

Enabling Effective Collaborative Learning in Networked Virtual Environments

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This paper considers the issue of enabling effective collaborative learning in networked virtual environments. It is suggested that the increasing use of networked virtual environments for learning and teaching, plus the high level of use of group assessment practices requires us to enable effective learning and ensure that it does take place. The roles and interactions of the individual students combining to form the group can be crucial to the success of collaborative learning. Identifying the possible range and mix of learner attributes and teaching and learning strategies which can help enable effective group learning in networked virtual learning environments is a crucial part of transforming higher education for the knowledge society. Developing previous work, a strategy and methodology for helping enable collaborative learning in networked learning environments is proposed. Factors such as cognitive profiles, collective project visualization and group learning are discussed within the context of providing the research framework. The research methods to be used are presented, the potential outcomes are discussed and conclusions drawn.

Keywords cognitive profiles, group learning, collaborative learning, e-learning, virtual environments

1. Introduction

The subject of enabling effective collaborative learning in networked virtual environments is a key area in the transformation of higher education for the knowledge society. The increasing use of networked virtual environments for learning and teaching, plus the high level of group assessment practices, requires us to ensure effective learning does take place. The different approaches to studying and varying interactions of the students who combine to form the group can be very important for successful collaborative learning. Consequently, we need to identify the possible range and mix of learner attributes, and thus teaching and learning strategies, needed to enable effective group learning in networked virtual learning environments.

Learner attributes and interactions with others can have a major impact on the individual learning process. As groups and learning communities are aggregations of individual learners, it follows that these characteristics will also impact on group learning in networked virtual learning environments. In addition to developing an understanding of group dynamics in such scenarios, the reflective and participative elements of the proposed strategy will help students to become effective life-long learners and successful members of the knowledge society.

In the emerging world of networked learning environments, it is necessary to consider the learning related challenges presented by the geographical, temporal, and cultural distribution of students working in virtual and e-learning communities. Group work and virtual learning environments increasingly form part of the ways that students study in many universities. Understanding the different social and learning dynamics within these environments is fundamental in helping to improve student learning.

2. Change in higher education

Many of the innovations in higher education in recent years (e.g. internationalisation, increased participation rates, the implementation of technology-supported learning systems) are linked to and reflect

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changes in and the demands of a globalised knowledge society. These changes also imply a need for students to become more independent in their attitudes to learning in order to be better able to function in a knowledge society. Self-regulation and autonomy in learning are prerequisites of a successful system of higher education experiencing high rates of inclusivity and participation. This is especially true in an emerging system where online and virtual environments become the norm for much learner interaction.

The rationale for this paper is the contention that the increasing use of networked virtual environments for learning and teaching, plus the high level of use of group assessment practices, require us to ensure that effective learning is taking place. The roles and interactions of individual students combining to form a group can be crucial to the success of collaborative learning. This paper sets out to identify the possible range and mix of learner attributes and teaching and learning strategies which can help enable effective group learning in networked virtual learning environments.

Learner attributes and interactions with others can have a major impact on the individual learning process. The profile of learner attributes used will be based on the suggestion by Jonassen and Grabowski [1] that:

the particular combination of aptitudes and traits possessed by each individual is reflected in the individual's cognitive styles, personality, and learning styles (p.xi).

For the purpose of clarity, we also differentiate between the terminologies used to describe virtual learning environments. *Networked virtual learning* allow group learning activities to take place between geographically dispersed students. *Group virtual learning environments* are the outcomes of the design projects to be undertaken by each group, i.e. a web-based learning environment developed by each group to support individual and group learning.

Senge [2] provides a useful action research model and framework with respect to group learning. Although Senge's model was originally developed in the context of learning communities and organizations, it is relevant and applicable to the approach proposed here because of the strong relationships between individual and group learning, learning communities and learning organizations. The key elements of Senge's model for enabling the formation of learning communities are: personal mastery; mental models; shared vision; team learning; and systems thinking. As with many models of learning communities and organizational learning, these elements exist in other models under other names. In terms of educational research and student learning we can consider them to be autonomous learning; cognitive or learning profiles; collective project visualization; group learning; and systems thinking.

The systems thinking element is especially important as it binds and integrates the other elements. It also provides a tool for holistic thinking, something which is not always actively encouraged in analytic conceptions of learning and teaching. This is particularly true for information technology students, as the nature of the subject area (and, consequently, forms of assessment and teaching) with its emphasis on analysis and the breaking down of systems and programs into their component parts, can cause students to self-select. This is illustrated in the prevalence of analytic (as against holist) cognitive attributes in such student cohorts when compared to the general student body or broader population [3].

Consequently, by adapting Senge's model to networked virtual learning environments, the proposed study will address the area of individual and group factors that lead to effective learning in networked virtual learning environments. This will be achieved by a reflective and reflexive monitoring of individual learner characteristics engaged in a creative technology project - the development of a group virtual learning environment. The impact of learner interactions on project outcomes, learning outcomes, assessment practices and learning community development will be addressed.

In adapting Senge's model, the systems thinking defines approach and perspective taken. In addition to the systems thinking, the other adapted key elements for the approach suggested are:

1. metacognition (Senge's personal mastery – metacognition refers to understanding and regulating one's own learning and as such is strongly related – see [4] below)
2. cognitive profiles (mental models – the mental models we construct are deeply dependent on our individual cognitive profiles)
3. collective project visualization (shared vision – the two terms are basically the same)
4. group learning (team learning – again, the two terms are basically the same in this context)

Each of these is discussed before the conceptual framework and methodological approach are introduced.

1. *Metacognition*

Learning in groups is a key element in developing the social and interactional skills needed by the student to be an effective learner and a productive member of a knowledge society. Group interaction and learning provide the building blocks to allow the student to develop as a participant member of a wider learning community. Understanding and regulating one's own learning (metacognition) is important in this process. Vermunt [4] suggested that "metacognition refers to learners' views and beliefs about learning and to the active regulation of their learning processes" (p.25). This dual aspect of metacognition is echoed by Hofer et al. [5]. In considering metacognition and self-regulatory strategies, Hofer et al., in agreement with earlier writers, proposed that the two main aspects of metacognition are "knowledge about cognition and self-regulation of cognition" (p.67). Knowledge about one's own cognition also implies knowledge about the cognitive process of others, including group members.

2. *Cognitive Profiles*

Enabling and enhancing metacognition can be achieved by the process of self-reflection on learner characteristics or profile. Learner characteristics and interactions with others can have a large impact on the individual learning process. As groups and learning communities are aggregations of individual learners, it follows that these characteristics also impact on group cohesion, leadership, group learning and, ultimately, learning community development. As mentioned previously, Jonassen and Grabowski [1] commented that aptitudes and traits are reflected in three characteristics. These three characteristics – cognitive style, personality type and learning form a *cognitive profile*. It can be argued that, in terms of learning in general and active learning in particular, students are potentially their own greatest latent resource. The realisation of this potential resource could have a significant effect on individual and group learning processes and the development of learning communities. By concerning ourselves with the individual student in relation to group dynamics, in particular group cohesion and leadership, this approach enables the student to consider his or her personal learning attributes within the context of a learning group and community.

3. *Collective Project Visualization*

A lack of a shared viewpoint is often at the root of poor communication in group projects. Understanding the reasons for the variety of viewpoints encountered over the duration of a development project leads us to the need for a shared view (or collective project visualization). A shared view can reduce some of the problems of communication and meaning interpretation that bedevil many group projects. It can be argued that this is indeed very important for delivering information systems and e-business value in a networked society. The continuing high cost of project failures demands that we consider the question of developing shared viewpoints in our attempts to ensure a successful implementation. The reflective and participative methodology proposed here will help overcome these problems.

4. *Virtual Learning Environments and Group Learning*

A strong sense of community is both important and difficult to foster in online and virtual learning environments. While virtual environments are in widespread use, their implementation is often a case of printed materials put online with little additional group moderation. Consequently, the student experience can vary enormously. Part of the aims of this study is to identify the types of group formation and interactions that are the most productive. Having shared goals, developing trust and successfully interacting when working in virtual learning environments are all factors in developing successful e-learning habits. These are also important factors in the development of learning communities.

3. Research framework

The research framework builds on Schön's and Argyris' work on the reflective practitioner [6] and learning organisations [7] and Checkland and Scholes' [8] Soft Systems Methodology implementation of this. Within this implementation, the concept of a cognitive profile [9] derived from available psychometric measures is used to provide a framework for reflection. A process of group reflection and negotiation is used to develop a Learning Community Environment (LCE), an example of Banathy's [10] concept of "functional context application".

Three measures have been selected based on empirical evidence of their validity and reliability as measurements and constructs to represent the elements of the cognitive profile. (i) The *cognitive style* measure is Riding's Cognitive Styles Analysis [11]. This is a computer-based test which measures personal preferences for representing and processing information. The *learning styles* instrument is the Approaches to Study Skills Inventory for Students [12]. This instrument measures deep, surface and strategic approaches to learning, with each approach containing several sub-categories. The *personality instrument* is Myers-Briggs Type Inventory [13] a well known instrument for measuring personality type.

Elements of the research framework include the:

1. development and application of the cognitive profile concept to provide a structured and accessible summary of the students' individual and group learning characteristics;
2. use of the profiles as a framework for structured reflection on individual and group learning characteristics;
3. identification of the impact of learner characteristics, as derived from the cognitive profiles, on the dynamics of group learning;
4. identification of key profiles for the development of successful learning groups and communities;
5. development of a methodology for enhancing student metacognitive awareness of individual and group learning with reference to the formation of learning communities

4. Methodology

The study will address the area of individual and group factors that lead to successful group e-learning and project work. This will be achieved by a reflective and reflexive monitoring of individual learner characteristics engaged in a creative technology project - the development of a group virtual learning environment. The impact of learner interactions on project outcomes, group cohesion, leadership and learning community development will be addressed.

This approach provides a framework and methodology for enhancing the quality of student learning, especially in the increasingly used virtual learning environments. This will be done by using reflection on cognitive profiles and their role in transforming student learning conceptions and beliefs. The relationship is crucial in terms of each individual understanding his or her learner attributes and how those attributes affect learning both as an individual and as a group member. The reflective activities will be undertaken in terms of individual and group learning. The latter activity will provide important insights into group cohesion and how it impacts on the development of learning communities.

The approach focuses on key drivers of the innovation process in virtual environments: decision making for successful design project completion; the characteristics of socially cohesive groups; and the emergence of group leaders. This could be expanded by extending the analysis to international students and enabling a cross cultural and global perspective to be brought to the study. This is an especially important element in helping to create the structure and processes for encouraging and managing innovation in a globalised knowledge society.

An innovative methodology – RAPAD (Reflective And Participative Approach to Design [3] – will be further developed and integrated in this study. RAPAD has an iteratively reflective and participatory approach and is a developmental methodology which encourages reflection within the context of a participatory approach to design. In this case, it is reflection by students on aspects of their own learning and

participation in the process of the design and development of group learning environments. The overall process for each student starts with critically reflecting on the elements of a personal cognitive profile. This is first done individually and then within the context of the project group. Comparative group discussions are also held to help the development of group cognitive profiles. The results of the reflections, discussions and negotiations are then applied to the design and development of a virtual learning environment to support learning by the group members. RAPAD has been primarily used in the design and development of personalised or group virtual learning environments [3].

5. Conclusions

The implementation of technology-supported learning systems is linked to and reflects many of the demands of higher education in a globalised knowledge society. These demands imply a need for students to become more autonomous in their attitudes to learning. Autonomy in the learning process requires both self-regulation and metacognition [4]. The metacognitive skills gained by participation in a learning exercise such as that described in this paper will help enable students to better understand their own learning and, via that, the learning of others. Group work and virtual learning environments increasingly form part of the ways that students study. Understanding the different social and learning dynamics of these environments is fundamental to helping improve effective collaborative learning in networked virtual environments which is also a prerequisite for the transformation of higher education for the knowledge society. Achieving this goal is also made more possible by the process outlined above.

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