# Interdisciplinarity in the CSCL Community – an Empirical Study

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**Abstract.** In previous work the CSCL community was analysed with respect to its scope, development, continuity and connectivity (Hoadley 2005, Kienle & Wessner 2005, Kienle & Wessner 2006). Main insights included a relatively low but stable continuity of individuals in the community, increasing international participation and increasing connectivity across different countries. Concerning the disciplines involved in CSCL and the disciplinary backgrounds of CSCL community members it was found that a variety of disciplines are represented in the community. A detailed analysis of the way these disciplines contribute to the progress of CSCL, the way members with different disciplinary backgrounds collaborate is still missing. In this paper we report an analysis of the CSCL community with respect to the disciplinary background of its members and the interrelation of various disciplines in CSCL. The analysis is based on a survey among members of the CSCL community actively involved in the CSCL 2007 conference (reviewers and authors of accepted contributions). The paper reports and discusses main results of this analysis with respect to disciplinary background of CSCL community members as well as links between the disciplines. In addition it provides insights into motives for interdisciplinary collaboration, beneficial and hindering factors. The results should help to sharpen our view of the CSCL community, contribute to a shared understanding about what CSCL (currently) is (and what is it not) and point out perspectives for future development of the CSCL community.

**Keywords:** CSCL community, community analysis, interdisciplinarity.

## Introduction

The CSCL community has an ongoing task in developing a common theory that integrates the foundations of the relevant disciplines (Stahl, 2002; Puntambekar & Young, 2003). At CSCL conferences (e.g. 2003 in Bergen, Norway) lively discussions occur about the nature of the CSCL community and the identity of this field. In order to provide a more objective picture, the CSCL community was analysed with respect to its scope, development, continuity and connectivity (Hoadley 2005, Kienle & Wessner 2005, Kienle & Wessner 2006). Main insights included a stable continuity of individuals in the community, increasing international participation and increasing connectivity across different countries (data is available at www.cscl-community.org). Concerning the disciplines involved in CSCL and the disciplinary backgrounds of CSCL community members it was found that a variety of disciplines are represented in the community: While Hoadley (2005) found out that the majority of authors have a departmental affiliation in education, he counted authors with affiliations in nine more disciplines (plus 47 authors working in "other" disciplines). To cope also with authors working in "outlandish" departments, e.g. a psychologist working in a computer science department, and thus learn more about the collaboration between disciplines in the community on a daily work level, a more detailed analysis is needed. How do the disciplines contribute to the progress of CSCL? How do people with different disciplinary backgrounds collaborate in the field?

CSCL has been labelled as multidisciplinary (i.e. multiple disciplines work in a field side by side), pluridisciplinary (i.e. multidisciplinary plus comparision of methodologies and results), and interdisciplinary (i.e. multidisciplinary plus synthesis of methodologies and results) (see for example Klein 1990). While often these terms are used interchangeably, it is an important question for the CSCL community whether it is composed of relatively independent, monodisciplinary sub fields or whether there is true interdisciplinary collaboration. We do not elaborate further on the benefits of interdisciplinary work here. Hoadley (2005) argues that all drivers of interdisciplinary research apply to CSCL as its research topic is complex, not confined to one discipline, addresses a

societal problem and is affected by new technologies. In their qualitative study Kienle and Wessner (2006) identified complementary competences and skills as one driving factor also for international collaboration in CSCL.

In this paper we want to provide answers to these questions about interdisciplinarity based on an analysis of the CSCL community focussing on disciplines and collaboration between members with different disciplinary backgrounds. Our hypotheses with respect to collaboration between disciplines are:

1. There is substantial interdisciplinary collaboration in the CSCL community as it can be seen from the research groups community members belong to and from the co-authorship of community artefacts.
2. There is a correlation between previous experience with interdisciplinary work and current interdisciplinary collaboration "behaviour" (i.e. if one has good experience with interdisciplinary collaboration chances are higher that he or she writes papers with interdisciplinary co-authorship).

In addition to evaluating these hypotheses empirically, we are interested in the motives, beneficial and hindering factors for interdisciplinary work in CSCL.

In the following section we describe the methods and data used in our analysis. Then we present and discuss the main results concerning our research questions and previous work. Finally, we conclude the paper with implications for the further development of the CSCL community.

## Methods and Data

Our analysis is based on data gathered via an email survey among all reviewers and authors of accepted contributions of the CSCL 2007 conference.

The conference organisation of CSCL 2007 provided us with names, email addresses and affiliations for reviewers and contact authors. In addition we got titles and the lists of co-authors for all contributions (i.e. paper, poster etc.). Due to privacy reasons data on papers and authors was limited to papers which have been accepted for presentation at the conference and their authors. From the lists of reviewers and authors we generated two lists of CSCL community members: A first list ("only-reviewers") contains all reviewers who did not serve as contact authors of accepted contributions to CSCL 2007. A second list ("contact authors") contains all contact authors of accepted contributions also including contact authors who serve as reviewers.

For each group a questionnaire was designed in order to learn about interdisciplinary collaboration in general and wrt. accepted contributions to the CSCL 2007 conference. Due to our study design (i.e. to consider only accepted contributions) we could get the data only after all decisions about acceptance or rejection of all contributions had been made. After getting the data from the conference organisation we conducted an email survey among all reviewers and authors as specified above. Unfortunately, we had to set a strict deadline of one week in order to have enough time to analyse the results and prepare the final version of this conference paper. Our questionnaire is structured as follows:

For authors and reviewers:

- Discipline(s): In which disciplines is the person trained (i.e. has a degree) and which discipline does he or she consider as main discipline?
- Interdisciplinarity of the research group to which the person belongs: How many people work in that group (graduate students and higher)? Is it a monodisciplinary group (which discipline?) or are there colleagues with different disciplinary background (which ones?)?
- Previous interdisciplinary collaboration: How often did the person collaborate with colleagues with different disciplinary background in the past? How successful and satisfying was that collaboration?
- Main aspects in favour of interdisciplinary collaboration: free text
- Main aspects against interdisciplinary collaboration: free text

For authors additionally:

- Interdisciplinarity of the submitted paper:

- Concerning the list of authors: Is it a monodisciplinary team (which discipline?) or do co-authors have different disciplinary backgrounds (which ones?)? If co-authored are interdisciplinary: What was the reason for establishing this collaboration?
- Concerning the research methods applied in the paper: What research methods are used (if not clear form the registration/submission data)? To which disciplines are these methods assigned?
- Concerning the research topics tackled in the paper: What research topics are tackled (if not clear form the registration/submission data)? To which disciplines are these topics assigned?

In order to get a high acceptance for our survey in the community which should result in fast responses and a high response rate, we promissed that all results will be aggregated and presented anonymously.

From this data (registration/submission and survey) we planned to calculate the following distributions:

- Distribution of research topics
- Distribution of research methods
- Distribution of disciplines in the group of authors and of reviewers: e.g. computer science, psychology, information science etc. We will consider also people with a background in multiple disciplines, for example a person with a background in education and philosophy.
- Distribution of disciplines in the submissions
- Correlation between interdisciplinarity of papers and the nature of the authors' research group
- Correlation between interdisciplinarity of papers and previous experiences with interdisciplinary work

We will collect and cluster the responses concerning motives for interdisciplinary collaboration and beneficial and hindering factors for interdisciplinary work in CSCL.

In total there were 222 reviewers for CSCL 2007. 74 of these 222 reviewers were also contact authors of accepted contributions (papers, posters etc.) and received the author questionnaire. The remaining 148 reviewers received the reviewer questionnaire.
The total number of accepted contributions was 155. As some persons were contact authors for more than one contribution, there were 148 individuals who served as contact authors for these 155 contributions.

Response rates:

- We received feedback from 41 out of 148 reviewers who did not serve as contact authors for accepted contributions ("only-reviewers"; 28 %).
- From reviewers who also served as contact authors for accepted contributions we received feedback from 19 out of 74 (27 %).
- From contact authors who did not serve as reviewers we got feedback from 19 out of 69 (28 %).

As some authors were contact authors for more than one paper and also some non-contact authors (who got the questionnaire forwarded by the contact authors) responded, we got in total 47 author questionnaires. These questionnaires refer to 43 out of 155 accepted contributions (28 %).

Overall, a response rate of 27 – 28 % seems acceptable fo this email survey, especially as there was only 1 week time to fill out the questionnaire.

## Results

This section presents the results of our analysis. First, this includes the distribution of research topics and methods, the distribution of disciplines, and the distribution of disciplines in the submissions. We present the correlation between interdisciplinarity of papers and the nature of the authors' research group as well as the correlation between interdisciplinarity of papers and previous experiences with interdisciplinary work.
Finally, we present the results concerning motives for interdisciplinary collaboration and hindering factors for interdisciplinary work in CSCL.

## Research Topics and Methods

The questionnaire didn't provide a list of research topics or research methods to choose from. As a consequence the answers to these questions were very heterogenous wrt. granularity and terminology. Actually, they were so heterogenous that we did not try to calculate distributions of topics and methods for this paper. Nevertheless, we saw that in many cases the same topics and methods are assigned to different or multiple disciplines.

## Disciplines and Main Disciplines

As for topics and methods we also did not provide a list of disciplines to choose from in the questionnaire. Thus again, the answers were heterogenous wrt. granularity and terminology. Table 1 lists the most frequently mentioned disciplines, table 2 the most frequently mentioned main disciplines for the subgroup "only-reviewers". Authors show similar distributions wrt. disciplines and main disciplines (not shown in this paper).

Table 1: Disciplines of reviewers.

| *Discipline* | *Number of reviewers* |
|---|---|
| Computer Science/Computing | 11 |
| Psychology | 10 |
| Educational Science/Education | 7 |
| Educational Psychology | 3 |
| Electrical Engineering | 3 |
| Learning Sciences | 3 |
| Teaching | 3 |
| Biology | 2 |
| Curriculum & Instruction | 2 |
| E-Learning | 2 |
| Information Science | 2 |
| Sociology | 2 |

In addition, each of the following disciplines were stated by one person:
Art History, Artificial Intelligence, Cardiorespiratory sciences, Cognitive Psychology, Cognitive Studies, CSCL, Cultural Studies, Curriculum and Methods of Teaching Arabic, Design, Digital librarianship, Economics, Educational Computing, Educational Measurement and Statistics, Educational Technology, Engineering, English & linguistics, English and American Literature, English Language and Literature, English Literature, Evaluation and Measurement (Education), Human-Computer Interaction, Informatics, Information Systems, Instructional Systems Technology, Knowledge Management, Library and Information Science, Linguistics, Media Arts, Music, Project Management, Research, Sciences, Social Science, Statistics, Telecommunications Engineering.

Note that these are 85 entries for a group of 41 persons, i.e. on average each person stated more than two disciplines she has an academic degree in.

Table 2: Main disciplines of reviewers.

| *Main discipline* | *Number of reviewers* |
|---|---|
| Education | 5 |
| Learning Science | 5 |
| Computer Science | 4 |
| Educational Psychology | 4 |
| Psychology | 4 |
| Human Computer Interaction | 3 |
| Educational Sciences | 2 |
| Information Science | 2 |
| Linguistics | 2 |

For each of the following disciplines exactly on person states these as main discipline:
Cognitive & Collaborative Technology, CSCL, Curriculum and Instruction, Database theory, Didactics Educational Technology, E-Learning, Groupware Engineering, Language, Learning Theory, Library and Information Science, New Technologies, Science Education, Teaching, Telematics Engineering.

## Correlation between interdisciplinarity of contributions and interdisciplinarity of the authors research group

Table 3: Correlation between interdisciplinarity of contributions and research team.

| *Contribution* | *Research team* |
|---|---|
| Mono-disciplinary: 17 | Mono-disciplinary: 4<br>Multi-disciplinary: 13 |
| Multi-disciplinary: 24 | Mono-disciplinary: 1<br>Multi-disciplinary: 23 |

Table 3 shows that in our sample (all author questionnaires that contain enough data about the interdisciplinarity of the contributions and of the research teams) only 5 of 41 teams are composed of reserachers from only one discipline. 24 out of 41 contributions are made in interdisciplinary teams. And only in one case a multidisciplinary contribution is authored from a person working in a mono-disciplinary group. (This group consists of 2-5 members, i.e. it is relatively small.)
When we look at the main discipline of contributions authored individually or in mono-disciplinary teams we found out that 9 out of 17 mono-disciplinary papers originate from psychology or educational psychology.

Table 4: Correlation between interdisciplinarity of contributions and experience with interdisciplinary collaboration (collaboration behavior).

| *Contribution* | *Collaboration behavior* |
|---|---|
| Mono-disciplinary: 17 | Collaboration<br>…on a daily basis 3<br>…regulalry 5<br>…sometimes 7<br>…never 2 |
| Multi-disciplinary: 24 | Collaboration<br>…on a daily basis 10<br>…regulalry 11<br>…sometimes 3<br>…never 0 |

As we can see in table 4, behavior in inter-disciplinary seems to correlate with the interdisciplinarity of contributions. In table 5 we look at success and satisfaction of previous collaborations. Success and satisfaction with previous collaborations is considered higher from authors in multidisciplinary teams than in monodisciplinary teams.

Table 5: Correlation between interdisciplinarity of contributions and experience with interdisciplinary collaboration (success and satisfaction).

| *Contribution* | *Collaboration success* | *Collaboration satisfaction* |
|---|---|---|
| Mono-disciplinary: 17 | …quite successful 6<br>…mixed 8<br>....quite unsuccessful 0<br>…no answer 3 | …quite satisfying 8<br>…mixed 6<br>....quite unsatisfying 0<br>…no answer 3 |
| Multi-disciplinary: 22 | …quite successful 13<br>…mixed 9<br>....quite unsuccessful 0<br>…no answer 0 | …quite satisfying 14<br>…mixed 8<br>....quite unsatisfying 0<br>…no answer 0 |

## Aspects in favor of interdisciplinary collaboration

Reviewers and authors stated the following arguments pro and con interdisciplinary collaboration (in our field) We clustered these aspects in the following way:

Interdisciplinary collaboration is natural and necessary for CSCL:

- Interdisciplinary collaboration is seen as natural and necessary as CSCL and the Learning Sciences are interdisciplinary fields, tackle complex problems which require interdisciplinarity.

Better outcomes:

- Interdisciplinary collaboration provides multiple perspectives, differents skills/strengths/opinions, different theoretical approaches and methodological frameworks, a broader knowledge base.
- Different views, different knowledge etc. can be combined, one learns more about others' perspectives and about the problem. The combination provides a mpore holistic view. People share problems and mental models.
- Methodological cross-fertilization
- Cross-fertilization of ideas
- Get a deeper understanding of other perspectives
- More useful outcomes
- Interdisciplinary collaboration leads to a focus on practice and provides common ground
- Reduce bias

Individual outcomes:

- Learn about other disciplines etc.
- Make connections to other disciplines
- Become more modest about your own field
- Refine and sharpen your methods and concepts

Political reasons:

- Increase awareness of learning sciences in science disiplines

Pragmatic reasons:

- provide setting for evaluation (classroom)
- provide hardware/equipment
- specialisation in a discipline ironically requires interdisciplinary collaboration.

### Aspects challenging interdisciplinary collaboration

Differences lead to misunderstandings; require time/effort

- There are a lot of differences between disciplines, e.g. wrt. disciplinary culture, language. Researchers have different mental models, different criteria for evidence. These differences lead to confusion and misunderstandings. In order to overcome this there is a need for sharing and/or integration. This is costly and/or time-consuming. Time plays a role for the beginning of a int.coll. Also the maintanenace of an int. team requires high efforts. Dogmas and straight jackets of a discipline hinder integration.

Results don't justify effort

- Sometimes the results of int. coll. do not justify the effort/the time.
- Results are seen on a more theoretical level, not touchable. There is no increased understanding about the research topic.

Interdisciplinary collaboration requires good logistics (collaborators work in other buildings/campuses). It is not easy to balance the perspectives in one study.

It requires mutual perception and appreciation (programmer vs. real researcher; use sw/etc. from collaborators)

It requires certain individual skills

- Flexibility, openness for other approaches

Structures - Funding and Promotion:

- Int. coll. is demanded by university managers and politicians but existing structures hinder it: career, funding, promotion, tenure. There are little merits from int. coll.

Structures - Publication:

- It is difficult to find a venue for interdisciplinary research
- Least publishable unit vs. conceptually pulishable unit

Lack of interdisciplinary graduate level course work

Some problems simply don't require or benefit from interdisciplinary collaboration

## Discussion

This section discusses the results presented in the previous section. Our hypotheses (see first section) were

1. There is substantial interdisciplinary collaboration in the CSCL community as it can be seen from the research groups community members belong to and from the co-authorship of community artefacts.
2. There is a correlation between previous experience with interdisciplinary work and current interdisciplinary collaboration "behaviour" (i.e. if one has good experience with interdisciplinary collaboration chances are higher that he or she writes papers with interdisciplinary co-authorship).

Wrt. the first hypothesis we have seen that more than half of the contributions (24 out of 41; in the sample of our study) were written in interdisciplinary teams. We have also seen that only 5 (out of 41) authors work in monodisciplinary teams. This demonstrates a substantial interdisciplinary collaboration in the CSCL community. Wrt. the second hypothesis we showed that experience with interdisciplinary collaboration correlates with the nature of author teams. Regular collaborators and people who experienced successful and satisfying collaborations before seem to be more open and willing to participate in new collaborations.

The analysis of the CSCL community members disciplines showed that people come from very different backgrounds and often have a background in more than one discipline (see also previous studies: Hoadley 2005, Kienle & Wessner 2006).
An interesting finding is that the majority of monodisciplinary contributions is in the field of psychology or educational psychology. This might indicate problems such as the ones mentioned in the factors hindering or

challenging interdisciplinary collaboration, e.g. specific criteria for evidence, difficulties to find accepted publication outlets or low merits in psychology for interdisciplinary collaboration in view of funding or promotion.

As with many empirical studies, there are some limitations with our study which should be discussed here. It might be that the response to our questionnaires is biased because only a certain subset of the reviewers and authors responded to our questionnaire. For example, if only people respond who are interested in interdisciplinary collaboration (a number of respondends actually did express their interest in the study's results) then the CSCL community seems much more interdisciplinary than it really is. The actual response rate of 27 – 28% might also limit the significance of this study. Another problem originates from the international nature of the CSCL community: Disciplines have slightly different names and meanings in different regions or even exist only in some regions (as an example there is no program "Learning Sciences" at German universities). Thus, all quantitative statements should be handled with care.

## Conclusions & Future Work

In this paper we presented an analysis of the CSCL community concerning the disciplines involved and the collaboration between disciplines. The analysis is based on latest data gathered in the context of the CSCL 2007 conference. Starting with a list of reviewers and contact authors an email survey has been conducted among all authors and reviewers for CSCL 2007.

The paper provided some evidence that there is substantial interdisciplinary collaboration in the CSCL community. This could be seen analysing the (inter-)disciplinarity of research groups and author teams in the CSCL community. We have also seen that an author's experience with interdisciplinary collaboration correlates with the interdisciplinarity of the CSCL 2007 conference contributions of that author.

CSCL researchers are convinced that CSCL in many or most cases requires interdisciplinary collaboration (see section on aspects in favor of interdisciplinary collaboration above). Thus, it is important to tackle the challenging aspects for interdisciplinary collaboration as mentioned above. Such actions cover multiple layers of the CSCL community. Some challenges can be addressed by each individual CSCL researcher, others require strategic actions on the community level. As an example: It was very difficult to find a high-quality and (at least for some core discipline(s)) widely accepted publication outlet for interdisciplinary CSCL research until two years ago. The international Journal on CSCL (ijCSCL) helped to improve this situation. Also the funding situation changed recently as can be seen for example in the European Kaleidoscope project.

While this study provides a current snapshot of disciplines and interdisciplinarity in the CSCL community it would also be fruitful to trace interdisciplinarity throughout the complete CSCL conference series. This might lead us to a general pattern how interdisciplinarity evolves, develops and is utilized in a scientific community.

## Acknowledgements

The authors thank Cindy Hmelo-Silver, Gijsbert Erkens, Yasmin Kafai and Nancy Songer for providing lists of authors and reviewers and for granting permission to use this data for our research. We are grateful to all participants of our study for their collaboration and timely response to our survey.

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