Improving Virtual Collaborative Learning through Canonical Action Research

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Abstract: Virtual collaboration continues to gain in significance and is attracting attention also as virtual collaborative learning (VCL) in education. This paper addresses aspects of VCL that we identified as critical in a series of courses named 'Net Economy': (1) technical infrastructure, (2) motivation and collaboration, and (3) assessment and evaluation. Net Economy is an international online setting, focusing on the business impact of new technologies and is highly notable for the divergent educational and cultural backgrounds of its participants. Having been subject to research from the onset in 2008, in which approximately 10 students were analysed and evaluated, the course has continued to gain significant success as a learning tool, with over 150 students currently enrolled throughout the various course cycles. In this paper we focus on how we implemented changes with regard to the above mentioned critical elements as part of canonical action research between the last course cycles. We outline the general learning scenario behind our VCL-courses, describe problems that we identified with the help of evaluation results and explain solution approaches and the impact of their implementation. The paper aims to provide a comprehensive example for virtual collaborative learning as well as explaining and exemplifying a systematic approach of improving complex e-learning settings through a series of steps, developed to ease the transition between each stage.

Keywords: Social Networking Services, Virtual Collaborative Learning, Virtual Team Work, Web 2.0, International Cooperation, Community of Inquiry Framework (CoI)

1. Introduction and action research approach

The possibilities for virtual collaboration are increasingly becoming an important aspect in theory and practice (Chen *et al.* 2008; Nunamaker *et al.* 2009). They are therefore being addressed more frequently in higher education, especially in the context of e-learning as virtual collaborative learning (VCL) (Ehsan *et al.* 2008; Hasan and Ali 2007; Lee *et al.* 2006; Rambe 2012; Stahl *et al.* 2006). Apart from the benefits of increased flexibility in terms of time and location and the greater focus on dealing with the topics in compliance with individual needs, the potential to foster communicative, social and media competencies is particularly worth mentioning. VCL-settings thus aim at the skills that are required and considered indispensable within a virtual collaboration involving heterogeneous teams working at various international locations.

These large and growing potentials can only be realized through a suitable design and a well-structured learning process that creates adequate solutions to major challenges of VCL, such as social, technical and didactic requirements (Garrison 2011; Lee *et al.* 2006; Stahl *et al.* 2006). The contribution of this paper demonstrates our own VCL-activities in a series of courses between 2008 and 2012. The paper aims to provide a comprehensive example for virtual collaborative learning, aiming at supporting other instructors who are working on VCL-settings with ideas and experiences. Considering the complexity and individuality of such settings, the second objective is to explain and exemplify canonical action research (CAR) as a systematic research and improvement approach in the e-learning context.

After briefly introducing the concept of virtual collaborative learning in Section 2.1, we will provide the example of the 'Net Economy' learning scenario as our own international setting for virtual collaborative learning in Section 2.2. Following Weber and Abuhamdieh (2011), we thereby conceive a learning scenario as a model for a certain type of class (Weber and Abuhamdieh 2011). In this sense the learning scenario, Net Economy, depicts the main processes and organizational solutions for our VCL-courses, examples include; the basic order of events, the time frame, approaches for video conferencing, team composition, course

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evaluation, and assessment. Figure 1 depicts the 'build-and-evaluate' relationship between the general learning scenario, Net Economy, and the specific course cycles that we will focus on in this paper.

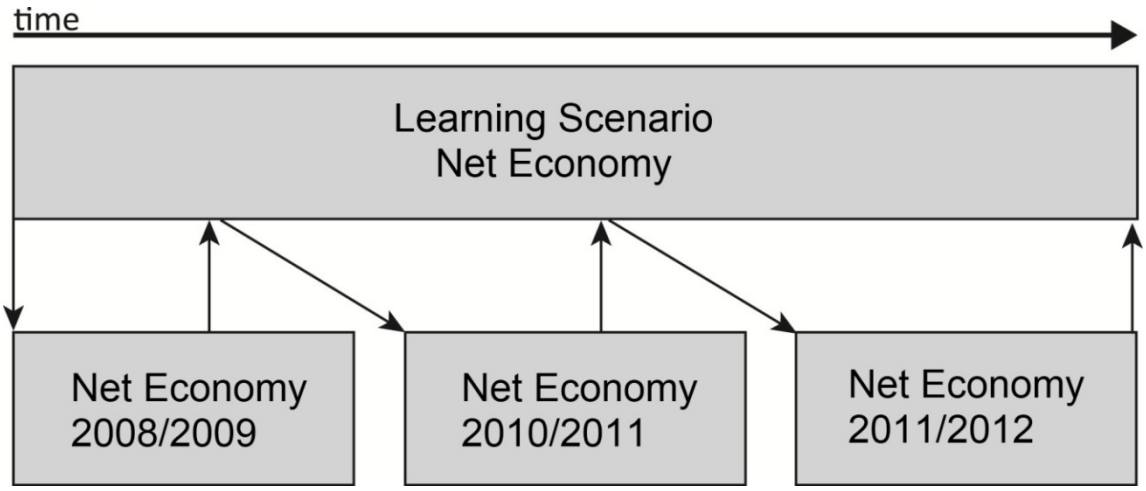

Figure 1: Build-and-Evaluate Loop

Based on our experiences and evaluation results from the Net Economy course cycle of 2008/2009 and in reference to the relevant literature, we will identify a selection of required improvements for the Net Economy learning scenario in Section 2.3. In Section 3, these needs for improvement are then compared to specific solution approaches, which we implemented in the course cycles of 2010/2011 and 2011/2012. After describing the solution approaches we will then evaluate and reflect on their effects with the help of the initial evaluation results from the latest course cycles. In summary, the paper addresses the following guiding questions:

- What are the main characteristics of virtual collaborative learning in general as well as within our specific VCL learning scenario, Net Economy, and what problems arose when we accomplished virtual collaborative learning based on the described learning scenario? (Diagnosis)
- What solution approaches for these problems did we derive from our own evaluation results and from VCL-related literature? (Action Planning)
- How did we implement these solution approaches as interventions in the course cycles of 2010/2011 and 2011/2012? (Intervention)
- What were the effects of these changes? (Evaluation)
- Is there a need for further changes in our learning scenario and what lessons have we learned? (Reflection)

In answering these questions we follow the five steps of canonical action research (CAR): diagnosis, action planning, intervention, evaluation, and reflection (Davison *et al.* 2004; Susman and Evered 1978). Action research is committed to "[…] the production of new knowledge through the seeking of solutions or improvements to "real-life" problem situations." (McKay and Marshall 2001) It thus serves both, research and practice by studying the real world while taking a particular theoretical framework into consideration. From the various forms of action research that differ regarding their process model, structure, researcher involvement, and primary goals, we chose canonical action research (CAR), which stands out due to its iterative, rigorous and collaborative approach focusing on the above mentioned dual aim of improving practice and contributing to scholarly knowledge. It applies a cyclical process model, provokes deliberate self-involvement of the researcher, and – if carried out correctly – produces research that is both rigorous and relevant. Despite its practical aims, many researchers insist that action research requires a clear theoretical framework (McKay and Marshall 2001; Davison *et al.* 2004). In addition to direct references on VCL (e.g. Dillenbourg 1999, Prasolova-Førland and Divitini 2002, or Tan and Lin 2008) and with regard to the VCL-characteristics described in Section 2.1, we therefore study VCL in the context of the Community of Inquiry framework for e-learning (Garrison 2011); we also consider the challenges and principles of successful (virtual) team work (Nunamaker *et al.* 2009). We specifically refer to this scholarly framework when discussing the problems which we identified regarding the course cycle of 2008/2009, in order to substantiate our solution approaches.

2. Virtual collaborative learning and the net economy learning scenario

2.1 Virtual Collaborative Learning

In the respective literature, VCL is employed in the context of various forms and aspects of learning scenarios, with the term itself not being used uniformly. For example "Collaborative Virtual Learning" (CVL) is also used by various authors (Prasolova-Førland and Divitini 2002; Tan and Lin 2008). VCL aims at establishing guided collaboration in a virtual environment to enable learning. Haythornthwaite and Andrews (2011) argue that, the value of merging collaboration and community in e-learning, lies in the intellectual and human benefits of collaborative activity. They state that such settings combine attention to work and work goals, with the affiliate needs of those who work together to achieve these goals (Haythornthwaite and Andrews 2011).

With regard to the remainder of this paper we would like to point out the following characteristics of VCL as discussed in (Balázs 2005; Dillenbourg 1999; Ghaoui 2003; Haythornthwaite and Andrews 2011; Li and Gong 2007; Prasolova-Førland and Divitini 2002; Schoop *et al.* 2005):

1. VCL builds on team work in small groups. Accordingly, various (educational) methods of group learning need to be adapted for VCL scenarios. This also implies the need for a very clear definition of appropriate tasks, which are usually based on authentic questions and problems from (professional) practice.
2. Virtual collaborative learning harnesses information and communication technology to facilitate direct interaction of learners in a virtual environment, rather than in face-to-face meetings. It thus combines the strength of interactive learning with technology driven flexibility. The preconditions of virtual interaction are however significantly different from face-to-face interaction, therefore deliberate attention to participant interaction must be paid.
3. Due to the high organizational challenges of VCL-settings, they require a very detailed and systematic preparation of the learning experience, as well as an explicit definition of the learning objectives.
4. The complex processes, together with the active role of the learners, require strong guidance of the students. This special need for "teaching presence", as Garrison (2011) calls it, must be considered in the planning and design of the virtual and the collaborative elements of a VCL scenario.

The theoretical background for our action research is based on the Community of Inquiry Framework (CoI) with its collaborative-constructivist perspective on learning (Garrison 2011). The CoI-framework strongly supports the idea of virtual collaborative learning settings, since it focuses on the opportunities of technology enabled learning. It is at the same time based on the premise "that a community of learners is an essential, core element of an educational experience when higher-order learning is the desired learning outcome" (Garrison 2011, p. 19). E-learning is thus considered as a means of facilitating interactivity and creating a quality learning experience. This corresponds with the idea of VCL in general and the Net Economy learning scenario in particular (see Section 2.2). The CoI-framework relies upon the three interdependent elements of (1) social presence, (2) cognitive presence, and (3) teaching presence as constituent parts of a successful (e-learning) experience (Akyol and Garrison 2008; Rambe 2012):

- The social presence is "the ability of participants to identify with a group, communicate purposefully in a trusting environment, and develop personal and affective relationships progressively by way of projecting their individual personalities" (Garrison 2011, p. 23).
- The cognitive presence in contrast is "the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse in a critical community of inquiry" (Garrison *et al.* 2001, p. 11).
- Finally, the 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" (Anderson *et al.* 2001). It is this teaching presence that combines and balances the elements of a community of inquiry in the overall setting.

The CoI-framework serves as orientation when identifying any need for improvement as well as developing changes accordingly, in order to strengthen our VCL-setting Net Economy. For example, in Sections 3.1.1 and 3.1.2 we describe a new type of coordination platform that we implemented (a social network instead of a traditional learning management system) and a modified team building approach that we developed, both with regard to the need for social presence. While this paper is meant to provide an overview of these

changes, their effects, for example the social effects of introducing a social networking service as the main coordination platform, are analysed in related papers. (Reference will be added after the review process)

With regard to virtual teamwork as an integral part of VCL, we also consider the challenges and principles of effective virtual teamwork as summarized by Nunamaker et al. (2009) as guidance. Nunamaker et al (2009) emphasize competing demands for attention, ambiguity of virtual communication, the establishment of personal relationships, and the need for accessible, stable, and user-friendly technology as the biggest challenges for successful virtual teamwork. Table 1 summarizes the challenges and the principles that proved to be a good 'fit' for our VCL-setting Net Economy.

Challenges facing virtual teamwork	**Principles for effective virtual teamwork**
• Loss of many non-verbal cues • Reduced mechanisms for informal conversation • Reduced opportunities to build friendships • Time zone differences • Complicated, unreliable technology • Building consensus at a distance • Establishing shared meaning at a distance • Different work processes • Different cultures	• Realign reward structures for virtual teams • Find new ways to focus attention on task • Design activities that cause people to get to know each other • Build a virtual presence • Agree on standards and terminology • Leverage anonymity when appropriate • Be more explicit • Train teams to self-facilitate • Embed collaboration technology into everyday work

Table 1: Virtual Teamwork – Challenges and Principles (Nunamaker *et al.* 2009)

2.2 The Learning Scenario Net Economy

In the framework of an international learning network we have offered cross-location VCL-courses entitled Net Economy numerous times over the past few semesters. Our general VCL-setting targets participants with heterogeneous educational backgrounds in the fields of business and economics, business informatics, and educational sciences, as well as with different cultural backgrounds from Germany (Bochum, Berlin, Dresden, Soest), Turkey (Istanbul), China (Shanghai), Lithuania (Kaunas), Latvia (Riga), and Indonesia (Jakarta). All partners agreed on the general learning scenario Net Economy, leading to a stabile VCL-concept that is being systematically improved throughout the course of the, previously mentioned, canonical action research approach. Through each course-cycle a different set of partners participated, with a different location taking the lead and responsibility for the course coordination.

The general VCL learning scenario Net Economy is divided into the two phases 'production phase' and 'experience phase'. Throughout the course, project work is conducted in small teams of 4-6 students across various locations, with team composition as well as presentation and discussion of findings being conducted through video conferencing. By separating these phases, the learning and working process is structured as a project with the use of predefined milestones. The students are asked to present and discuss their (interim) findings at so-called 'steering committees' and within phase-specific final presentations. These steering committees and final presentations are held at each location and are merged together through video conferencing. The participants are prepared for this through introductory presentation training, but also through e-lectures on project management, group coordination, and the use of specific communication tools (e.g. the video conferencing tool 'Adobe Connect'). These efforts aim to reconcile the differing levels of media and teamwork skills among the students and enable them to fulfil the requirements of the VCL-setting.

During the production phase participants experience a "learning through teaching approach" (Biswas *et al.* 2005). Under their instructors' guidance they develop multimedia learning materials such as web-based training systems or Google sites on methods of strategic management (VRIO, business model analysis, SWOT analysis, scenario planning) or current IT-topics such as "Web 2.0". In this way they are able to gain a new insight and prepare themselves for the next phase. The experience phase, in contrast provides the students with a case study, with previous examples including; electronic marketplaces (2008/2009), grocery home delivery (2010/2011), or the use of Web 2.0 within and between companies (2011/2012). While working on

these case studies the students can apply their newly acquired knowledge to real-life business challenges. The two phases are thus linked together in a way that the learning material, created during the production phase, provides a substantive knowledge base for the tasks within the case study phase. In addition, both phases (production and experience phase) provide the participants with the opportunity to foster international contacts and to gain experience in cross-cultural, technology-based learning and work.

Figure 2 summarizes the main aspects of the learning scenario Net Economy: its global context, the use of information and communication technology (especially Web 2.0 applications), its two phases, the student teams, as well as the combination of classroom presentations and online group-work phases. Further details on the organizational structure and the main processes of the Net Economy classes will be provided in the following Sections, where we will discuss problems that have arisen and the solutions that we developed with respect to these problems.

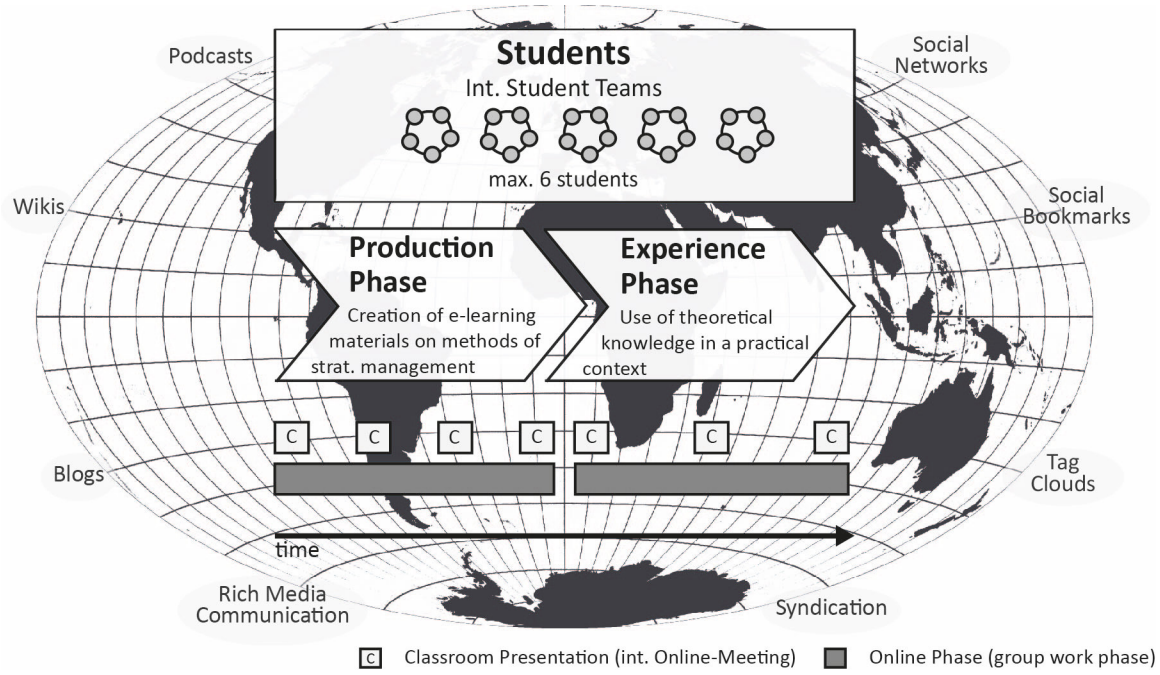

Figure 2: The Net Economy Learning Scenario

In summary, the learning scenario Net Economy is not only associated to cognitive, but also to affective and psychomotor learning goals. Considering the mostly, content-focused, classes in the students' curriculums, it was developed to help the students experience coordination, team work, language and cultural challenges in a modern, technology-based work environment. In addition to the impartment of new knowledge, attention is paid to fostering and deepening vocational abilities, such as the use of new media (software tools, Web 2.0 applications) and ultimately the preparation for life-long learning (Chen *et al.* 2008; Safran *et al.* 2007). Due to the international setting, the students understand and fully agree with the need for virtual collaboration and the use of English as the primary language for correspondence. In addition, the cooperation of the different universities and their instructors/researchers created an agile and innovative teaching/research alliance within the e-learning field itself.
The learning scenario Net Economy as a VCL-setting aims at initiating:

- Online group-work processes;
- The employment of methods of strategic management, project management, and team coordination;
- The design of social, medial and cultural activities and their interactions in a global and digitized context;
- An on-going creative cooperation and exchange among the participating institutions.

The Net Economy course cycles which we derived from this general learning scenario have proven to be a motivating and enlightening learning experience for all those involved. In the courses, e-learning and online cooperation were not just phase-specific or redundantly supporting features of a traditional setting, but rather

provided the systematic and consistent foundation for innovative learning and working processes. Still, the challenging overall setting incurred problems and the evaluation results regularly point at improvement needs. In Section 2.3 we will show, which problems we identified after the course cycle of 2008/2009 and how these challenges relate to the above described scholarly framework.

2.3 Necessary Improvements

Our evaluation of the 2008/2009 course cycle focused on learning satisfaction and was accomplished in three steps via online forms: (1) At the beginning of the course the students' attitudes and expectations were surveyed with the help of a master data sheet. (2) During the experience phase, the students were asked to evaluate the learning material and the case study provided to them. (3) Finally, after the course ended, the students were asked to evaluate the complete course and aspects of the instructional setting, e.g. the collaboration concept. The evaluated items of this final questionnaire covered five subject areas that score a satisfaction rating (scale: 1 = very good, …, 6 = inadequate) for key aspects of the learning scenario:

- Overall learning arrangement;
- Support by lecturers and tutors;
- Organization and implementation of project work;
- International collaboration;
- Technical infrastructure / Use of media.

While systematically building on to this rather simple evaluation approach during the past years (see Section 3.3), we kept the questions from 2008/2009 in the questionnaire to allow for a comparison of the various course cycles regarding the students' learning satisfaction. Figure 3 summarizes the results from the last three runs of the class.

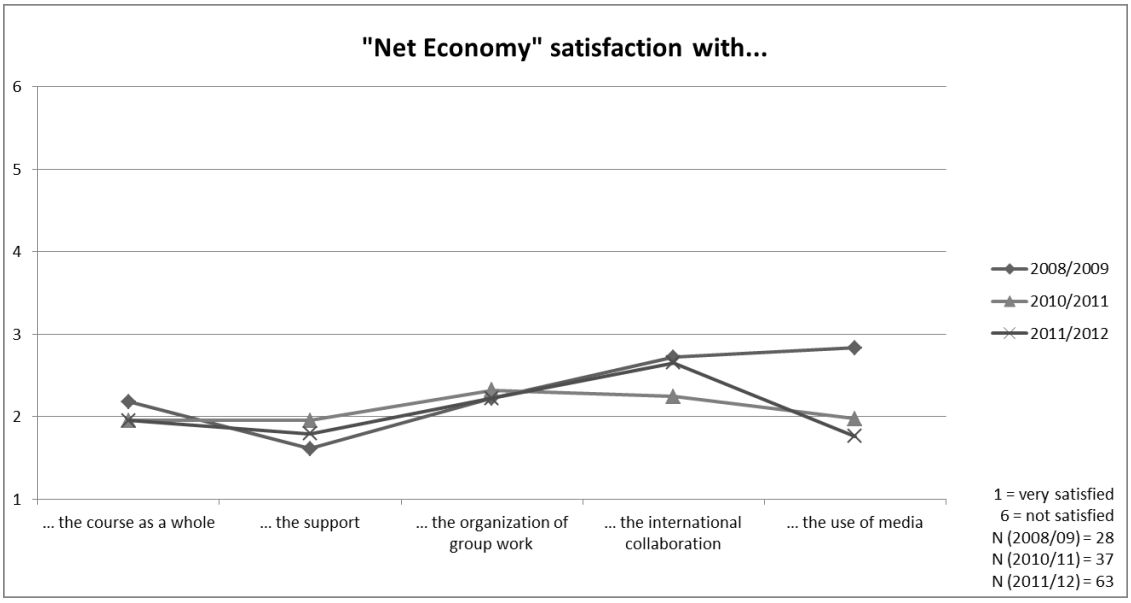

Figure 3: Comparison of student satisfaction

While the students from 2008/2009 were very satisfied with their support, the good evaluation results for the overall course and for the organization of the project work leave leeway for further improvements. According to the students' feedback, the international collaboration and the technical infrastructure provided to them turned out to be the most challenging aspects of the setting. The depicted evaluation results for the later course cycles show that the changes we implemented in 2010/2011 and 2011/2012 had positive effects regarding these two critical aspects of the setting. Table 2 shows the detailed results from the 2008/2009 evaluation. The evaluation combined a standard form, provided by one of the participating universities, with additional questions concerning the specific Net Economy setting. Since grading questions were added, two additional measurement scales needed to be included in the evaluation: *: approval from 1 to 4 (1 = absolutely yes … 4 = absolutely no) and **: grades according to the German grading system (1 = very good … 6 = inadequate)

Aspect	Statement	Av.	DV	N
Class	The course was well structured.*	1.93	0.65	29
	I gathered knowledge and skills of high relevance.*	1.89	0.74	28
	Theoretical and practical aspects were combined successfully.*	1.82	0.61	28
	There was a clear conception that was kept throughout the course.*	1.89	0.75	28
	I enjoyed the inclusion of external experts.*	1.48	0.59	25
	Blackboard (Learning Management System) supported the learning process*	1.96	0.92	28
	Overall grade for the course**	**2.18**	**0.86**	**28**
Instructors	The instructors were well prepared.*	1.36	0.68	28
	The instructors lead the course in a clear manner.*	1.75	0.75	28
	The instructors demonstrated dedication to the course.*	1.36	0.68	28
	The instructors were open to questions/criticism.*	1.54	0.74	28
	Overall grade for the instructors**	**1.61**	**0.68**	**28**
Project work	I valued the project structure of the course. *	1.96	0.76	27
	There was a clear structure of project phases due to the steering committees.*	1.93	0.73	27
	The online presentations of (intermediary) results were an important exercise. *	1.89	0.80	27
	The project tasks were clear and unmistakable.*	2.22	0.89	27
	Overall grade for the project organization**	**2.22**	**0.98**	**27**
Collaboration	Online collaboration with students from other locations was a good experience.*	1.37	0.69	27
	Online teamwork helped me to get introduced to helpful tools and procedures. *	1.89	0.85	27
	The assignment of given roles facilitated our teamwork. *	2.27	1.00	26
	I enjoyed the online collaboration.*	1.81	0.94	26
	Overall grade for the online collaboration**	**2.37**	**1.18**	**27**
Participant	Male / female	16/12	-	28
	Age	25.19	2.93	26
	I enjoyed the topics of the course.*	1.93	0.77	28
	My attitude towards e-learning developed positively.*	**1.96**	**0.70**	**27**

Table 2: Net Economy evaluation results 2008/2009

*: Approval from 1 to 4 (1 = absolutely yes … 4 = absolutely no)
**: Grades according to the German grading system (1 = very good … 6 = inadequate)

Taking both the presented scholarly framework and our own evaluation-based experiences into consideration, we will now describe the need for improvements that we derived in preparation for the 2010/2011 course cycle. We make no claim that this selection is complete, rather we chose aspects that came to the fore when discussing our experiences and the evaluation results in preparation of an extended and improved learning scenario.

1. *Flexible, low-cost and technically simple infrastructure for plenary interactions and collaborative learning and working processes within the teams*: As Nunamaker et al. (2009) point out, "Technological glitches will cripple the productivity of even the most knowledgeable and motivated virtual teams." In line with this statement, during the 2008/2009 course we encountered considerable difficulties due to differing technical equipment and skills among the participating students, instructors and institutions. A low-cost and flexible technical architecture which is geared towards the interests and abilities of the participants therefore appears more important than sophisticated functionality of high end tools. The challenge lies in providing a coherent package of communication tools in an integrated form which fosters effective team-work processes and positive team development, while being embedded into the everyday life of the students (see Table 1; Nunamaker *et al.* 2009). Also, the technical infrastructure (especially for the purpose of video conferencing) needs to be simple in order to allow for the flexible integration of all participating institutions and instructors with their heterogeneous equipment and skills. With regard to group dynamics, video

conferencing should be made available within the teams, as this influences the team cohesion more positively than other forms of communication (Ehsan *et al.* 2008).

2. *Team composition, work-load distribution within the teams and assessment*: In the evaluation of 2008/2009, on a scale from 1 to 4 (1 = I absolutely agree, 4 = I absolutely disagree) students expressed a very positive attitude towards working with students from other locations and disciplines ("Online collaboration with students from other locations and disciplines was a significant experience for me": 1.37). They also attested that they enjoyed online collaboration in general ("I enjoyed the online collaboration": 1.81). Against this background, the overall grade for the experienced online collaboration (2.37 on a scale from 1 = very good to 6 = inadequate) and its considerable deviation from the standard (1.18) indicate that factors with a negative influence exist which require further investigation. Students were allowed to comment on their responses, which revealed that some of them experienced the collaboration processes as too challenging and exhausting. Several students complained about freeloaders who made the work in their teams more complicated. In correspondence with these experiences concerning the social presence within the Community of Inquiry (Garrison 2011), several authors point out and stress the relevance of team and member-related factors such as team composition and internal heterogeneity, team spirit or the consequences of a free-rider mentality (Liccardi *et al.* 2007; Ehsan *et al.* 2008; Hasan and Ali 2007). In 2008/2009 the students only had little influence on the team composition. When the groups were compiled, merely brief profiles and role requests that students had to fill out before the course started, were taken into account by the instructors. The students, however, took little advantage of this possibility and in most cases did not provide any convincing profiles. It is therefore necessary to develop a team building approach that boosts social presence in the setting in order to facilitate the development of team spirit and a distinct sense of responsibility among the team members. With the emphasis lying on virtual team work and the desired complex and interdisciplinary tasks, the modus operandi should provide a heterogeneous composition of the teams. Apart from this composition, the quoted factors and framework conditions for the setting must be taken into account in the assessment and particularly in the grading process. The team results should be given priority, but at the same time, individual differences in performance need to be considered to reduce the negative impact of freeloaders. This aspect refers to the need of a teaching presence as part of the CoI-framework.

When looking at the solution approaches for theses conceptual problems of the Net Economy learning scenario, the following framework conditions regarding the setting as part of an international learning network need to be kept in mind:

3 Limitations regarding language abilities of students and instructors range from minor differences in the level of fluency, up to language incompatibilities.
4 Various ways of establishing the course as part of a broader curriculum imply major differences regarding the motivation and commitment of the participants at the different locations.
5 The student teams are characterized by extensive heterogeneity with regard to the participants' nationalities and educational backgrounds.
6 There are considerable differences between the participants regarding their technical equipment and media experience.
7 There are also considerable differences between the instructors as to their knowledge and experience regarding the learning scenario and the course topics.

Table 3 summarizes the identified problem areas and assigns them to the build-and-evaluate loop according to our canonical action research approach. In Section 3 we will present the solution approaches listed in the column on the right of the table.

Phase	Problem Areas	Solution Approaches
Build	Technical Infrastructure; Motivation and Identification; Tasks and Collaboration	3.1 Motivation and Identification - Technical Infrastructure: NING - Self-responsible Team Building Process
Realize		3.2 Collaboration Support - Technical Infrastructure: Web 2.0
Evaluate	Assessment/ Evaluation	3.3 Assessment and Evaluation - Assessment and Grading - Competence based Evaluation

Table 3: Problem areas and solution approaches

3. Solution approaches

In 2008/2009, 64 students from 5 universities and 3 countries (China, Germany, and Turkey) participated in the Net Economy course. The following solution approaches were developed in preparation for the expanded version of the 2010/2011 course with 96 participants from 6 universities and 3 countries: Germany, Lithuania and Latvia. In 2011/2012, 180 students from 5 universities and 2 countries (Germany and Indonesia) participated. More than 80% of both Bachelor and Master students in all course cycles had a Business or IT-focus, with Master students being given additional tasks by their home universities. While the course duration was reduced to 10 weeks (compared to 14 weeks in 2008/2009) due to different semester schedules at the various locations for these course cycles, the main structure of the learning scenario as described in Section 2.2 was retained. In contrast to 2008/2009, where only students from the German language study programs participated, in 2010/2011 and 2011/2012 approximately 40% of the students were from an English language study program, however, as of yet no native speakers have participated.

3.1 Motivation and Identification

As described in Section 2.3, the evaluation of 2008/2009 pointed at the existence of a relationship between the students' lack of involvement in the preparation of the course and problems of cooperation which later occurred within the teams. Based on our experience, the students' comments, and the emphasis of the need for a social presence in the CoI-framework, we argue that these problems in particular were caused through some students' insufficient identification with their teams and a sluggish team building process. To deal with this matter, the following adjustments have been initiated: (1) change of the technical infrastructure by using the social networking service NING as the central course platform instead of a traditional learning management system (e.g. Blackboard in 2008/2009); (2) modification of the team building process; (3) introduction of a modified roles approach.

3.1.1 Change of the Technical Infrastructure: NING

The first modification concerns the central course platform of the learning scenario. The platform should reflect the reality of today's globalized world and media-dominated social environment, and it must meet the framework conditions of the VCL-setting. With regard to the identified problems, it additionally needs to be flexible and powerful in terms of social identification and collaboration. Rather than a classical learning management system (LMS) as used in the Net Economy course of 2008/2009 (Blackboard), the employment of a social networking service (SNS) appears more suitable for the learning scenario Net Economy with regard to the need of social presence. Apart from the additional functionality in terms of communication and collaboration, SNS facilitate identification with the course and help students to get to know each other, while being part of the students' day-to-day life (see table 1, Nunamaker *et al.* 2009). We chose NING as a platform to create a private SNS for the Net Economy course. NING allowed us to define unique profile questions, and to easily employ main SNS-features like community and group creation, moderation, use of rich media, rss feeds, tracking of latest activities (including status updates), and various forms of communication. The evaluation results for the technical infrastructure and the survey of the use of NING both in 2010/2011 and

2011/2012 support this idea. A detailed analysis specifically on the social effects of the changed coordination platform is available in. (Reference will be added after the review process)

3.1.2 Modification of the Team Building Process

Another crucial aspect for the success of the learning scenario needing improvement is the team building process. For this purpose, a two week preparation phase was added to the learning scenario in which the students had time to acquire the information and skills (e.g. media skills) necessary to accomplish the tasks of the production and experience phase. With this preliminary preparation phase the students were given the opportunity to familiarize themselves with the tasks and the various roles that would arise during the team work process.

Whereas in 2008/2009 the composition of the team was determined by the course instructors, in this new approach the task of defining the team was delegated to the students during the preparation phase. Students had to create a personal profile on NING, which then served as their application to become a team member. The questions concerning the profile prompted a critical reflection on their individual strengths, weaknesses and previous experiences relating to both the topics of the class and virtual collaboration (e.g. use of media). A secondary objective of this self-reflection consisted of preparing an expanded evaluation of the development of skills during the course, which will be described as our enhanced competence-based evaluation approach in Section 3.3. Based on the profiles that the students developed, the instructors appointed the team leaders who then recruited their teams. The composition of the teams was thereby restricted with regard to group size and the number of team members from each participating location: A maximum of six students per team with no more than two students from each location being allowed. Shortly prior to the start of the production phase, conflicts were solved by the instructors, if necessary. By delegating the task of group definition we intended to strengthen the students' self-reliance and identification with their teams – thus, social presence. The team building approach turned out to be a very effective element of teaching presence, which also helped to establish the SNS successfully. (Reference will be added after the review process).

3.2 Collaboration Support: Web 2.0 Applications

In order to produce content, in 2008/2009 the students employed predetermined desktop applications which were not designed or suitable for the collaboration in geographically distributed teams. Among them, special tools for the design and the production of web-based training, e.g. Adobe Captivate and Lersus (as an editing tool for web-based trainings). Considering the objectives and framework conditions of the learning scenario, this unsustainable approach was the cause for various difficulties (usability, version control, and cooperation/collaboration). We therefore not only changed the course platform, but we also introduced various web 2.0 tools, e.g. Google docs, Google sites, blogs, wikis, project management tools, etc. during preparation phase. This enabled a simultaneous, straightforward online collaboration. However, with the exception of the central course-platform NING, the specific choice of communication and collaboration tools was left entirely up to the students. This was a major modification compared to 2008/2009, when the tools were rigidly predetermined.

3.3 Assessment and Evaluation

3.3.1 Assessment and Grading

In the 2008/2009 Net Economy course grading was based on separate team assessments for the phases of the setting. Frustration and motivation problems arose as a result of the free-rider mentality exhibited by a small group of students. For a better assessment of the combined individual and team performance within the learning scenario, and also considering the stronger self-reliance exhibited by students in the modified setting, we developed and implemented the following assessment procedure: Firstly, two instructors evaluated the solutions presented by a team based on an evaluation sheet with scores ranging from 0 to 100 points. This team result accounted for 50% of the grading of each team member. Secondly, the score was multiplied by the number of team members and assigned to the team as a whole. For example, if a team's results were evaluated with 80 points (representing the grade B), then a team with 6 team members received a score of 480 points. Based on this score the team then conducted a self-assessment. It was the team's responsibility to agree on a fair allocation of the score within the team by discussing individual performances and contributions by the team members. The result of this self-assessment accounted for another 25% of each team member's

grade. Thirdly, to guarantee that students not only concentrate on the findings and ideas of their own team, a multiple choice quiz was included after production phase. The test covered only learning material and content developed by the student teams during production phase and counted for another 25%. In conclusion, this approach integrated the individual performance of each student and the team result, while allowing the instructors to consider special dedication and free-rider mentality among the team members.

3.3.2 Competence-based Evaluation

Finally, to improve the assessment of the course impact on the participants' skills and their learning satisfaction, the evaluation process as described above was enhanced. We developed a competency-oriented evaluation approach based on an inventory by Paechter et al. (Fink 2010; Paechter *et al.* 2007). As shown in Figure 4, this approach covers seven areas: Experience with (1) use of wikis (Google Sites) (2) social communities, (3) international collaboration (4) group-work, (5) project work, (6) presentation of findings and (7) the subject area of the course. Emphasis was placed on the assessment of the development of media skills and collaboration / group working skills. Testing the students before and after the course determined the self-perceived change in the skillset. Additionally, the students were asked to rate the individual importance of each item. This way, in addition to the feedback on the students' learning satisfaction, we are also now able to assess the development of their skills.

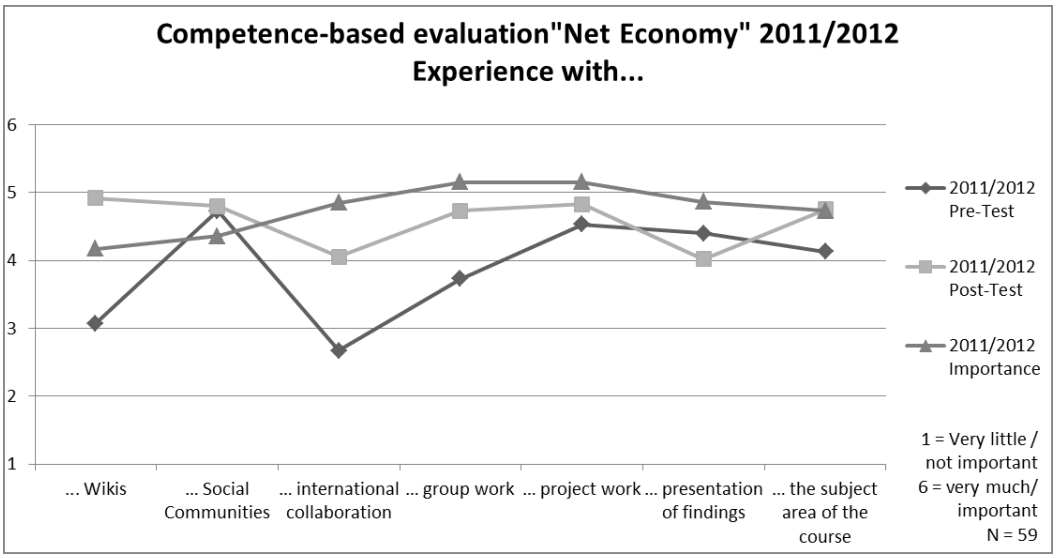

Figure 4: Evaluation results: Self-assessment of acquired skills in 2011/2012

Overall, the students recognized an increase in competence in all five areas in which high levels of skills were achieved. This suggests that the main goals of the learning scenario were achieved and that the modifications described in this paper had the desired effects regarding the overall goal of enabling learning in a Community of Inquiry with social, cognitive, and teacher presence. A description and discussion of the detailed results of the evaluation (including the open-text comments of the students) were left out in this paper in favour of a more comprehensive derivation of improvement needs (Section 2.3) and solution approaches (Section 3). However, they are the subject of related work (references will be added after the review process).

4. Summary and outlook

This paper has addressed considerable aspects of VCL-arrangements as identified during a series of VCL-courses called Net Economy that we offered over the past few years. Structured according to the cyclical process model of canonical action research (diagnosis, action planning, intervention, evaluation, and reflection) we have

- (1) described the general learning scenario Net Economy and diagnosed the course cycle from 2008/2009;
- (2) identified major conceptual problems (technical infrastructure, motivation and identification, collaboration, and assessment / evaluation) and

- (3) documented the implementation of solution approaches (use of the social network NING; use of Web 2.0 tools instead of single-user desktop applications; deferring team building process to students; enhanced grading approach; enhanced evaluation approach);
- (4) / (5) presented some initial evaluation results that help us reflect the effects of our interventions.

Our changes can be considered successful and have helped us improve the Net Economy learning scenario, specifically for the courses from 2010/2011 and 2011/2012. At the same time the depiction of our complete action research approach was conceived as a contribution to the scholarly discussion of virtual collaborative learning and how social presence, cognitive presence and teaching presence can be strengthened to create a Community of Inquiry and a successful learning experience. However, in this paper we compared several course cycles in which some of the variables have changed over time. For example, the number of students rose from 64 to 180 and the set of participating locations with their individual cultural characteristics changed. The cultural challenges of the setting in general and the effects of the above mentioned changes need to be addressed in future research. Additionally, the evaluation and the reflection of our interventions have been given only superficial attention thus far and need more emphasis in future evaluations. For example, we have gathered rich data on the use of the different technical infrastructures implemented, such as the new course platform NING and the interconnections that arose between the students using this platform, in particular during the 2011/2012 course cycle. Currently we are using this data in order to analyse the quality of the social presence that we strived for by changing from a traditional learning management system to a social network. Findings indicate that NING led to a well-meshed network of relationships among the students from the participating locations and that the development of these relationships was fundamentally influenced by the phase concept and team building approach of the Net Economy learning scenario, described in the paper. NING was actively used throughout the complete setting for both; class related tasks and pure social matters. For a detailed analysis see (reference will be added after review). Finally, we have not paid much attention to the need for cognitive presence in this paper. In order to address this important aspect we need to further change the communication infrastructure of the class in a way that the communication channels of the students become more transparent and accessible for us as researchers also outside the social network. Despite these and other limitations, we consider the 2010/2011 and 2011/2012 Net Economy courses as further successful evolutionary steps in our cyclical canonical action research approach. We will now start the analysis and discussion of the results from the latest course cycle and the interventions that we developed in preparation for this latest run.

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