

MEDIATED LEARNING IN VIRTUAL LEARNING ENVIRONMENTS

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This presentation explores what does mediation mean, when developing virtual learning environments where a physically present human mediator is not available but where a humanistic component is highly needed in the learning process. The mediated learning experience is studied when using an interactive tutoring method IQ-FORM to support students in their learning. IQ-FORM gives information about learner's qualities. The theory of mediated learning experience of Reuven Feuerstein provides a meta-level theoretical background for this research. This research is a part of a large national research venture in Finland for new tutoring and counseling methods in a Web-based learning for the Finnish Virtual University Consortia.

1. INTRODUCTION

The presentation gives one example of the methods of mediating students in their learning process. The method acts as a mediator of learning through providing support and tools for better self-awareness when studying in technology based environments.

Studying in a virtual environment sets new kind of demands on learning skills. Students have different abilities to learn in a virtual environment but they should be given equal opportunities to success. It is important to find out, how learning skills for technology based

studying can be developed. It is essential to explore if cognitive and intellectual skills can be modified so that the student can benefit of studying in this new mode of learning. This critical issue will be analysed and reflected in the framework of Feuersteins theory of Structural Cognitive Modifiability.

The virtual environment is deprived in one essential sense: there is no physical presence of a teacher or peer students. When thinking about how to make studying in a virtual learning environment successful the author came across the theory of mediated learning experience (MLE) of Reuven Feuerstein and its basis in the theory of structural cognitive modifiability (SCM). This study is a part of the authors' study on learning in virtual university environments. The research has three purposes:

- to explore how does the theory of MLE fits the new technology based learning environments
- to study empirically, what are the student experiences of mediated learning when using mediated tools
- to develop theoretical principles, how to enrich virtual learning environments to increase students' potential to manage their own learning and learning environments

This presentation focuses on the first question of the study. The aim is to create a theoretical basis for empirical phases of the research and for developing criteria, which could be used in creating the criteria to enrich virtual university learning environments.

2. THE OF THE CONCEPT OF MEDIATION

The concept of mediation is becoming quite significant when describing and discussing learning in virtual learning environments. Feuersteins theory of MLE emphasizes strongly the role of the mediator in learning. Can one state that mediation in Feuersteinian sense is can take place in net based studies?

When analysing the concept of mediation and the actual process of mediation, one needs to ask, what is this message form especially in net based learning? It is not teaching, it is not writing, it is not speaking, it is not throwing images and sounds from Internet, it is not

expressing feelings. It is a combination of this all and yet -something more. In the context of virtual learning environments mediation can be regarded from at least two aspects mediation

- in view of learning research
- in view of communication sciences

When thinking about the *learning research view* on mediation Feuerstein theory of MLE and his description of mediation offer a comprehensive explanation of the phenomena of mediation. His criteria for MLE are targeting the learning process and its conditions comprehensively. According to Feuerstein '*MLE is a universal modality of interaction and appears, to a greater or lesser degree, in all cultures which perpetuate themselves, irrespective of the level of technological content of functioning and of the richness of the language used in the interaction...*' (Feuerstein 1991, 21).

An expert of *communication sciences*, professor Tapio Varis (2001, 194) makes adequate and challenging remarks about the concepts of communication, media and mediation. He states, that, when using the word communication we usually refer to transmission and mediation of information. According to him it is essential to notice that media is much more than only means of transferring information. The media extends human senses and the dominant media of different eras determine, which sense is primarily used in the search for information and in the process of thought. Varis' remarks that media affects the ways of thinking, constructing science and belief systems. (2000, 192-193). Varis refers to the French philosopher Régis Debray, in whose thinking "communication" is a modern but late answer to a more difficult and permanent problem of mediation. (ibid., 194).

3. THE CONTEXT OF THE STUDY: RESEARCH FOR VIRTUAL UNIVERSITY

The Consortium of the Finnish Virtual University (FVU) was established at the end of the year 2000. The Finnish Virtual University is an alliance of all universities in Finland and it will create channels to deliver courses and other study options in different universities. The portal of the FVU combines and makes available the supply of the partner universities to students, who may select individual courses or larger combinations. They may also connect

conventional campus-based studies and FVU studies with each other. The FVU does not serve as a direct provider of instruction. However, it has certain meta-level counselling and tutoring services.

3.1 The research task of the IQ-FORM project

IQ FORM research project began at the end of 1999 and it is a co-operative project with educational, computing and information technology sciences (WWW-site <http://www.edu.helsinki.fi/iqform/>). IQ-FORM has as task to develop one of the core service utilities of the Finnish Virtual University. It provides tutoring and counseling tools for student during their individual learning processes and study performances in Web-based learning environments. The Project Director is *Professor Hannele Niemi*, Dean of the Faculty of Education at the University of Helsinki.

- The project will explore how different learners study in virtual environments and what kind of support they would need.
- The project has been developing a flexible IQ FORM data bank, which will be used during 2001 in virtual university courses.
- The project is also developing a tutorial package, which can be adapted according to the needs of specific courses, students and teachers. (IQ-FORM research team, <http://www.edu.helsinki.fi/iqform/>)

Students will have a virtual university Web portal from which they can select different options. Some of the options provide tutoring for learning skills. These options will be e.g. "*Who am I as a learner*" or "*How to become an active learner*". The IQ-FORM -project will promote tools for students to develop high quality learning skills and help them to become self-reflective and co-operative learners (Niemi 2000a; 2001).

The researchers of the IQ-FORM project are mainly from University of Helsinki but there are co-operation and networking with partners in universities of Oulu, Tampere and Joensuu which will apply new learning and tutoring tools in their virtual courses.

3.2. Virtual university as a learning environment

Professor Hannele Niemi states that the virtual university means a space in which university studies are served to students using the newest environments of communication and information technology. The studies can be organised fully in technology based environments (for example, through computers and digital TV) or they may be a combination of contact hours and different variants of distance learning methods. The capacity and speed of technical environments make it easy to combine different technological tools as well as different sources of information, such as texts, pictures, simulations and voices. (Niemi, 2001)

Steve Ryan and co-writers (Niemi 2001; Ryan 2000: 2) define virtual university using the following two levels:

"Virtual Education Institution may be defined as:

(a) An institution which is involved as a direct provider of learning opportunities to students and is using information and communication technologies to deliver its programmes and courses and provide tuition support. Such institutions are also likely to be using information and communication technologies for such other core activities as:

- administration (eg, marketing, registration, student records, fee payments etc);*
- materials development, production, and distribution;*
- delivery and tuition;*
- career counselling, advising, prior learning assessment, and examinations*

(b) An organisation that has been created through alliances/partnerships to facilitate teaching and learning to occur without itself being involved as a direct provider of instruction. Examples of such organization would be the Open Learning Agency of Australia, the emerging Western Governors University in the United States, and the National Technological University (in Canada - the author's addition)".

4. THEORETICAL FRAMEWORK

The theoretical framework of this presentation comes from Reuven Feuerstein's theory of mediated learning experience, which provides the meta-level theoretical background for the research.

The mediated learning experience is studied when using a new tutorial advice/instrument/facilitator, the *IQ –FORM tools*, in virtual learning environments. The IQ-FORM tools consists of an *IQ-FORM databank* which is the tests sets for assessing learner qualities and and a *IQ-FORM tutorial package*.

The theory of mediated learning experience of Feuerstein is a basis when analysing the phenomena of supported learning in a virtual learning environment.

The theories behind the creation of IQ -FORM databank for defining the learning qualities of students are H. Gardner 's multiple intelligence theory (Gardner 1983) and P. Pintrich's & P. Ruohotie's motivational theory (Ruohotie & Pintrich 2000). The questionnaires work as a data bank, from which students may select different combinations to become more conscious of their learning styles and motivational strategies and changes in these qualities during the course (IQ-Research group 2001a and IQ-Research group 2001b). The profiles based on the tests tutor the students to find help and support from their teachers or peers and to encourage them to use new kind of learning material or routes to find more effective learning strategies.

5. THE METHOD TO MEDIATE LEARNING IN VIRTUAL UNIVERSITY

IQ –FORM forms a tool set, which can be regarded as an instrument aiming at mediated learning through mediated learning experience.

IQ-FORM databank giving information about learner's qualities

The first tool is called IQ-FORM databank intelligent questionnaire), which is an interactive databank and gives information about learner's qualities e.g. learning profiles and

motivational structures as well as social navigation during their virtual studies (Niemi 2000a).

IQ-FORM tutorial package for students, student groups and teachers

The other tool, or set of tools consists of a tutoring package for learners and teachers. This package contains guidance packages for students, student groups (in specific virtual classes) and teachers. The student packages will lead the student for example to analyse their learning styles, strengths and weaknesses and help them, when a problem situation occurs. The student group packages will guide the students for example to team work and goal settings in discussion groups. The teacher packages will advice the teacher, what to do, when she/he gains information about the students with IQ-FORM in form of learning profiles and group profiles, for example if the study motivation of the group as a whole is low, how to proceed (IQ-FORM research team, <http://www.edu.helsinki.fi/iqform/>).

The first virtual courses which will use the IQ -FORM as the supportive tool will be starting Fall 2001. A part of students participating in the courses will also be interviewed to get information how they use the IQ -FORM as data bank during the courses and how it helps them to grow as learners.

6. JUSTIFICATION FOR THE USE OF THE THEORY OF MEDIATE LEARNING EXPERIENCE IN IQ-FORM

There are theoretically solid reasons for using Feuersteins theory of Mediated Learning Experience in IQ-FORM.

- *The view about the human being*
- *The goal of meaningful learning*
- *The goal of an empowering learning environment*

6.1 The view about the human being

The belief system about human potential and Feuersteins theory of structural cognitive modifiability form a kind of paradigm, theoretical basis, in his thinking. This paradigm with a theory of cognitive modifiability comes close to the views representatives of latest

learning research laying the basis to IQ-FORM project. Burden presents Feuersteins theories in a shape of an iceberg (Burden, in Kozulin 1991, 47), where the base is in the understanding of cultural transmission and a belief system about human potential. This lays the basis to the theories of structural cognitive modifiability and mediated learning experience and their applications.

Feuerstein presents the view that the human cognitive processes are modifiable. According to him *"we refer to structural changes, or to changes in the state of the organism, brought about by a deliberate program of intervention that will facilitate the generation of continuous growth by rendering the organism receptive and sensitive to internal and external sources of stimulation"* (Feuerstein, 1980). The human beings can learn to learn how to learn. The human is capable of modifying the underlying structure of his cognition. Feuerstein defines intelligence as "a process broad enough to embrace a large variety of phenomena that have in common the dynamics and mechanics of adaptation. According to him, intelligence is this adaptability of the organism, that we refer to as modifiability (1990)."

It is quite uncomplicated to reflect Feuersteins thoughts to learning research: Niemi writes about a transition in the learning paradigms. During the last few decades, we have had three different paradigms of research on learning and knowledge, philosophical views of knowledge and their impact on educational research and practice. This traditions are empiricist, rationalist and socio-historical (Niemi, 2001, Case, 1996; Raynolds, et al. 1996). *A differentiating factor is what is seen as the main agent in knowledge creation.* Knowledge creation comes close to the view of Feuerstein about cognitive modifiability, when looking at Niemis' definition of it.

According to Niemi the empiricist tradition sees that knowledge is created by the experience that we have with the environment with which we are interacting. The rationalist tradition assumes that knowledge is created in our minds, while the socio-historical tradition sees that knowledge is socially constructed. Niemi states all the different paradigms are needed as complementary forces, because we cannot undermine thinking processes as key factors for the creation of knowledge. (Niemi 2000a).

Niemi (2001) writes:

We may see in learning paradigms a transition from external to more internal determinants, from unidimensional to multidimensional research designs and explanations, from decontextual to more specific, situational and contextual knowledge, and from static to more individually and socioculturally constructed knowledge. The research of learning is in a transitional stage.

Feuerstein calls the process through which we help humans develop the capacity to adapt to their environments the mediated learning experience. Feuerstein's theory of mediated learning requires that teachers set themselves between the child and his or her experiences.

IQ-FORM also has a view of the human being as ever developing creature. Niemi (2001) states that *"Learning is an intentional, purposeful process. Human beings want to see a purpose in their life. The higher education period is unique in a student's life. They want their studies to give them something valuable and ew. Students will work very hard if they comprehend the meaning of their studies. "*

6.2 The goal of meaningful learning

The IQ-FORM postulates of meaningful learning of professor Niemi has a familiarity with the criteria of mediated learning experience of Feuerstein.

Postulates of meaningful learning: What makes meaningful learning? (Niemi, 2001):

1. *Fearless interaction.* There is a need of cultural change of learning. This means moving towards encouragement and sharing - a culture which allows risk-taking and open collaborative problem-solving. It is a challenge without fear. The interaction in a virtual learning environment should be encouraging. - not making the students stiffened with fear.
2. *Experience of mastering something* - learning a process that supports self respect - which means learning for competence, not for control.

3. *Sense of sharing*: giving something to others and having a feeling that my part is important and valuable.

4. *Positive tension*: the drive to make an effort, towards something that a person considers as valuable, overcoming difficulties - students are not seeking an easy life - they are seeking meanings.

When reflected to the main criterias of MLE of Feuerstein, intentionality and reciprocity, transparency and meaning one can state that the goals are the same: to awake the students intentionality and self-awareness to study for meaningful goals.

3. The goal of an empowering learning environment

The virtual learning environment can be regarded in view of Feuerstein's analysis of culturally different and culturally deprived individuals. This might look strange at first, but when regarding a learner studying in a virtual learning environment one can state that this environment is deprived. It is not an environment, which has the characters of a natural learning environment with physical components and an authentic experience of comprehensive human interaction is missing. We may say that human mediation is limited and there is a danger that it is seriously missing. It is also important to notice, that the virtual learning environment is a fact, which can't be avoided in the learning situations of today, the most common example of this are the ATM:s of banks. VLE is also a challenge and an opportunity.

Professor Niemi states that

“The learning process should be an active process, in which the learner has ownership and initiates. Learners are expected to build their own learning environments using traditional information sources and learning materials, and modern knowledge technology. The main message is: Learning should empower people. It also includes the ideals that assessment confirms progress rather than branding failure. The virtual university is a forum which provides new learning opportunities for different learners. In IQ FORM project the aim is develop to advance different learners capacity to become active learners and to take their responsibility to manage own learning processes. The project is built on the

following epistemological principles and values: Learning is an intentional, purposeful process. Human beings want to see a purpose in their life. The higher education period is unique in a student's life. They want their studies to give them something valuable and new. Students will work very hard if they comprehend the meaning of their studies.” (Niemi, 2001)

When studying the theory of MLE, one can state that the basic motivation of Feuerstein to fight the deprived learning situation can be applied to many human learning situations, also, or one could say specially well, to a situation, when the learner is confronted with novel learning technology and virtual learning environments. According to Feuerstein the culturally deprived individual is an individual who's modifiability is restricted - the one who either has not been exposed or has not been able to benefit from his exposure to mediated learning experience. He is the devoid of learning tools, habits, dispositions and propensities to learn. (Feuerstein 1991, 5). The individual studying in a virtual learning environment can be culturally deprived, namely lacking tools, or alphabets to understand the educative offering of the net based course or its technological tools.

Feuerstein began to build tools to assist children in a culturally deprived environment and created the Instrumental Enrichment (IE) programme and the Learning Potential Assessment Device (LAPD) along with this developments his theory of Structural Cognitive Modifiability (SCM) and Mediated Learning Experience (MLE) took shape. (Burgess, 2000, 6-20)

Feuerstein's program aims to make an intervention in the learning process and develop the cognitive modifiability of the learners. If his theories are well adopted, one can utilize them build an empowering learning environment. The IQ-FORM project also strives to active involve in the learning process with the IQ-FORM tools in order to assist students for developing as learners by becoming aware of their learning strategies and help them to develop their learning skills.

7. CRITERIA FOR ASSESSING MEDIATION IN VIRTUAL ENVIROMENTS

7.1. Criteria for Mediated Learning Experience

Feuerstein presents twelve criteria of Mediated Learning Experience. These parameters are in presented different scripts in different order and with some slight differences of phrasing, but the first ones always mentioned first. These are (Feuerstein, 1991, 15):

- 1) Intentionality and Reciprocity
- 2) Transcendence
- 3) Mediation of Meaning
- 4) Mediation of Feelings of Competency
- 5) Mediation of Regulation and Control of Behavior
- 6) Mediation of Sharing Behavior
- 7) Mediation of Individuation/Psychological Differentiation
- 8) Mediation of Goal Seeking, goal setting and goal achieving behavior
- 9) Mediation of challenge: the search for novelty and complexity
- 10) Awareness of the human being as a changing entity
- 11) Mediation of the search of optimistic alternatives
- 12) Mediation of Feeling of Belonging

Feuerstein states (1991, 15) that of these twelve the first three, *intentionality and reciprocity*, *transcendence* and *mediation of meaning* are all necessary conditions for MLE.

Intentionality and Reciprocity

According to Feuerstein (Feuerstein, 1991, 17-20) the specific content of interaction is shaped by the intention to mediate to the mediatee and reciprocity is a way to turn an implicit intention into an explicit, volitional and conscious act. Feuerstein asks: how different is the mediated event from the regular one? It is important to note that the "intentionality" of the mediator is different from for example from an ordinary teaching situation where a teacher simply transmits information.

Feuerstein states that the intention transforms the three partners involved in the interaction: the stimuli, the mediator and the mediatee. A particular event is transformed in some of its characteristics by the mediator's intention to make it experienced and not only registered by the mediatee. The transformation means that the mediator strives to transform the mental,

emotional and motivational state to the mediatee. (ibid.), It seems clear that mediation is a deeper act than simple information sharing.

According to Feuerstein this modality of interaction (intentionality and reciprocity) creates in the mediatee an awareness of the learning process and the didactics underlying it. In his view

“the metacognitive components form an important part of the mediational interaction, taking the form of induced self-reflection, insight and articulation of the total field of components. This orientation, once internalised, becomes the steering power towards more efficient learning, and in turn, leads to higher levels of modifiability.”(Feuerstein, 1991, 20)

Transcendence

Transcendence means going beyond the goals of the interaction and can be described as bridging learning in the current situation to new situations. It is one of the most important components of mediation. In addition to intentionality and reciprocity is according to Feuerstein transcendence. Transcendence creates for the mediatee a possibility to enlarge his cognitive and affective range of functioning. Feuerstein points out that the mediation of transcendence is present from the very beginning of mediation and it should not be seen to be attributed only to a situation where generalisations and conceptualizations and abstract functions are mediated. Even an uneducated or low functioning mother may transcend the immediate goal of the interaction. (Feuerstein, 1991, 20-24)

Mediation of Meaning

If the first two criteria (representing the structure of interaction, answer to the questions when, where, how, what etc.) are met, MLE is performed. The mediation of meaning answers to the questions why, what for and other questions related to the causal and teleological relationship reasons. Feuerstein points out that the pedagogic and didactic reasoning of teachers or parents is often kept secret, but MLE “animated by the intention to transcend mediates to the mediatee the meaning of the interaction”.(Feuerstein, 1991, 24). Lack of meaning affects both the mediator and mediatee and has a negative outcome. (Feuerstein, 1991, 24-28)

The above three criteria are essential in defining MLE. However, the mediator also pays close attention to other aspects of learning from experience, which are listed above.

7.2. MLE criteria in Virtual Learning Environment

When assessing if the criteria for mediation of Feuerstein can be used in studies of virtual learning environment and especially in the IQ-FORM project certain questions arise:

- How do the three main criteria of MLE, intentionality and reciprocity, transcendence and meaning fit to adults studying at university level who already have a good capacity to learn?
- How do they fit the technology based learning environment?
- What do the criteria mean for the design of the IQ-FORM tools such as the tutoring package?

MLE and university students

The ideas of MLE were developed, when studying learning behaviour of groups of children deprived in some aspects and with problems to learn. Nevertheless even university students need to develop their cognitive functions. Rafi S. Feuerstein states, that a high level engineer, who works in an absolutely new technological environment, is likely to meet difficulty in learning effectively similarly to a child with Down syndrome who has trouble learning something quickly. People like this can be similar to normal, but culturally deprived child, who do to a mediational deficiency learns slowly and in a defective manner (Rafi Feuerstein 2000, 156). Rafi S. Feuerstein continues, that there are certainly people that are on a lower level of modifiability but *a state of lower modifiability is likely to appear in every person*. This kind of state can appear as well in an university student. When studying difficult topics or topics which are boring (for example any kinds of formulas or law paragraphs needed to be memorised) it is important that the students see the intention of the studies and wake up their volition and conscious will to learn.

IQ-FORM project uses the theories of Pintrich & Ruohotie (2000), which are to a large extent oriented to adult learner with “normal” learning skills. It is important to see that even university students can learn to develop their consciousness in the act of learning. IQ-FORM starts with testing the motivational structure of the students in a given course, the a tutorial package is offered to students to help them to become more active learners, to increase their

intentionality, to help them to transcend the things they have learned to new learning situations and to help them to see the meaning of their studies.

The principles in the construction of the IQ –Form tools are (Niemi 2000):

- Flexibility
IQ-Form will give qualitative and quantitative data, which can be used for different purposes to develop the quality of learning.
- Interactivity
IQ –Form allows a dialogue between learners and tutors.
- Support
IQ –Form offers learners with information about their own learning and effective ways of steering it.
- Tutoring
IQ –Form provides supervision to learners for finding options, which help them to learn more effectively.

IQ-Form helps the course tutor to supervise and support students to become more effective learners. IQ-Form can also be used by the course designers who need to understand different learning routes and difficulties.

In a net based learning environment IQ-FORM is needed for (Niemi 2000):

- Accepting learners' differences
- Interaction between learners and peers
- Interaction between tutor and the students
- Interaction between learners and course providers
- Awareness of one's own learning processes
- Keeping up motivation
- Providing new learning skills

MLE and a technology based learning environment

The core topic of this research project is what does mediation mean in virtual learning environments. MLE stresses the role of the human mediator. One can ask, can supportive tools such as IQ-FORM partly replace the human mediator, especially when IQ-FORM also offers an opportunity to human interaction although without face to face situation?

The starting point of IQ-FORM was to find something to support the student when studying, often lonely, only accompanied by the computer. The goal is to find humanistic components, such as tutorial packages to help the student. The packages involve also interactive components, where the student can get in contact with the teacher and the peer students.

Criteria of MLE and IQ-FORM

The three first criteria of MLE form a theoretical basis when building the argumentation for good learning environments. Intentionality and reciprocity, transcendence and meaning are all classic terms of learning research with long tradition of philosophical and epistemological groundings in phenomenology and existentialism. All the twelve criteria on MLE are an essential help, when looking for well functioning tutorial package for the IQ-FORM project to develop theoretical principles, how to enrich virtual learning environments to increase students' potential to manage their own learning and learning environments. The questions arising in this phase of the study are:

Intentionality and Reciprocity:

-How does IQ –FORM help the learner to understand how she/he is using her/his cognitive abilities? Can IQ –form help the student to build conscious volitional acts in his/her learning process?

Transcendence

-How do IQ –FORM assist the students when "bridging" he experience and lessons learned in the current situation to new situations?

Mediation of Meaning

-Does IQ –FORM give tools to the student understand the meaning of her/his learning accomplishment in a deeper sense.

The above mentioned being the necessary conditions of MLE are going to be studied, however also the rest of the MLE criterions also are also studied:

Does IQ – FORM support the development of a feeling of competence?

Does IQ –FORM support the student when she/he strives to regulate and control the learning process?

Does IQ –FORM encourage the student to a sharing her/his knowledge with other students?

Does IQ –FORM support the student to become aware of her/his individual psychological qualities as a learner?

How does IQ – FORM support goal seeking, goal setting and goal achieving behaviour?

Does IQ – FORM challenge students to search for novelty and complexity when studying?

Does IQ – FORM makes the student to become aware of the human being as a changing entity in other words to become aware of the modifiability of her/his cognitive structures?

Does IQ – FORM support the search of an optimistic alternative in means of anticipating positive outcomes of their studies?

Does IQ –FORM mediate a feeling of belonging in a study group?

8. LOOKING FORWARD - IMPLEMENTATION MLE CRITERIA IN EMPIRICAL RESEARCH

During Fall 2001 IQ-FORM learning support tool is going to be used in courses at the partner universities of IQ-FORM in Helsinki, Tampere, Oulu and Joensuu. A selection of students using are going to be interviewed.

The theories of Structural Cognitive Modifiability and Mediated Learning Experience give a comprehensive theoretical background to developing theoretical principles for how to enrich virtual learning environments to increase students' potential to manage their own learning and learning environments.

The forthcoming research tasks of the author are to study the broad variety of empirical verifications of theories of Feuerstein and to explore further how does the theory of MLE fits the new technology based learning environments and to study empirically, what are the student experiences of mediated learning when using mediated tools. The final and most demanding task is to develop theoretical principles, how to enrich virtual learning environments to increase students' potential to manage their own learning and learning environments.

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