overview of collaborative learning. Section 3 explains our research methods and approaches. Section 4 presents the factors for effective online learning groups. In Section 5, the factors are discussed, and the paper is concluded in section 6.

II. Collaborative Learning

Collaborative learning refers to instructional methods that encourage students to work together to find a common solution [2]. Ashley [3] and Stahl, Koschmann [4] contend that collaborative learning involves joint intellectual effort by groups of students who are mutually searching for meanings, understanding or solutions through negotiation. This approach is learner-centered rather than teacher-centered; views knowledge as a social construct, facilitated by peer interaction, evaluation and cooperation; and learning as not only active but interactive [5]. This interaction is in line with Andersons online learning framework which argues that learning can be achieved through any of the following interactions: student-teacher, student-student, and student-content [6]. This is also apt with Stahl, Koschmann [4] who asserts that learning takes place through student-student interactions, and it is in agreement with our own earlier studies [7, 8]. Ludvigsen and Mrch [9] found out that students effectively develop deep learning when using computer supported collaborative learning. Therefore, careful integration of computer supported interaction can heavily increase learning in online learning systems.

Collaborative learning is based on consensus building through interaction by group members, in contrast to competition. This can be very helpful for distance learners, who are typically adults. Collaborative activities are essential to encourage information sharing, knowledge acquisition, and skill development [10]. Different technological tools have been adopted for collaboration in distance learning.

Collaborative learning hinges on the belief that knowledge is socially constructed although each learner has control over his/her own learning. Online learning sys-

tems offer the possibility for these collaborations to be achieved through communication among learners. Collaborative learning (and also our study presented here) is underpinned by the social constructivist learning theory [5].

III. Approaches and Methods

The design science methodology was employed to find the factors. This methodology is aimed at iteratively coming up with an artefact, in this case the guidelines for the introduction of online learning groups. Figure 1 indicates the various stages in the design science methodology. The distinct stages of the design science process

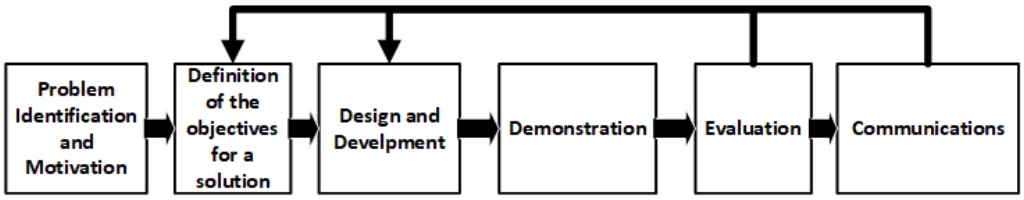

Figure F.1: Design science process

as adopted from Peffers, Tuunanen [11] are described below with corresponding methods used in each phase.

Problem identification and motivation. This stage defines the specific research problem and justifies the importance of a solution. The problem definition is later used to develop an artefact that can effectively provide a solution. Our problem emanates from the need to support online learning groups and their importance for effective learning.

Define the objectives for a solution. This stage uses the problem definition and knowledge of what is possible and feasible to define the objectives. In this research study, we use research questions under three research directions, which are effectiveness of learning groups, processes to support effective online learning groups and tools to support online learning groups. Our overall aim is to determine solutions for supporting effective online learning groups.

Design and Development. This stage creates an artefact which is used in the study, based on the needs of the end users of the desired solution. In our study, the artefact is a set of factors that guide the introduction of online learning groups. We started the process by interviewing experienced online learning facilitators and looking at online learning interactions within the online learning systems. This input was transcribed and analysed and led to an initial set of factors, which was improved in the iterations of the study. This was done for two courses whenever the courses were run (in the demonstration stage). Figure 2 illustrates how the factors evolved through phases.

Demonstration. This stage demonstrates the use of the artefact. We used two online courses, one run in Norway and one run in Uganda. A MOOC course was run at the University of Agder [12] and an undergraduate course was run at Makerere University [13]. Both courses were run in the real environment and used customised existing LMSs to verify and improve the factors.

Evaluation. This stage observes and measures how well the artefact provides a solution to the problem. It was during this stage that we used mixed methods in evaluating the online courses under demonstration. We iterated back to design and development to improve the artefact. Surveys were used in the online courses to understand the processes of online learning groups. In addition, we also observed the interaction logs in the online learning courses. With this data, we identified themes which informed the elements of the factors. The factors where then evaluated through focus group with online facilitators to find agreements with the guidelines. The focus group discussions were then transcribed and analysed.

Communication. This stage communicates the research outputs of the previous stages and possible starts a new iteration to ensure improvement in the artefact which is quality assured.

The study followed a phased approach as shown in Figure 2 below. In phase 1

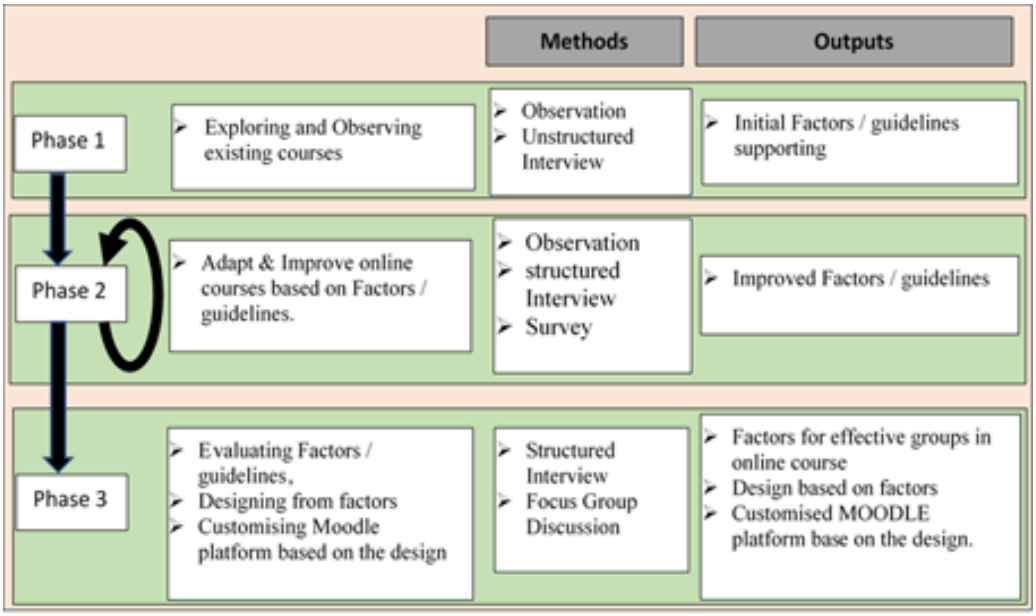

Figure F.2: Overview of methods and research outputs under research phases

the focus was on exploration and observation of existing online courses. Qualitative methods were used in the collection and analysis of data. Data logs were observed and analyzed. Unstructured interviews were used when interviewing experienced online facilitators. After the collection and analysis of the data we came up with the

initial factors and guidelines. Then, in phase 2, we adapted and improved online courses based on the initial factors. Data to verify the factors was collected using observation of the interaction logs, structured interviews and surveys for large online classes (MOOCs). Finally, in phase 3, we adapted and improved the online courses based on the improved factors and evaluated the factors. This led to the final factors. Sections 4 and 5 elaborate the factors in detail.

IV. Factors for Effective Groups in Online Courses

This section describes the factors for effective groups in online courses in the following dimensions: overview of the factors, supporting online learning group institutional policy, supporting online learning group institutional technology, quality of online learning group activity, quality of online learning group and quality of online learning group facilitation.

4.1 Overview of the Factors

Learning groups have been advocated for increasing interaction and learning. However, the use of learning groups has not been very easy in online learning systems. Therefore, this study provides guidelines for effective ways of using groups in online learning courses. These guidelines are given as factors in five dimensions as shown in figure 3. All the five dimensions contribute to the factors for effective online learning groups abbreviated as FEOLG. OLG stands for online learning groups. The dotted arrows indicate the order in which the dimension should be acted on, normally starting from supporting OLG institutional policy. The arrows indicate that the factors describe a continuous process that provides support to make online learning groups effective. The following sections describe the five dimensions in detail.

4.2 Supporting Online Learning Group Institutional Policy

The first-dimension concerns supporting online learning group institutional polices. Often online courses are run without having supporting policies to ensure their success. This can create problems in the running of the online course. Therefore, having the supporting institutional policies can create possibilities of groups in online learning courses. Under this dimension, the following key sub elements where identified through the iterative process.

Progressive group assessments policies are institutionalized. Respondents revealed the need of having an institutional policy that caters for the progressive group assessments. This was emphasized for helping in the reward of students during the online progressive group work. During the focus group discussion, the facilitators at Makerere University advised on the need for embedding such policies

Figure F.3: Factors for effective online learning groups

in the curriculum. When such policies are not available, administering group work online becomes difficult. The facilitators at the University of Agder emphasized the need of awarding between 40% 60% on progressive assessment. This helps the students to be rewarded given the amount of work involved in the online group activity.

Digital assessment for groups policies are institutionalized. The respondents emphasized the need for digital assessment for groups policies. One of the respondents said that the policy should put emphasis on feedback for facilitators and peers. This is in line with the peer assessment based activity which revealed improved interaction among learners in groups [13] and the individualized activity which also revealed improved interactions [12]. Digital assessment and feedback are key in online learning groups, and they need technological support.

Online facilitation and tutoring policies are institutionalized. Facilitation and tutoring must be scaled to enhance its efficiency. With large online classes, there is a need for many online tutors to assist in scaffolding learners. It was revealed that

facilitators with large classes at Makerere university are not assigned to online tutors to help in the process. This is because of the costs involved in paying the online tutors. During the focus group discussion one of the respondents said that lack of online tutors to help in the support for the online students create heavy information overload for the facilitators. The respondents revealed the importance of recruiting and remunerating online tutors to help in effective student support hence learning.

4.3 Supporting Online Learning Group Institutional Technology

Technology support for online learning groups is very important in enhancing effective online group work. Technology is key in supporting all the other dimensions. There are many online learning technologies available both commercial and open source and institutions should choose one institutional technology to use. This helps in having a single point of contact of the institution for the support and maintenance of the learning management system. To have good support for online learning groups, the technology should support the following elements.

Authentication. The technology should allow for users to login to access the platform. The users should be categorized differently to allow distinct access. The users may include the following facilitators/tutors, learners, eLearning administrators, and eLearning support team.

Systems administration. The technology should allow system administrators to administer the platform, including the possibility to add users and give them different access. Facilitators should have control of their online courses. Learners should have sufficient access rights to allow for interaction and submission.

Announcements. The technology should allow facilitators to send communication about the progress and course status. This triggers the learners to actively participate in the activities of the course. This could be implemented using the message boards which can be embedded in the users home page.

Discussion. The technology should support users to interact with one another within groups, both synchronously and asynchronously. This can be implemented using forums. Discussion forums should be designed in such a way that students can discuss within their groups. Discussions can enable learning within the platform when learners are engaged and communicate through the platform.

Co-creation of artefacts. The technology should support learners to be able to create artefacts together in a group. Co-creation was emphasized because of its need for jointly creating knowledge together in a group. Examples are joint programming and writing a document together. This helps increasing learning through interaction, as emphasized in Mayende, Prinz [14].

User support. The technology should support users (facilitators and learners)

in the use of the system. This support can be embedded within each course such that learners can ask questions related to the technology. Technological experts should be available for each online course to allow for support within the course.

4.4 Quality of Online Learning Group Activity

The group activity is very important in ensuring that learners interact effectively within the groups. Activities with emphasis on interaction is important for online learning. In earlier papers we have suggested peer assessment based activity [13] and individual based activity [12] as a form of activity organization. Both increased interaction among learners within the online learning group. The following checklist can be used for ensuring effective group activity.

- The activity has a clear and relevant title.
- The activity is clearly marked as a group activity.
- The activity is connected to the course learning outcome.
- The purpose of the group activity is stated clearly and concisely.
- The activity has outlined the tasks that the groups will be required to do.
- The activity is simple enough to be completed with ease in the given time for most groups.
- The activity provides clear instructions.
- The activity identifies the tools that participants require performing the tasks.
- The activity clearly states the completion criteria of the task.
- The activity clearly states the time required for completion.
- The activity indicates the contribution to the final grade of the course.
- The activity has rewards.
- The activity is structured for peer feedback and assessment.
- The activity enables teacher assessment.

Following the above checklist will help in ensuring effective group interaction. Emphasis is put on the way these activities are structured to encourage interaction and feedback. Outcomes from the evaluation indicate that online facilitators agreed that the online group activity is central to the effectivity of online groups. The system should cater for structuring the online activity.

4.5 Quality of Online Learning Group

Group composition is also very important in ensuring effective interaction within the online environment. The following essential elements should be taken into consideration when creating groups: group size, diversity, unity and stability.

The group should be composed of between 2 and 7 members. The readings did not clearly indicate the exact number of students that are required for an effective learning group, although emphasis on small groups is indicated. During the demonstration, we used five members in the group in one course and in another course, we had seven members. Both showed effective interaction in the groups. Our indication of 2 to 7 members was not extensively empirically studied. More studies might be needed to establish the exact number of learners required in an online learning group.

The group composition should promote diversity. Our findings revealed the need for diversity in the groups (various levels of experience, diverse backgrounds, different age and gender). This helped to scaffold peer learning as illustrated by Vygotsky [5].

The group composition should promote unity. Unity was emphasized to allow for possibility of putting learners together to make it possible for physical meetings as well as finding a common base line for discussions.

The group members should be kept in the same group for a longer period. Preferably learners should be kept in a group for at least a semester or 6 months. This allows for better group dynamics and social connection. This can help a group to go through all the different stages of group development as illustrated by Tuckman and Jensen [15]. At University of Agder students were kept in the groups for the full semester and this improved group dynamics.

4.6 Quality of Online Learning Group Facilitation

Physical class room teaching differs from online teaching. In both situations learners should be guided when interacting within a group. Physical groups allow to see what the learners are doing in real time. This possibility gives facilitators the opportunity to identify learners with challenges and to assist them immediately. This can help learners to learn better through intervention and scaffolding of the students learning.

Also in online teaching, facilitators are encouraged to show their presence within the learning environment. When learners within the online system do not see and feel the presence of the teacher, their participation is discouraged. Therefore, it is important to have a manageable number of learners per facilitator. The system should also have means to detect problems and warn the facilitator for easier follow

up. This can help the facilitator to intervene and offer solutions to learners who need help and guidance. Such intervention will help to increase motivation and group interaction which is a precursor for meaningful learning.

The findings also reveal the importance of online facilitation, which is different from traditional teaching. The facilitators play a leading role in motivating and sustaining learner interaction within the online learning groups. Interventions by facilitators can provoke the students to interact at higher levels of Blooms taxonomy [16]. This can also be supported through automated intervention by checking the status of groups and the individual students in the groups and sending them emails in case of deviations.

V. Discussion

These factors are effective because they have been developed through an iterative process of design science. This has been done over the three years period of the project. The study was done in phases as seen in Figure 2. In the first phase, we started by exploring and observing the existing courses. Mainly online courses at the University of Agder were observed and experienced online facilitators were interviewed. This helped in coming up with the initial factors, which focused on the following important elements for effective online learning courses: courses design, trained online facilitators, motivation and sustaining interaction and peer assessment based activity [17]. This initial list was used in the demonstration and led to phase 2.

In phase 2, we adopted and improved online learning courses based on the initial factors. This was accomplished using different case studies. The case studies were from authentic online courses at the University of Agder and Makerere University in several different studies [8, 12–14]. In this phase, we used observation of online interactions, interviews of facilitators and learners and surveys. In the case study with peer assessment based activity we found enhanced engagement and interaction, and the quality of the peer feedback was improved [13]. This indicates the importance of the online learning group activity, in agreement with Salmon, Pechenkina [18]. The second case study was a MOOC run at the University of Agder, which confirmed the importance of the online learning group activity in enhancing interaction. It also revealed the importance of facilitator feedback or interventions, the composition of a group and technology in enhancing interactions within the online learning groups [8, 12]. This is in line with Salmon, Gregory [19] and Salmon, Pechenkina [18].

Finally phase 3 evaluates the factors using focus group discussion and interviews. This has been done in one case study and we are going to make more eval-

uations on another case. This was done in understanding best practices for online learning designs [14].

VI. Conclusions

This paper concludes with identifying five key elements for ensuring effective online learning groups. The five elements are supporting online learning group institutional policies, supporting online learning group institutional technology, quality online learning group activity, quality online learning group and quality online learning group facilitation. However, the main emphasis is put on the online group activity and its structure within the online learning systems to cater for effective interaction. Once the activity is well structured with interaction embedded in it, there is a good chance that the learners will actively interact within the group. This interaction should also be supported by well-trained online facilitators or tutors. The trained facilitators intervention can help in motivating the learners and sustain the group interaction. For an effective support of the elements appropriate technology needs to be used. In addition to the design science process for developing these factors we are in the process of evaluating them on a case study and our developed online learning system that supports the factors.

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