MENTORING FOR INNOVATION: KEY FACTORS AFFECTING PARTICIPANT SATISFACTION IN THE PROCESS OF COLLABORATIVE KNOWLEDGE CONSTRUCTION IN TEACHER TRAINING

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ABSTRACT

This paper presents data about the successful use of the Mentored Innovation Model for professional development for a group of Hungarian teachers (n=23, n=20 in two iterations), which was employed in the CALIBRATE project in order to enhance their ICT skills and pedagogical competences needed for participation in a multicultural, multilingual educational innovation process. This model relied on the three basic constituents of an online community of inquiry: cognitive, social and teaching presence. Satisfaction regarding the model was explored through the observation of perceived (subjective) values provided by the participating respondents in order to identify the role of the virtual learning environments employed, activities of the facilitator and the participants' self-perceived social presence in the success of the training process. Mentoring was identified as a key factor of success in the in-service training process.

KEYWORDS

In-service teacher training, Online mentoring, Collaborative knowledge construction, Participant satisfaction, Perceived learning

I. INTRODUCTION

CALIBRATE (http://calibrate.eun.org, 2005-2008) was a European project supported by the Information Society Technologies (IST) Programme in which eight Ministries of Education, linked their national digital learning content repositories, investigated new intelligent search functions like curriculum mapping of resources and established a new multicultural and multilingual open source web community for finding, authoring and sharing learning resources. The process of developing the European Learning Resource Exchange (LRE) is currently continuing in the MELT project [1].

In Hungary, the *Mentored Innovation Model* (MIM) was employed to work together with teachers in piloting the first federated European digital learning resource repository, the LRE. In this paper, we analyse results regarding the efficacy of the MIM employed in two virtual learning environments in preparing teachers for performing the sophisticated innovation activities of piloting the LRE. Identification, retrieval, adaptation for classroom use and pilot teaching with international digital content and the evaluation of this process in collaborating groups required highly reflective behaviour related to the teachers' traditional pedagogical practices. Work with the LRE included providing constructive feedback and intensive engagement in the long-term co-development of learning resources. The collaborative processes were facilitated and moderated by e-moderators [2] – in the first phase one in each of the domain-specific groups, in the second phase one e-moderator in the larger group of in-service teachers. They provided professional mentoring i.e. scaffolding the knowledge creation of teachers by peers, e-moderators or facilitators in an e-learning environment to

support innovative practices. The e-moderators were also of Hungarian nationality and had been previously trained for the facilitation of online processes in the MIM in a uniform manner. They were experienced in online teaching and learning processes and delivering teacher professional trainings. The preparatory session for the facilitators aimed at harmonizing their teaching philosophies with those of the training participants and the aim of the mentoring scenarios. The MIM relied on the three basic constituents of the online community of inquiry: cognitive, social and teaching presence [3].

II. MENTORED INNOVATION MODEL: FACILITATING COMMUNICATION AND SCAFFOLDING LEARNING

The MIM is based on trialogical learning theory, which is elaborated during another European research project, *Knowledge Practice Laboratories, KP-Lab* [4]. Trialogicality refers to the processes involved when "shared objects of activity are collaboratively formulated and developed by using mediating tools, signs, and (conceptual and material) artefacts" [5]. In the current context, technology provides for *flexible tool mediation* so as to facilitate knowledge-creation processes. However, beyond collaborative activities, the trialogical learning theory also emphasizes the importance of the activity of individuals as part of the collective. Thus, interaction between personal and social levels, the elicitation of individual and collective agencies, and the development through transformation between various forms of knowledge and practices are the activities characteristic of this learning framework [6].

 While the traditional (dialogical) model for innovation elevates researchers and training staff to the role of knowledge providers who organize learning experiences for teachers, who are supposed to acquire and (slightly) adapt an elaborated set of educational methods and content, MIM is based on the collaboration of peers working on a boundary object: an innovative educational program. While the dialogical collaboration model is linear, MIM has a spiral structure where cycles of exploration, learning and creation of new knowledge are iterated on higher levels. In the framework of a design-based research experiment, MIM is integrated with school practice, teachers, educational researchers and trainers are equal partners who may alter shared knowledge objects profoundly if educational practice requires different approaches.

MIM is aimed at changing the professional self-concept, educational strategies and teaching methodology of teachers. It is a professional development experience as well as a competence enhancement process, which combines innovation with training in the following steps:

    a. Problems are identified and elaborated separately by teams of teachers and researchers.

    b. A common research and development agenda is negotiated, with the involvement of local community stakeholders (policy makers, parents etc.,).

    c. Supporting structures to solve complex pedagogical problems are provided by researchers and training experts (mentoring).

    d. Shared objects of activity are identified and developed (mentored innovation).

    e. Cognitive tools are employed to promote scaffolding through structuring inquirers' activities in a way that facilitates complex problem solving.

    f. Design-based research in the form of school experiments is performed in several iterations to test problem-solving strategies, refine shared pedagogical objects (teaching programs and aids, evaluation instruments, social involvement campaign strategies etc.).

    g. Local and national level dissemination of results is organized through a wide variety of channels (ranging from community campaigns to educational conferences).

    h. Teachers redefine professional self. Both teachers and participating educational researchers (who collaborate with teachers) act as innovators and mentors for new adaptors of teaching programs.

MIM is rooted in theories of social learning - more precisely it is strongly related to Vygotsky's [7]

ideas on *social mediation* and Engeström's [8] principles on *activity theory* .

The concept of social mediation encompasses both social mediation of individual learning and participatory knowledge construction [9]. Active *social mediation of individual learning* refers to the most fundamental social mode of learning in which an individual is helped by another one or a group of individuals. Scenarios such as a teacher teaching reading and writing; parents correcting children's misuse of words; a master guiding his apprentices; children working together on solving a task in Maths all underpin the general idea that in order to create a better system for learning a facilitating social agent is brought in who helps to meet the conditions [9]. *Social mediation as participatory knowledge construction* entails less the socially mediated knowledge acquisition but it rather means that cognition and learning products (jointly created) are distributed over the individuals and their social context (and not being preserved by the individuals) [9]. Thus, learning is seen as a participation in a social process of knowledge construction, and is located in the relations and activities of the participation.

When addressing the issue of mediation Kozulin and Presseisen suggest focusing on the role of the other individual as a mediator of meaning since as they argue "the meaning of one's own activity is formed by mediation through another individual" [10]. In this context Salomon and Perkins refer to various features that characterize social mediation, including intensive interaction, rapid feedback, highly personalized and situationally contingent guidance, encouragement, and the elicitation of responses from the student in the form of explanations, suggestions, reflections etc., [9], which in the MIM are undertaken by the facilitators.

The spiral structure of the MIM (especially the first five steps) incorporates the cycles Engeström [8] refers to in the process of expansive learning. Expansive learning ideal-typically evolves through the following stages: (1) the conflictual questioning of the existing practice; (2) the analysis of culminated contradictions; (3) modelling the new solution; (4) formation of the new model i.e. new pattern of activity; (5) the implementation of the new model in practical action; (6) reflection and evaluation of the process; and (7) consolidation of the new practice [11].

Paavola and Hakkarianen claim that this model provides "a basis for his [Engeström's] well-articulated interventional tools that allow an individual or a community to reflect on its practices and deliberately bring about changes so as to overcome tensions and disturbances of the prevailing activity system" [5]. Accordingly, the MIM that is rooted in theories of social learning including the concept of social mediation and elements of Engeström's [8] model, has been employed in educational settings in order to facilitate the change of in-service teachers' professional self-concept, educational strategies and teaching methodology. Crucial to this process are the e-moderators i.e. facilitators who provided *professional mentoring* i.e. scaffolding the knowledge creation of teachers in an e-learning environment to support innovative practices. Professional mentoring is undertaken in the form of knowledge-building discourse "whose aim is progress in the state of knowledge: idea improvement" [12]. Knowledge-building discourse can (1) focus on problems and depth of understanding; (2) be decentralized, open knowledge environments for collective understanding; and (3) productive interaction within broadly conceived knowledge-building communities [13]. Thus, in the process of knowledge building focus is on problems (rather than on categories of knowledge), "engagement is at the level of how things work, underlying causes and principles, and interrelatedness of ideas explored over lengthy periods" [13]. Further it is to be understood as a decentralized, open knowledge building with a view on collective knowledge. This process involves complex interactions that aim at engaging the participants, distributing work within the group, sustaining inquiry, and monitoring advances.

Knowledge-building interactions and mentoring carried out by the facilitators in the MIM relied on the online community of inquiry [3]. The community of inquiry (CoI) is based on the many combinations of interaction among agents of the online learning but it is more than a magnitude of interaction among participants: it is a model that maps and defines educational presence [14]. Educational presence is composed of social, teaching and cognitive presence, thus the CoI considers these three presences, and integrates social, teaching and cognitive elements that exceed social exchanges and low-level cognitive interaction [15].

Social presence or the "illusion of nonmediation" [16] is defined as the ability of learners to project

themselves socially and emotionally [17], which means the extent to which a person is perceived as a
"real person" in mediated communication [18, 19]. It supports both cognitive and affective objectives.
The former ones by instigating, sustaining, and supporting critical thinking, the latter ones by making
group interactions engaging and intrinsically rewarding [20]. Two concepts are associated with the
concept of presence: (1) intimacy and (2) immediacy [18]. Social presence, seen from this perspective
refers to the degree to which a communication medium contributes to intimacy, while immediacy
entails the distance between the communicator and the object of his/her communication [19]. Thus,
similarly to Short et al.'s [19], in our view as well, social presence characterizes the medium, the
communicators, and their presence in the interactions. Teaching presence refers to the role of the
online instructor "to design and integrate the cognitive and social elements of a community of inquiry
for educational purposes" [3]. Interactions (both social and content-related) need to have clearly set
parameters and focus, which is done by the instructor. Accordingly, teaching presence is "the design,
facilitation, and direction of cognitive and social processes for the purpose of realizing personally
meaningful and educationally worthwhile learning outcomes" [15]. Therefore, teaching presence,
according to Anderson et al., begins before the course commences since the teacher plans and
prepares the course, and it is maintained throughout the course as the teacher facilitates the
interactions and collaborations [21]. The third pillar of the CoI framework, cognitive presence is
defined as the extent to which learners are able to construct and confirm meaning through reflection
and discourse [22, 23, 24]. It was operationalized as a practical inquiry model consisting of four
phases: (1) triggering event (issue or dilemma emerges and is identified), (2) exploration (treatment of
the issue through reflective discourse by using techniques such as brainstorming, questioning, and so
on), (3) integration (meaning is constructed), and (4) resolution (application of new knowledge to
educational contexts).

III. METHODOLOGY

A. Sample – Teachers participating in the first and the second phase of the CALIBRATE project

In the first phase of the implementation and evaluation of international learning resources, (March-
May 2007), 23 Hungarian in-service teachers worked in collaboration with their colleagues, pupils,
facilitators and educational researchers. The second phase took place between October 2007 and
January 2008, during which 20 in-service teachers collaborated. The two cohorts were not identical.
The community of in-service teachers searched and evaluated this repository and identified *learning
objects* (LO-s, simple elements to be used flexibly in different cultural contexts) and *learning assets*
(complex learning materials that are curriculum-related and may contain cultural characteristics to be
adapted or accepted) useful for teaching practice. Instead of only evaluating digital tools and learning
materials – the usual assessment method for ICT-based educational innovations – teachers were asked
to form discipline-based educational innovation communities and associate educational methods best
suited to the resources they found in the LRE in the form of lesson plans (uploaded through a
template) or freely described user stories.

	Male	Female	Primary school	Secondary school	Not from the capital	From the capital	Mathematics Informatics	Science	Foreign languages	Humanities	TOTAL
March–May 2007	3	20	9	14	16	7	5	7	7	4	23
October 2007 – January 2008	4	16	5	15	9	11	10	5	2	3	20

Table 1 Basic information on the Hungarian participants

Evaluation was carried out in seven countries, including Hungary. Basic issues of European
educational policy making were addressed: is it realistic to expect teachers to make regular and
effective use of an international set of learning resources and assets in foreign languages, developed

for use in a different educational system? Are they able to retrieve, adapt and – after a brief observation or an in-depth test in the classroom – evaluate learning materials developed by their peers in other countries? Three approaches were used to answer these questions:

A. Participant observation and testing: a core group of pioneer ICT teachers followed the work of software developers, tested beta versions and offered practice-related feedback.

B. School based case studies that focused on problems of LRE and LeMill introduction and use in the pilot validation phase.

C. In vivo experiments with novice users during National Evaluation Days in seven countries that included training teachers to act like reflective practitioners – researchers of their own practice.

Successful use however, required preparation of piloting teachers for work in collaborative knowledge building communities. Pilot teachers were mostly high-level ICT users, the pre-tests of ICT performance and educational strategies revealed that they belonged to the category of innovators and early adopters [20, 25]. However, Hungarian teachers had modest experience of using federated search in linked digital content repositories. Significant differences in foreign language skills and motivation to take part in a collaborative educational innovation enterprise were also revealed.

B. Virtual learning environments used

In the first phase, activities were hosted in the virtual learning environment (VLE) Future Learning Environment (FLE3), which is an asynchronous groupware system designed for supporting collaborative knowledge building and progressive inquiry in educational settings. It is the third version of a web based, open source software developed by the Learning Environments for Progressive Enquiry Research Group of the University of Industrial Arts Helsinki (http://fle3.uiah.fi). In the second phase, the community platform and social software LeMill, newly developed for the support of the federated repository, was used for sharing knowledge and pedagogical practices, adapted or self-developed contents (www.lemill.net). It may be used for finding, authoring and sharing learning resources, but may also be utilized as a site for international professional co-operation among members of an international community of teachers. Both VLEs played a crucial role, both in the collaborative processes and the mentoring events, since they served as an appropriate platform of learning and sharing ideas, materials and practices within the community that consisted of in-service teachers located in different parts of the country. Thus, communication and exchange of information was carried out exclusively on these platforms. However, besides establishing flexible tool mediation in regard to collaborative work, the VLEs also proved an effective tool for providing help in the research and data analysis processes.

C. Research context, research questions, survey instrument and procedure

The integration of teachers' online learning groups and professional communities into teacher training and teachers' professional training plans has been widely accepted [26, 27, 28]. In Hungary, enhancing teachers' personal knowledge and giving space to their professional growth are crucial in transforming the educational system into a more adaptive learning system. Involving teachers in educational research projects as active collaborating members could be one step towards the research-based teacher training and teachers' professional training [29]. In the current study, the instructional context for the research-based training of in-service teachers' communities was the MIM in the framework of the CALIBRATE project.

According to our hypothesis mentoring is a key factor of success in the in-service training process, and that mentoring failure (lack of scaffolding and effective online communication within the community etc.) can lead to lack of collaboration and a high number of drop-outs in virtual courses. With the presented survey instrument and series of analyses our aim was to investigate the participating in-service teachers' satisfaction with the model, to identify the role of the VLE and the facilitator in the success of the mentoring process and the participants' self-perceived development. Based on the above foci we formulated the following research questions:

1. What are the elements that influence participant satisfaction and self-perceived learning success in the online mentoring process in the CSCL environment?

2. How are these elements interrelated?
3. What is the position of the facilitator among the elements of the MIM?

The survey instrument used for assessing participants' perceptions of the MIM, and developing a model of participant satisfaction consisted of 25 Likert-type items [30]. The items used a 4-point response scale (strongly disagree, disagree, agree and strongly agree), and respondents were asked to consider their ratings in the context of the online mentoring model. Accordingly, satisfaction regarding the MIM was explored by relying on the perceived (subjective) values provided by the participating respondents.

Previous to the questionnaire development process, a survey of the literature on the evaluation of online mentoring models and participant satisfaction was carried out [15, 31, 32, 33, 34, 35, 36]. Those items were adapted that were considered to be relevant in the presented pedagogical scenario as regards the experiential information about the respondents in obtaining their rankings of their satisfaction with the mentoring events.

Four criteria of the MIM were in the centre of the investigation: (1) participants' global satisfaction, (2) the facilitator's activity, (3) the online communication in the VLEs (LeMill and Fle3), and (4) the participants' perceived social presence. We obtained four separate variable groups on the basis of the above areas. Each variable group contains one dependent and various independent variables.

Not all the independent variables had significant impact on the dependent variables thus exclusively the ones with significant impact are reported. This in the case of the first iteration means 3 variables concerning "global satisfaction", 2 variables for the "facilitator's role" and another 2 in the case of "social presence". As for the dependent variable "satisfaction with the online communication in the VLEs" 3 independent variables were reported. In the second iteration the number of those having significant impact grew to 3. In the case of the other three dependent variables the same independent variables proved to have significant effect. (The dependent and independent variables within each variable group in both iterations are presented in Table 2, Table 3, Table 4 and Table 5)

Instead of employing statistical means and relying on normal distributions for further analyses, multi-regression data analysis was used so as to depict the *perceived importance* of the four dependent variables and the independent variables that have an assumed impact on participant satisfaction. In the first phase of the regression analyses, we focused on investigating the extent to which the independent variables affect significantly the dependent variable.

The following procedure was carried out in the case of all the four criteria of the model. The 4-scale ratings were converted to a 0-100 scale in order to yield single scores for each variable (dependent and independent). Regression analyses were computed and significant items were indicated – with the respective importance values. *Importance value* is used to calculate satisfaction indices that measure the quality of the mentoring process by incorporating the participants' judgement in a weighted form. Variables of the MIM with significant impact affect satisfaction proportionate to their importance. On the basis of the importance values, global indexes were calculated referring to the four criteria. In the second phase of regression analyses when an *explanatory model* was created we employed these indexes. Since it was intended to create an explanatory model in which all the four dependent variables (that are the criteria for evaluating the MIM) are present, R^2 values were calculated for each of the four criteria.

Explanatory models are outputs of categorical regression by optimal scaling (CATREG) provided by the statistical software SPSS. Important to the series of multi-regression analyses and model building are the following values. *Adjusted R^2*, or *total variance* refers to the explanatory power of the model. It is a value ranging between 0 and 1, it is proportionate to the part of variance of the dependent variable that is explained by the independent variables. It is claimed that the higher the R^2, the "stronger" the explanatory power of the model. *Beta-coefficient (β)* refers to the extent any of the independent variables impacts the dependent variable. A higher β corresponds to a higher impact. *Importance* is the most easily interpretable coefficient of the independent variables that equals the part of R^2 explained by an independent variable. *Contribution* or *overall importance* relates to the effective importance (impact) of any independent variable on the dependent variable. It is calculated by multiplying the R^2 by the importance value.

IV. ANALYSES

A. In-service teachers' global satisfaction

In the first phase (March – May 2007) we found four variables to have a significant impact on the in-service teachers' global satisfaction (with the mentoring process in general and the online collaborative work in the VLE) (Table 1): 'benefits' (affective rather than cognitive nature) (p = .000); the 'experience gained by participating the mentored innovation model – the usefulness of the experience' (p = .000) and the 'quality of learning' (p = .000). The two variables (describing the affective dimension) focusing on the experience and benefits gained in the collaboration and the mentoring events were considered to be almost equally important (values 69 and 70).

We found similar results concerning the in-service teachers' global satisfaction with the added participants' data of the second phase (October 2007 – January 2008) (Table 2). This time again the same three variables showed significant impact on the participants' global satisfaction however, the importance values changed slightly. The 'benefits' gained (p = .000) influenced the most global satisfaction, i.e., the importance value of this variable was also the highest. The 'usefulness of the experience' (p = .000) and the quality of learning (p = .000) impacted global satisfaction as a criterion of the mentored innovation to a different extent however, their satisfaction indexes were the same (74-74).

Among the satisfaction indexes related to the three variables, the one referring to 'the quality of learning' was the highest (72 and 76), in other words the participants were the most satisfied with the quality of learning (pedagogical innovation transmitted by the project) that took place in the VLEs.

Components of the model	Beta	DF	F	Significance	Importance after transformation	Importance	Index of satisfaction (0-100)
Phase I. (n = 23) Participants' global satisfaction $(R^2 = .71)$ $(\alpha = .86)$							
benefits gained	.427	3	12.85	p = .000	.43	.30	69
usefulness of the experience	.326	2	7.85	p =.000	.30	.22	70
quality of learning	.349	2	1.83	p =.000	.26	.19	72
Phase II. (n = 20) Participants' global satisfaction $(R^2 = .81)$ $(\alpha = .78)$							
benefits gained	.457	3	12.85	p = .000	.45	.37	74
usefulness of the experience	.366	2	7.81	p =.000	.33	.27	74
quality of learning	.393	2	14.84	p = .000	.28	.23	76

Table 2 The results of the survey on in-service teachers' global satisfaction

B. The facilitator's role

Regarding the evaluation of the facilitators' role, two variables showed significant impact in the first phase: feedback provided by the facilitator (p < .002), and the help offered by the facilitators (p = .000) contributed to the self-perceived knowledge advancement. In our project in the case of the in-service teachers the strong impact of giving feedback was supported and the aspect of professional scaffolding (help provided by the facilitator) was also added. Thus, feedback provided by the facilitators within the mentoring process on the participants' activity in the VLE proved to be just as important as the constant help i.e., the professional scaffolding offered by them. As regards the participants' satisfaction with the facilitator's role, both variables were rated with the same values (78-78) i.e., the participants were satisfied with the feedback provided by the facilitators and the professional scaffolding offered by them to the same extent (Table 3).

Components of the model	Beta	DF	F	Significance	Importance after transformation	Importance	Index of satisfaction (0-100)
Phase I. (n = 23) The facilitator's role $(R^2=.64)$ $(\alpha = .95)$							

Facilitator's feedback	.355	2	7.36	p < .002	.38	.25	78
Help provided by the facilitator	.534	2	16.61	p = .000	.61	.40	78
Phase II. (n = 20) The facilitator's role $(R^2=.83)$ $(\alpha = .89)$							
Facilitator's feedback	.374	3	9.59	p = .000	.43	.26	75
Help provided by the facilitator	.650	3	18.77	p = .000	.75	.46	78
Facilitator created a feeling of online community	.247	2	4.89	p < .010	.18	.11	76

Table 3 The results of the survey on the facilitator's role

In the second phase a third variable 'the facilitator created a feeling of online community' referring to the facilitator's role as a social director was added to the two previously mentioned ones (p < .010). The importance values of the two other variables increased: the 'feedback provided by the facilitator' (p = .000) and the 'help offered by the facilitator' (p = .000). As regards the satisfaction indexes, we detected an interesting transformation: the variable 'help offered by the facilitator' (which had the same satisfaction index as the 'feedback provided by the facilitator') now had a higher satisfaction index (78); the participants were more satisfied with the facilitators' role as social director (76) than with the feedback provided by them (75). Since the in-service teachers were located in different parts of the country and worked purely online, the facilitator's role as social director was of high importance. Thus, the process of creating a sense of online community must be carefully planned in advance and scaffolded by ice-breaking or socializing activities.

C. Social Presence

In respect to the perceived social presence two variables proved significant: 'participants' point of view was acknowledged by the facilitator' (p = .000) and 'distinct impressions of the group members were created' (p < .001). The residual percentage in the case of social presence is high (75%). However, this phenomenon can be considered as normal from the research methodological point of view, since only little is known about the characteristics of the form, the content and the effects of social presence as articulated by Lombard and Ditton [16].

The structure of the variables and their impact on the social presence constituent changed with the added participants' data from the second phase. The variable 'distinct impressions of the facilitator' (p < .016) also had a significant impact on participants' satisfaction regarding social presence. As for satisfaction, the variable 'participants' point of view was acknowledged by the facilitator' has the highest index (80) (Table 4). By having a third significant variable the residual part has decreased to 59% but this value is still high.

A person is perceived as 'real' in mediated communication if they fail to realize the existence of a medium in their communication and interact as if it were not there. What is highly important in this context is that in a VLE the concept of presence manifests itself through the interactions among the participants and the instructor and is thus a social phenomenon. Accordingly, this variable needs to be further elaborated since the participants' and the facilitators' perceived social presence (which can be grasped and made visible in the form of online interactions within the mentoring process in the VLE) is crucial to the success of online pedagogical scenarios alike. As Picciano puts it, "students who feel that they are part of a group or 'present' in a community will wish to participate actively in group and community activities" [34].

Components of the model	*Beta*	*DF*	*F*	*Significance*	*Importance after transformation*	*Importance*	*Index of satisfaction (0-100)*
Phase I. (n = 23) Social presence $(R^2=.25)$ $(\alpha = .77)$							
Participant's point of view was acknowledged by the facilitator	.475	2	12.07	p = .000	.64	.16	81
Distinct impressions of the group members were created	.355	3	6.72	p < .001	.35	.09	73
Phase II. (n = 20) Social presence $(R^2=.41)$ $(\alpha = .82)$							

Participant's point of view was acknowledged by the facilitator	.349	2	11.13	p = .000	.43	.18	80
Distinct impressions of the group members were created	.234	3	4.65	p < .005	.26	.10	76
Distinct impressions of the facilitator were created	.251	2	4.34	p < .016	.31	.13	73

Table 4. The results of the survey on social presence

D. Online communication in the MIM

The following three variables proved to have significant effect on the participants' satisfaction with the online communication: 'feeling comfortable with participating in online knowledge-building discussions' (p = .000), 'individual opinions acknowledged by group members' (p = .000) and 'feeling comfortable conversing with the facilitator through the online surface' (p = .000). With the added participants' data collected in the second phase, satisfaction with the online communication and the importance values of the variables changed: the importance of the variable 'feeling comfortable with participating in online knowledge-building discussion' grew slightly (p = .000); the impact of the variable 'individual opinions acknowledged by group members' decreased considerably (p < .007); while the variable 'feeling comfortable conversing with the facilitator through the online surface' grew (p = .000). The drastic decrease of the importance of the second variable can be explained by the fact that the variable referring to the facilitator's role as a social director now had an impact on the satisfaction with the facilitator criterion; in the case of social presence, the variable 'distinct impressions of the facilitator' influenced the participants' satisfaction. Since the two new variables are associated with the "activity" of the decreased variable, it is assumed that the values were transformed and rearranged. This rearrangement of values is directly linked to the increase of the residual part from a low value of 22% to a relatively high one of 42% in the case of the online communication criterion of the MIM.

The satisfaction index is high in the case of all the three variables (74-77-76) (Table 5), but the participants were the most satisfied with the experience that group members acknowledged individual opinions. Fostering a supportive and fertile learning environment, facilitating and scaffolding collaborative work are important tasks of the mentor (facilitator). In the MIM, help and feedback provided by the facilitators and their openness towards the participants' previous professional experience, practice and knowledge are indispensable conditions of in-service teachers' acting efficiently in knowledge-building communities. They are expected to have an attitude of collaborating with the teachers as a community of professionals rather than simply 'test dummies' with mainly receptive skills in the process of pedagogical innovation.

Components of the model	Beta	DF	F	Significance	Importance after transformation	Importance	Index of satisfaction (0-100)
Phase I. (n = 23) Online communication in the MIM $(R^2 =.78)$ $(\alpha= .83)$							
Participating in online discussions	.489	3	32.94	p = .000	.44	.34	75
Individual opinions acknowledged by the group members	.477	1	37.87	p = .000	.34	.27	78
Conversing through the VLE	.328	2	15.68	p = .000	.21	.14	74
Phase II. (n = 20) Online communication in the MIM $(R^2 =.59)$ $(\alpha= .84)$							
Participating in online discussions	.539	3	32.04	p = .000	.64	.38	74
Individual opinions acknowledged by the group members	.134	1	3.20	p < .007	.05	.03	77
Conversing through the VLE	.298	2	10.15	p = .000	.31	.18	76

Table 5. The results of the survey on online communication in the MIM

E. Relationship between the components of the MIM

In the second phase of regression analyses, the relations between the four components of the MIM that were described by using four variable groups were mapped (Figure 1). Thus, potential relations and effects were investigated between the participants' global satisfaction, the facilitator's activity, the perceived social presence and the online communication in the MIM. In this phase, in the first round of the analyses the participants' global satisfaction was considered as the dependent variable, and its potential relation to the other three constituents was analyzed. The only component that had statistically significant impact on the participants' global satisfaction was 'the online communication in the MIM' with an extremely high importance value demonstrating a strong explanatory power (p = .000) (.94). Accordingly, in the cases *Calibrate 1* and *Calibrate 2* it was found that online communication in collaborations maintained in the framework of the MIM moderated by a facilitator directly impacted participants' satisfaction and the success of the online mentoring process. In the present evaluation framework, claiming that in-service teachers' satisfaction was significantly impacted by the online communication component refers to satisfaction with the participation in on-task discussions, the experience of individual opinions being acknowledged by the fellow group members and the comfortable way of conversing through the medium.
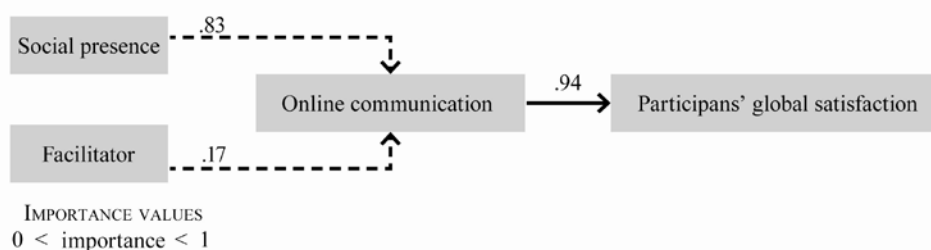

Figure 1 Explanatory model for the Calibrate 1 and Calibrate 2 cases

In the next round of regression analyses (when the online communication component was considered as the dependent variable), we found that the other two components (individually) – facilitator's activity (p < .013) (.17) and perceived social presence (p = .000) (.83) – had statistically significant influence on the participating in-service teachers' online communication and through it on the global satisfaction. Consequently, we claim that the facilitator's activity (their teaching presence) and social presence directly impacted online communication in the CSCL environment in the mentoring process**.** However, between the two components (social presence and facilitator's role) there were not any significant relations detected. Hence, the facilitator's influence on participants' social presence was not confirmed by the analyses. (For the detailed results see Table 6*.*)

Components of the model	Beta	DF	F	Significance	Importance after transformation	Importance
1st step: Course satisfaction as dependent variable $(R^2 = .78)$						
Facilitator's role (independent variable)	.12	2	1.64	p < .210	-	.07
Social presence (independent variable)	-.04	3	.20	p < .901	-	-.01
Online communication (independent variable)	**.86**	**3**	**110.06**	**p = .000**	**.734**	**.94**
2nd step: Online communication as dependent Variable $(R^2 = .77)$						
Facilitator's role (independent variable)	**.21**	**2**	**4.88**	**p < .013**	**.135**	**.17**
Social presence (independent variable)	**.75**	**2**	**63.28**	**p = .000**	**.641**	**.83**
3rd step: Social presence as dependent variable $(R^2 = 1)$						

Facilitator's role (independent variable)	-	-	-	-	-	-

Table 6. Data on the second phase of regression analyses

V. DISCUSSION AND CONCLUSION

As indicated by the research context, the purpose of this study was twofold. On one hand, the aim was to integrate communities of Hungarian in-service teachers in research-based training activities, which the EU funded large-scale research project allowed for. On the other hand, to evaluate and identify key factors of success of the applied instructional context, the MIM.

With the reported participant activity analyses, an extensive number of variables of the participating in-service teachers' satisfaction with the MIM were revealed, focusing specifically on four major issues: global satisfaction, the facilitator's activity, perceived social presence and online communication. Our analyses identified statistically significant values and showed variables of the four basic criteria of the online mentoring processes. The results of this study showed that out of the four components of the MIM the participants were satisfied with the *facilitator's role* and the *social presence experience* in the CSCL environments to an equal extent (global indexes: 78-78). These two are immediately followed by the *online communication* component (75). Thus, according to the survey, the participants were highly satisfied with the vibrancy of discussions and interactions that took place in the online environments facilitated by the e-moderators.

The facilitator's activity or their *teaching presence* [21] as a crucial component of the MIM was investigated through numerous variables focusing on their three main areas of responsibility: (1) course design and organization, (2) facilitating discourse, and (3) direct instruction. Components of the latter two areas of responsibilities were also pinpointed by the variables constituting the 'facilitator's role' variable group. The results showed that the *pedagogical role* [37] or *instructor role* [38] of the facilitator (as a consultant, guide and resource provider) was highly relevant. This role encompasses professional scaffolding offered to the online participants in their growing understanding of the (course) content, and the facilitation of their knowledge building in order to complete assignments and reach learning aims set prior to the process [38, 39, 40]. This is maintained by initiating questions and provoking responses from the participants, and focusing discussions on crucial points so that discussions progress beyond info sharing to knowledge construction, weaving together different concepts and assisting participants in connecting content with prior knowledge [21, 38, 41]. Significant results concerning the online communication component of the MIM, more precisely the independent variable 'participation in on-task discussions' (which covered the above referred activities and strategies employed by the facilitator) revealed that facilitating discourse and skilful direct instruction have a strong explanatory power concerning participants' satisfaction with the online communication that took place in the MIM. Accordingly, online communication is a strong indicator of satisfaction. Providing useful and creative feedback and evaluating contributions are both effective techniques applied by the online instructor maintaining the pedagogical or instructor role [2, 21] and preserving teaching presence. Especially in online environments timely informative feedback is critical as compared to face-to-face settings since learners may feel isolated due to the characteristics of the communication medium [38]. Significant results showed that participants of the present survey were highly satisfied with the quality of the feed-back offered by the facilitator and the help (professional scaffolding) provided by the facilitator which both had a strong explanatory power in the variable group investigating the facilitator's activity.

Satisfaction regarding the quality of the teaching and learning experiences in the MIM – as an indicator of perceived *cognitive presence* that is the extent to which participants were able to construct and confirm meaning through reflection and discourse – received the highest rate in the variable group concerning the participants' global satisfaction. Accordingly, participants were the most satisfied with the quality of learning that took place in the CSCL environments in the framework of the MIM. Based on these significant results (even if self-perceived cognitive presence was surveyed), we can claim that in the presented scenarios effective online communication contributed to the participants' growing understanding of the content, and managed to contribute to the facilitation of their knowledge building so that discussions progressed beyond info sharing to knowledge construction.

The facilitator's *social presence* [17] or the *social director role* [37, 38] that involved the establishment and facilitation of personal relationships within the collaborating community was also identified (indicators of it are pinpointed in the online communication and social presence constituents of the MIM). Beyond the facilitators' activities linked to its professional scaffolding, the participant's ability to create distinct impressions of the facilitator was revealed as being of high explanatory power in the evaluation of their role. Thus, evolving social presence, the "illusion of nonmediation" [16] is also essential to developing teachers' satisfaction with the online experience. Establishing a comfortable and effective work-relationship between group and mentor, acting authentically both as a reliable human being and a professionally competent colleague, is likewise a must in online collaborations and mentoring events.

Significant results revealed that the variable 'individual opinions acknowledged by group members' had a strong explanatory power within the online communication variable group. However, the social presence variable group became tangible to a limited extent. Despite the fact that the participants managed to form distinct impressions of each other and the facilitator, and felt that their opinions were acknowledged both by the facilitator and their peers, a fundamental part of the social presence-element has not been made visible yet. What is however leading in this direction are the significant results concerning the explanatory power of the variable (within the online communication variable group) indicating that the in-service teachers felt comfortable conversing through the medium (in the presented scenarios the VLEs), and the relevant indexes showing a high degree of participant satisfaction. Thus, the "illusion of nonmediation" as Lombard and Ditton [16] characterized the concept of social presence, i.e., interacting as if we were not using a digital medium of transmitting information, was successfully maintained. Participants perceived each other and their facilitators as a "real person" in the mediated communication [18, 19], communication through the medium contributed to the intimacy among the communicators and eventually reduced the distance between the participants.

Statistically, the referred independent variables are part of various variable groups (see Cronbach-alfa measures for the four variable groups in Table 2, 3, 4 and Table 5) but in real-life online mentoring events online communication cannot be considered without the facilitator's activity (teaching presence), the participants' social presence and the communication medium. This is supported by the above reported results, which clearly demonstrated that there is a statistically significant relation among the components, and also an indirect impact of them on the participants' global satisfaction.

With reference to the use of research-based training activities in teachers' professional training, we found that an innovation process which involved both the transformation of individual and social practices and technical innovation evolved in the communities of in-service teachers who shared common teaching philosophies and methodological concerns. LeMill, the technical innovation which allowed for mediating online experiences was acknowledged as having the potential to become a central tool for initiating teachers' innovative knowledge-building communities. In the participating Eastern European countries such as Hungary, where ICT-supported collaborative scenarios are manifestations of an emerging pedagogical paradigm, the research-based training activities partly catalyzed innovation processes and contributed to the more efficient pedagogical use of digital resources [41]. The MIM as part of the methodological inventory of the training activities also accelerated innovation processes and the transformation of individual and social practices within which the facilitators' role and the online communication components of the model proved the most influential on participating in-service teachers' satisfaction and self-perceived development. Accordingly, the MIM and its adjusted (further developed) form is envisioned to become part of both in- and pre-service teacher training curricula ensuring the acquisition of cutting edge skills and ideas about working in research-based online training activities.

VI. ABOUT THE AUTHORS

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VII. ACKNOWLEDGEMENTS

VIII. REFERENCES

1. MELT (2007-2009, http://info.melt-project.eu) is supported by the European Commission's eContentPlus Programme. It brings together 18 public and private sector content partners, including 12 Ministries of Education, the ARIADNE Foundation and commercial publishers such as Cambridge-Hitachi and Skolavefurinn. The project's aim is to provide a scalable and cost-effective solution for European content providers faced with the challenge of creating more and better metadata. This new service enables schools to find educational content from many different countries and providers through an agent based, intelligent search system. At the end of 2008, 18 partners from 14 countries have made available 37,593 resources and 97,200 assets in the Learning Resource Exchange.
2. **Salmon, G.,** E-Moderating: The key to teaching and learning online, London: Kogan-Page, 2000.
3. **Garrison, D. R., Anderson, T., & Archer, W.** Critical inquiry in a text-based environment: computer conferencing in higher education. *The Internet and Higher Education.* 2(2-3): 87-105 (2000).
4. The EU-funded research and development project, KP-Lab (www.kp-lab.org, 2006-2011), is currently working on the elaboration of new models for professional skills development based on this concept of trialogical knowledge creation.
5. **Paavola, S., & Hakkarainen, K.** The Knowledge creation metaphor–An emergent epistemological approach to learning. *Science* & Education. 14: 537-557 (2005).
6. **Paavola, S., & Hakkarainen, K.** Background and Characteristics of "Trialogical Learning," v.2.0. Working Paper. University of Helsinki (2006).
7. **Vygotsky, L.S.,** Mind in society: The development of higher psychological processes, Cambridge, MA: Harvard University Press, 1978.
8. **Engeström, Y.** Expansive learning at work: toward an activity theoretical reconceptualisation. *Journal of Education and Work.* 14(1): 133-156 (2001).
9. **Salomon, G., & Perkins, D.N.** Individual and social aspects of learning. *Review of Research in Education.* 23(1): 1-24 (1998).
10. **Kozulin, A., & Presseisen, B. Z.** Mediated learning experience and psychological tools: Vygotsky's and Feuerstein's perspectives in a study of student learning. *Educational Psychologist.* 30(2): 67-75 (1995).
11. **Engeström, Y., Miettinen, R. & Punamäki, R-L.** (Eds.), *Perspectives on activity theory,* Cambridge, England: Cambridge University Press, 1999.
12. **Scardamalia, M., & Bereiter, C.** Technologies for knowledge-building discourse. *Technology in Education.* 36(5): 37-41 (1993).

13. **Scardamalia, M. & Bereiter, C.** Computer support for knowledge building communities. *The Journal of the Learning Sciences.* 3(3): 265-283 (1994).

14. **Garrison, D.R., & Cleveland-Innes, M.** Facilitating cognitive presence in online learning: interaction is not enough. *American Journal of Distance Education.* 19 (3): 133-148 (2005).

15. **Garrison, D. R. & Anderson T.,** E-Learning in the 21st century: A framework for research and practice. London: Routledge/Falmer, 2003.

16. **Lombard, M. and Ditton T.** At the heart of it all: The concept of presence. *Journal of Computer Mediated Communications.* *3*(2) (1997). http://jcmc.indiana.edu/vol3/issue2/lombard.html.

17. **Rourke, L., Anderson, T., Garrison, D.R., & Archer, W.** Assessing social presence in asynchronous text-based computer conferencing. *Journal of Distance Education.* 14: 51-70 (1999).

18. **Gunawardena, C.N., & Zittle, F.** Social presence as a predictor of satisfaction within a computer mediated conferencing environment. *American Journal of Distance Education.* 11(3): 8-25 (1997).

19. **Short, J., Williams, E., & Christie, B.** *The social psychology of telecommunication.* London: Wiley, 1976.

20. **Rogers, E. M.** *Diffusion of Innovations*, 4th ed., New York: Free Press, 1995.

21. **Anderson, T., Rourke, L., Garrison, D.R., & Archer, W.** Assessing teaching presence in a computer conference context. *Journal of Asynchronous Learning Networks.* 5 (2) (2001). http://www.sloan-c.org/publications/jaln/v5n2/pdf/v5n2_anderson.pdf.

22. **Garrison, D. R., Anderson, T., & Archer, W.** Critical thinking, cognitive presence, and computer conferencing in distance education. *American Journal of Distance Education.* 11: 1-14 (2001).

23. **Garrison, D. R., & Arbaugh, J. B.** Researching the community of inquiry framework: Review, issues, and future directions. *The Internet and Higher Education.* 10 (3): 157–172 (2007).

24. **Garrison, D.R.** Online community of inquiry review: social, cognitive and teaching presence issues. *Journal of Asynchronous Learning Networks.* 11(1) (2007).

25. http://sloanconsortium.org/publications/jaln/v11n1/v11n1_8garrison_member.asp.

26. **Lakatos-Török, E., & Kárpáti, A.** Relations of ICT competence, educational practice and innovational success in the Hungarian test-group of the Learning Resource Exchange. *Magyar Pedagógia.* 109(3): 229-259 (2009).

27. **Le Cornu, R.** Peer mentoring: engaging pre-service teachers in mentoring one another. *Mentoring and Tutoring.* 13(3): 355-366 (2005).

28. **Lieberman, A.** Networks as learning communities, shaping the future of teacher development. *Journal of Teacher Education.* 51(3): 221-227 (2000).

29. **McLaughlin, M.** Rebuilding teacher professionalism in the United States. In: A. Hargreaves, & R. Evans (Eds.), *Beyond educational reform: bringing teachers back in.* Buckingham: Open University Press, 1997.

30. **Csapó, B.** A tanári tudás szerepe az oktatási rendszer fejlesztésében [The role of teachers' knowledge in the process of enhancing the quality of the educational system]. *Új Pedagógiai Szemle.* 3-4: 11-23 (2007).

31. **Dorner, H. & Major, É**. (2009). Evolving collaboration among teacher trainees – analysis of collaborative discourse. *WoPaLP (3),* 76-96. Available at: http://langped.elte.hu/W3Dorner_Major.pdf

32. **Harasim, L.** Teaching and learning on-line: issues in computer-mediated graduate courses. *Canadian Journal of Educational Communication.* 16(2): 117-135 (1987).

33. **Harasim, L.** Collaborating in cyberspace: using computer conferences as a group learning environment. *Interactive Learning Environments.* 3(2): 119-130 (1993).

34. **Hiltz, S.R.** The "virtual classroom": using computer-mediated communication for university teaching. *Journal of Communication.* 36(2): 95-104 (1986).

35. **Picciano, A. G.** Beyond student perceptions: Issues of interaction, presence, and performance in an online course. *Journal of Asynchronous Learning Networks.* 6(1) (July 2002). http://sloanconsortium.org/sites/default/files/v6n1_picciano_1.pdf.

36. **Richardson, J. C. & Swan, K.** Examining social presence in online courses in relation to students' perceived leaning and satisfaction. *Journal of Asynchronous Learning Networks.* 7(1): 68-88 (2003).

37. **Swan, K. & Shih, L. F.** On the nature and development of social presence in online course discussions. *Journal of Asynchronous Learning Networks.* 9(3) (2005).
http://sloanconsortium.org/sites/default/files/v9n3_swan_1.pdf.

38. **Berge, Z.L.** Facilitating Computer Conferencing: Recommendations from the Field. *Educational Technology.* 35 (1): 22-30 (1995).

39. **Hootstein, E.** Wearing Four Pairs of Shoes: The Roles of E-Learning Facilitators. In: G. Richards (Ed.), *Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2002,* Chesapeake, VA: AACE, 457-462, 2002.

40. **Goodyear, P., Salmon, G., Spector, M., Steeples, C., & Tickner, S.** Competences for online teaching. *Educational Technology Research & Development.* 49(1): 65-72 (2001).

41. **Green, L.** Playing croquet with flamingos: a guide to moderating online conferences. *Office of Learning Technologies.* (1998). http://www.emoderators.com/moderators/flamingoe.pdf.

42. **Mason, R.** Moderating educational computer conferencing. *The Distance Education Online Symposium,* 1(19) (1991). Available at http://www.emoderators.com/papers/mason.html.

43. **Kárpáti A., & Blamire R.** *Evaluation and validation of the first European Learning Resource Exchange.* (2008). (Final Validation Report of the CALIBRATE project) http://calibrate.eun.org/shared/data/calibrate/deliverables/D4_2_Final_Validation_ReportFinal.pdf.