Towards Technology for Supporting Effective Online Learning Groups

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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

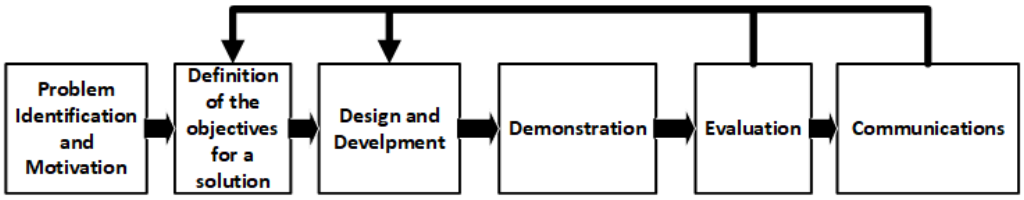

Figure F.1: Design science process

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

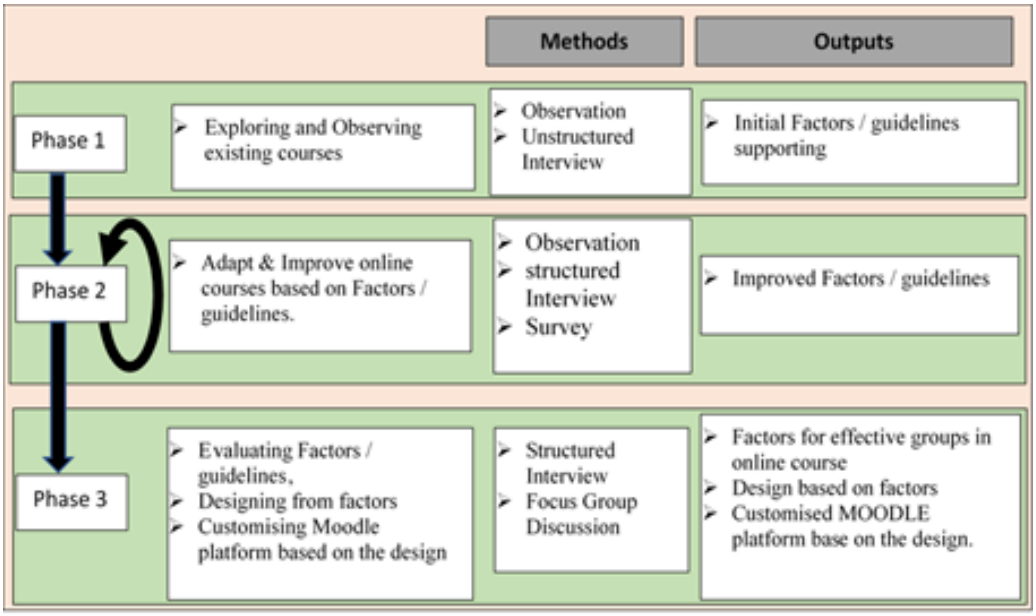

Figure F.2: Overview of methods and research outputs under research phases

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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