Technische Universität Dresden
Medienzentrum

Prof. Dr. Thomas Köhler
Jun.-Prof. Dr. Nina Kahnwald
(Hrsg.)

GeNeMe '13

Gemeinschaften in Neuen Medien

an der
Technischen Universität Dresden
mit Unterstützung der

BPS Bildungsportal Sachsen GmbH
Campus M21
Communardo Software GmbH
Dresden International University
eScience – Forschungsnetzwerk Sachsen
Gesellschaft der Freunde und Förderer der TU Dresden e.V.
Gesellschaft für Informatik e.V.
Gesellschaft für Medien in der Wissenschaft e.V.
IBM Deutschland
itsax – pludoni GmbH
Kontext E GmbH
Learnical GbR
Medienzentrum, TU Dresden
ObjectFab GmbH
Transinsight GmbH
T-Systems Multimedia Solutions GmbH
Universität Siegen

am 07. und 08. Oktober 2013 in Dresden

www.geneme.de
info@geneme.de

B.6 Designing e-research: A framework for researcher's social online knowledge

Bahaaeldin Mohamed, Thomas Koehler, Metwaly Mabed
Technische Universität Dresden, Medienzentrum

Abstract
Design strategies to support and enhance scientific collaboration are still ambiguous. The ability of universities and research institutes to support a collaborative scientific research environment among researchers through appropriate methods needs to be further investigated. The lack of understanding about the human factors behind collaboration, the nature of scientific tasks, and the institute's cultural environment are motivations for this study. As a part of our work on a European integrated project, Edu-Tech, this study investigated which factors of collaborative research are important to give us a clear picture for enhancing the social perspective of the project's webpage. This research purposes a model, Time Environment, Individual and Group (TEIG), in order to provide descriptive variable necessary to understand the transformation of online social knowledge. Accordingly, we provided a new prototype for designing our online community, Edu-Tech, which is now ready to facilitate collaboration among researchers.

Keywords: e-research; e-collaboration; motivation; communities of practice; computer supported collaborative work

Acknowledgements
We would like to acknowledge the support of the Education & Technology project and our partners in Norway, France, Poland and Austria for their support and contribution to data collection.

1 Introduction

Currently, e-research represents a rapidly growing area in science. The term is known by several synonyms, mainly e-science, e-humanities, e-social science, cyber-science, cyber infrastructure, cyber-research, humanities digital, humanities online, grid humanities, among others. These terms, in general, refer to understanding the sociological pattern of research and technology, how research moves online, and how it becomes more social and collaborative. A differing interpretation of e-research is that old paradigms cannot be copied and thus a new framework is needed (Meyer &

Schroeder, 2009, p.274). Furthermore, Meyer & Schroeder (2009) argues that not only is an understanding of e-research important, scientists also need to become aware of how knowledge has been historically transformed into online form (p.249).

E-collaboration or online collaboration is the one of e-research direction which denotes the use of one or more computer mediated communication tools to accomplish single or multiple tasks through collaboration between individuals (Cai & Kock, 2009, p.823). CSCL research indicates how collaboration and technology facilitate sharing resources and creating knowledge among persons. Wang (2009) designs his conceptual framework to remedy weaknesses in building effective collaboration (p.1). He considers all levels of: (a) individual cognitive behavior which elaborates skills, knowledge, emotions and motivation; (b) levels of interaction including interaction factors such as friendship among groups, roles, resources and environment; (c) process of organizing collaboration which may refer to responsibilities and roles; and (d) the collaboration assessment process. They specify four key indicators for understanding online collaboration: learning performance based on skill, interaction behaviors that drive participation and communication, and both performance and interaction indicators, which they refer to as social support. Group awareness is an important aspect for collaboration in CSCL research, this aspect relates to being involved and knowledgeable about the interest and behavior of group members (Bodemer & Dehler, 2011, p.1045).

This first section of this paper describes the Education & Technology project. This is followed by an overview of the study model for understanding the readiness of collaboration. The paper also presents the results of a survey the collaboration readiness of international PhD candidates at five European universities in the field of e-science, and the measures that were used to gather the data. Finally, the paper presents the results of our analysis and concludes with a list of recommendations to improve future work.

2 Motivation (Edu-Tech) integrated project

The Education and Technology Project (Edu-Tech) aims to develop electronic courses for the postgraduate level in the field of educational technology. Five European universities and two public research institutes participated in the program with the goal of creating a European network that would be able to award joint PhD degrees (see http://edu-tech.eu/) and to develop and provide a PhD student network in Europe in the field of educational technology. Accordingly, the study developed two main concepts. First, the project sought to create advance online courses that would enhance PhD students' competences and qualifications and four E-modules were developed pertaining to collaborative learning, social and cultural implication of new media, pedagogic design of media and technologies, and information systems and knowledge management. Second, the project sought to encourage collaboration between students, creating an online forum to facilitate this development. European universities are increasingly required to encourage collaborative research and produce collaboration between doctoral students, improve their quality and enhance their motivation for collaboration and working together, not only formally but also informally.

Education & technology project includes substantial, central and real social factors which pertain to research contribution. These factors are often overlooked and are not always integrated in the e-learning concept of self-regulated learning. A practical development was the creation of a summer school program, which led to collaboration. Four key summer schools were held at four different European universities in Germany 2008, France 2009, Norway 2010, Poland 2011, and Austria 2012. The project has earned an additional grant to be continued, therefore this year summer school was held once again as second turn in Germany 2013 and will be continued as it was before. One of the authors of this paper "Bahaaeldin Mohamed" participated in three of these summer schools, acting as an active participant, presenting his PhD project, and interacting with other experts in the same field. This led to an exchange of experiences which resulting in collaboration and knowledge. A central goal of the summer school program is to lead collaboration by organizing different socio-technical, socio-research, and socio-entertainment activities.

3 Low-level participation on www.edu-tech.eu

The main aim of the Educational & Technology (E&T) project is to enhance doctoral students' research skills by providing developed E-modules in the field of educational technology and provide learning content for students, not to enhance online collaboration. Although an integrated online forum was used to produce collaboration among students, the primary use of the online forum led to nonuse. Previously, participants used the online forum for the sole purpose of social presence and to present their own projects without any single attempt to create collaboration among them. If this website is to be classified as a Learning Delivery System (LDS), then it already provided an affordable and configurable Learning Delivery System (LDS) used to deliver a training curriculum for doctoral students and to track results from evaluation process. LDS are online systems that facilitate access to online courses through a dedicated platform and collective tools to facilitate synchronous and asynchronous computer-mediated communication. However, these LDS stop short of enabling active real scientific collaboration online in the sense of providing collaboratory environments. As Farooq et al. (2009) report, sharing resources, scientific joint paper, discussion, brainstorming, explaining and elaborating information could direct collaboration between peers in a scientific community around existing online platform and can lead to truly active collaboration attempts through collaborative research environments (p.304). Thus, this study seeks to support and increase edu-tech.eu's LDS to create collaboration opportunities for enhancing distributed scientific online collaboration.

4 Framework of factors of collaborative research work

Collaboration will be supported by the proposed-Edu-Tech technology at different levels, from the individual through the space of group and finally via the territory of scientific context and the institutional and cultural environment. Therefore, our understanding of what online collaboration means is established through the understanding of the individual, group, and contextual factors behind collaboration and what motivates researchers to work together effectively. Patel, Pettitt & Wilson (2011) report that collaboration can be understood in terms of the institutional cultural context in which researchers are working (p.4). On the other hand, collaboration can rely on interaction between researchers. An individual's cognitive ability and competence may also lead to collaboration. Therefore, this study includes these factors in its framework.

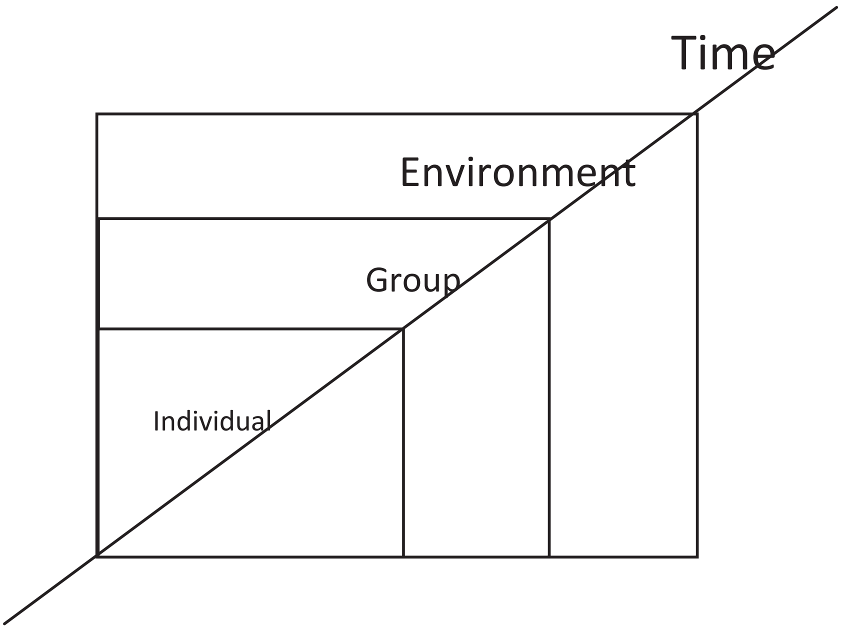


Figure 1: Factors supporting online collaboration in e-science

In order to test the effectiveness of collaboration it is important to define what constitutes effective collaboration. Sargent and Waters (2004) report that collaborative team characteristics, collaborative environmental characteristics, and a collaborative process lead to collaboration (p.1). From this perspective, collaboration has three main outcomes: (a) objective outcomes which relate to publications, reports and presentations; (b) Subjective outcomes which deal with collaborative experiences, self-efficacy, and self-confidence; (c) Dealing and connecting with other collaborators. Patel et al. (2011) outline seven main factors involved in collaboration: context, support, tasks, interaction process, team, individuals and overreaching factors (p.3). This model was developed to act as a standard for profiling collaboration readiness. Serce et al. (2011) analyze collaborative behavior through online communication (p.500). The results show that communication patterns are related to the mode of communication, the real-life application of the task and leadership. Effective online collaboration is more effect during asynchronous communication. Using these empirical works as a starting point, this study aims to outline factors affecting collaboration and the nature of the collaboration process in e-science.

Accordingly, the following question emerged: Why do social science researchers, primarily in the field of educational technology, cooperate at the levels they do? Skatova and Ferguson (2011) answer a similar question; they present a different aspects and perspectives by highlighting that collaboration exhibits strikingly different properties as a result of different resources and levels of discipline (p.1). Furthermore, collaboration relates to biological, psychological and economic backgrounds. Thus, Skatova and Ferguson (2011) report that reward and punishment relate to human behavior and collaboration (p.1). Accordingly, collaboration can either be a matter of feedback and interdependence, or a direct result of the context in which it takes place. These questions will be answered in the following conceptual framework, in order to test to what extent the factors of individuals, group, environment and technology that contribute to the collaboration process in scientific and academic research.

5 Hypothesis

The key issue of the current study is whether (and if so, in what ways) academic faculty members and doctoral candidates would collaborators and under which online collaborative patterns this would occur. Turel and Zhang's (2011) concept, Technology Acceptance by Group (TAG), attempts to outline the factors that contributes to the group's acceptance of technology (p.63). Technology Acceptance Model (TAM) (Davis, 1989) is most frequently used in prior studies, arguing that technology usage is controlled by personal behaviors which are influenced by ease of use and perceived usefulness. These factors could potentially predict user attitude and system usage. Technology could influence the context of organization and facilitate communication among colleagues and employers in the organization (Boone & Ganeshan, 2001, p.485).

H1: Technology use has a direct effect on individual characteristics that encourage academic collaboration.

H2: Technology use has a direct effect on group interaction that encourages academic collaboration.

H3: Technology use has a direct effect on environmental concerns that encourage academic collaboration.

Skatova and Ferguson (2011) found that people would collaborate when others start to contribute a high proportion of the initial donation (p.240). They also report that the expectation of human co-operative behavior could be interpreted through reinforcement sensitivity theory (RST). Thus, it is possible that incentives could encourage an individual to collaborate. This relates to the public goods game theory which describes pro-social and selfish actions. Individual contribution increases as he/she benefits from the contribution of others, but not every individual is sure that others will also contribute (Skatova & Ferguson, 2011, p.240). This theory provides understanding about the influence of group pressure (reputation building and the risk of punishment) on encouraging academic collaboration.

H4: Individual concern has a direct effect on group concern, encouraging academic collaboration.

H5: Individual concern has a direct effect on the environment and context of organization, shaping academic collaboration.

H6: Individual concern has a direct effect encouraging academic collaboration.

Group concern in our group is more than a group concept, it includes the concept of building relationships, sharing awareness, shaping the role, and developing the team (Patel et al., 2011, p.11). Bodemer and Dehler (2011) provide the concept of group awareness in contributions to collaboration, reporting three types of concerns: behavioral awareness, cognitive and social awareness (p.1044). These three concepts contribute to a new understanding and being informed about group behavior will facilitate understanding about collaboration among student group.

H7: Group concern has a direct effect on academic collaboration.

The natures of the task, organizations' policy statement orientation and the type of supported technology play a role in shaping communication patterns which are related to the mode of communication (Serce et al., 2011, p. 491). Pawan and Ortloff (2011) investigate influences relating to the type of activities that lead to successful collaboration (p.463). They also define the factors that contribute to sustainable collaboration between teachers, mainly conflict, tension and opportunities. The factors of task performance, group functioning, social support and environmental (contextual) support were investigated by Daradoumis, Mones and Xhafa (2006) as environmental factors behind online collaborative interaction.

H8: Environmental concern has a direct effect on group concern for academic collaboration.

H9: Environmental concern has a direct effect on academic collaboration.

6 Method

6.1 Data collection and respondents

Participants comprise 29 international doctoral students who participated in the Education & Technology European project summer schools. They were studying in different European countries: Germany, Norway, France, Austria and Poland (68.96% Germany, 13.8% Poland, 10.34% France, Austria 3.4% and 0.0% Norway). Their countries of origin include Chili, China, Egypt, Sudan, Syria and Nigeria. Participants were drawn from different departments, primarily educational technology. Data were collected between 17.07.2011 and 30.08.2011. A questionnaire was administered using online software and data has been collected online from participants. The data collection process experienced difficulties provoking participants' participation via distance. Therefore, it was necessary to send more than one e-mail reminder to convince members of the group to participate. The statistics for the online survey management system present that total numbers of participants were (n=72) and the number of completed surveys was (n=29). Some respondents skipped one or more questions, incomplete answers were eliminated. The final number of participants represents 40.27% of the group. Our sample was balanced with regard to gender, at a rate of 56.6% male and 41.4% female.

6.2 Measures of academic collaboration

We conceptualize collaboration in terms of five dimensions: (a) the time dimension (5 items) that concerns some aspects are either increasing or decreasing over time likely trust, conflict and experiences; (b) contextual dimension (6 items) that investigate the influence of culture, the nature of the task and supported technologies; (c) the individual factor (5 items) presents the cognitive and psychological aspects that control the process of being a collaborator; (d) group factor (5 items) which concern group awareness and building team concepts; and (e) technology use and technology adoption process among researchers and doctoral candidates (5 items). This study investigates the extent to which these factors encourage academic collaboration, and whether these items were present during collaboration. Working on the same project at the same institute was excluded and does not count as research collaboration.

Participants were asked to identify their preferred method of interaction for research-based relationships. This included the human factors identified above, their preferred collaboration partner, the type of activities they would deal with, activities they would like to be involved in, their preferred application and how they imagine the future of our web-based research portal. The questions were predominantly a mixed selection among pre-defined categories and likert scales of “strongly disagree” to “strongly agree”.

6.3 Data Analysis

Analysis of this quantitative data was performed using both the statistical package SPSS and Partial Least Squares (PLS) technique in order to develop our model of collaboration. A variety of statistical analyses were performed concerning measure eligibility and the regression. As we included multi-part questions in the survey, it was important to check the validity and reliability of the scale; that is, to make sure all the items in the question were measuring the same underlying construct. For the PLS technique for adaptive data modeling, the quality criteria of AVE were almost equal to five, and composite reliability equal and greater than 7. Thus, the accepted level of validity and reliability in our scale were guaranteed.

7 Results

7.1 Demographic data

Of the responses we received, participants backgrounds varied. Concerning (a) academic degrees: (n=1) 3.4% are professors, have a bachelor degree in education (n=3) 10.34%, 51.72% have a Master degree (n=15) and 17.24% have a doctoral degree (n=5). The sample as a whole was relatively highly educated. With regard to (b) gender, Males (n=17) 58.6% outnumbered females. The field of study also varied (c) and specializations included educational technology, computer science, social science, economics, communication and psychology. Experience range from 1 to 18 years. Participants (d) ages ranged from 26 to 48 years of age.

The results of the survey are presented in two main categories, indicating that during our investigation the following led to collaboration: (1) answers to our questionnaire which related to human, task and technology concerns; and (2) describe in detail our proposed collaboration model.

7.2 The nature of communication, task and technology

We wanted to understand with whom Education & Technology website users would collaborate online. Researchers were asked to select their preferred partner who they would like to virtually interact with on our project website. The results present that there are two items rated relatively higher than 50%. These items were: "who is looking for similar types of papers as I am" (72.4%) and "whose papers I have read" (51.7%). On the other hand, it is interesting to note that results indicate that the rate of (13.8%) was reported for the item, "working individually on my research". The lowest rated item was "who cites my papers" (10.3%).

It seems relatively clear that working individually in research is no longer accepted in the time of social networking and social revolution and accordingly, it is important to note the extent that e-research studies drives knowledge advancement (Meyer & Schroeder, 2009, p.247). These results indicate the importance of incentives for academic collaboration, as reported in the literature review (Patel et al., 2011, p.13; Skatova & Ferguson, 2011, p.240).

With regard to preferable scientific tasks, the items of 'representation of self' (37.9%) and 'personal record keeping' (13.8%) rated relatively low. This study treated the items which have been quoted over 50% as accounted items. Accordingly, the items 'brainstorm new ideas' (62.1%), 'plan joint project' (51.7%), 'giving and receiving help' (55.2%), 'exchange resources and information' (75.9%); 'elaborating information' (58.6%); 'sharing knowledge' (51.7%); ' feedback' (65.5%). Concerning access to information, the results indicated that (79.3%) like to be informed when 'recent papers published in my area' and about 'new colleagues who are working in my area' (55.2%).

The results refer to academic collaboration rather than individual performance, as our study attempts to provide an understanding about methods and processes which could plausibly enhance academic collaboration. The methods concern brainstorming, exchanging, elaborating and sharing information and knowledge. In other words, the process should implement scientific collaboration which may refer to the conceptualization of joint projects and present the possibility to write a joint paper.

Concerning the use of technology and how researcher would like to be informed, of the researchers concerns indicated that they just want to be informed, regardless of the tools that are used, and the primarily rated the need to be informed at a high level, with RSS and HOT TOPICS being discussed in the forum and mailing list. Additionally, they wish to ensure that cooperative online tools are used to drive collaboration and interaction and brainstorming processes. Interestingly, (24.1%) of our participants rated digital library/search engine as an expected future function of our project website and (20.7%) prefer that the website be developed as a hybrid portal for different kind of academic services.

The results in this branch pose a paradox between recommending collaboration and the desire for a digital library only, the scientific portal's future direction. The discrepancy resulted from a lack of incentives or an unclear understanding of organized scientific collaboration. If the website's primary use was shifted toward encouraging collaboration, this change could encourage participants to think about other useful way for using the website in order to create a useful collaboration portal (Farooq et al., 2009, p.304).

Concerning the satisfaction function of the E&T website, (13.8%) report that they often using our E-modules, while, at the same time, (13.8%) believe that our online discussion forum is an adequate tool to led e-collaboration concerning the reality of scientific tasks. However, (48.27%) report that they would like to use the website in the future. With reference to how our website compares to normal learning management system, LMS, which is used by participants to follow their current courses, (31%) accept that LMS is an adequate tool for dealing with their research activities. (37.9%) accept the idea that e-mail and an informative website are adequate for research practices. Overall, the results indicate that researchers look forward toward a dream tool that could coordinate research activities with a proper adequate function for scientific activities.

7.3 Results of the measurement model

Before analyzing this model, its reliability was measured. Cronbach's alpha exceeded the required threshold of 0.7 for all items, implying high internal consistency of the scales (Cronbach, 1951, cited by Serenko, 2008, p.465). Our model was tested using smart PLS version 2.0 (Ringle et al., 2005, p.1). PLS (Partial Least Squares) is "the second generation structural equation modeling technique that assesses both the measurement and structural model in a single run" (Serenko, 2008, p. 465). This technique was chosen for two reasons: first, it is the proper technique for smaller sample sizes and second, it eliminates restriction on data distribution like normality (Serenko, 2008, p.465).

In order to submit an accepted level of eligibility for the questionnaire, some items are removed which do not have sufficient weight vis-à-vis their main factor 6 items (TIM_2, TIM_3, COL_7, COL_8, GRO_5, and TEC_5) with loading below the selected threshold of 0.7 were dropped to ensure construct validity. Once these items were removed, the model was re-estimated.

To evaluate the discriminate validity of measures, a matrix of loadings and t-values was constructed. Additionally, the process of removing lower loading values items and re-distributing the items of the first factor of our questionnaire, "Time factor", to other factors and later deleting this time factor completely because it has lower validity than other measured factors. Therefore, all items are re-categorized under the proper category where it makes higher significant than others, and it was concluded that discriminate validity of the measure was adequate. Furthermore, the measure of convergent validity was anticipated by assessment of the t-test in the item loading. Data presents that the inspection revealed that all t-values were significant at the 0.001 level. This is the evidence that all indicators effectively measured their respective constructs.

According to the results, seven out of nine hypotheses were supported and two were rejected. Data summarizes the validation of the hypotheses. As such, most relationships were supported. In order to present the insignificance of the rejected linkages, Technology-environment and Environment-collaboration links were removed and the model was re-estimated.

7.4 Structured model

In order to assess the structure model, a bootstrapping technique was applied (Chin, 1998; Gefen et al., 2000, p.27; cited by Tselios et al, 2010). The examination of t-values was based on 1-tail test with statistically significant levels of $p<0.05$ (*), $p<0.01$ (**) and $p<0.001$ (***). Results are presented in Figure 1. Dotted lines highlight the insignificant paths.

In particular, the outcomes of the structural model in terms of direct effects, bootstrapping and t-statistics confirmed the majority of hypotheses, at various significance levels (Figure 1). Specifically, "Technology" is associated with a very strong significant relationship with "Individuals" (H1 at $\beta = -0.57$, $p<0.001$ level) and significant relation with "Group" (H3 at $\beta = 0.19$, $p<0.05$ level). (H2) did not confirm the relation between "Technology" and "Environment". Additionally, the relationship (H4) between "Individuals" and shaping "Collaboration" along with the relationship (H5) of "Environment" and the relationship with (H6) "Group" with regard to shaping academic "Collaboration" were also confirmed with high significance (β = 0.69, β = -0.45, β = -0.57, β = 0.63, p<0.001). Moreover, the "Group", in relation to academic collaboration, has a significant relationship (H7 at β = 0.40 p<0.05). Finally, the relationship between "Environment" and "Group" (H8) has high significance (β = -0.06, p<0.001). On the other hand, the relationship between "Environment" and shaping academic "Collaboration" (H9) were unrelated in the context of shaping academic collaboration.

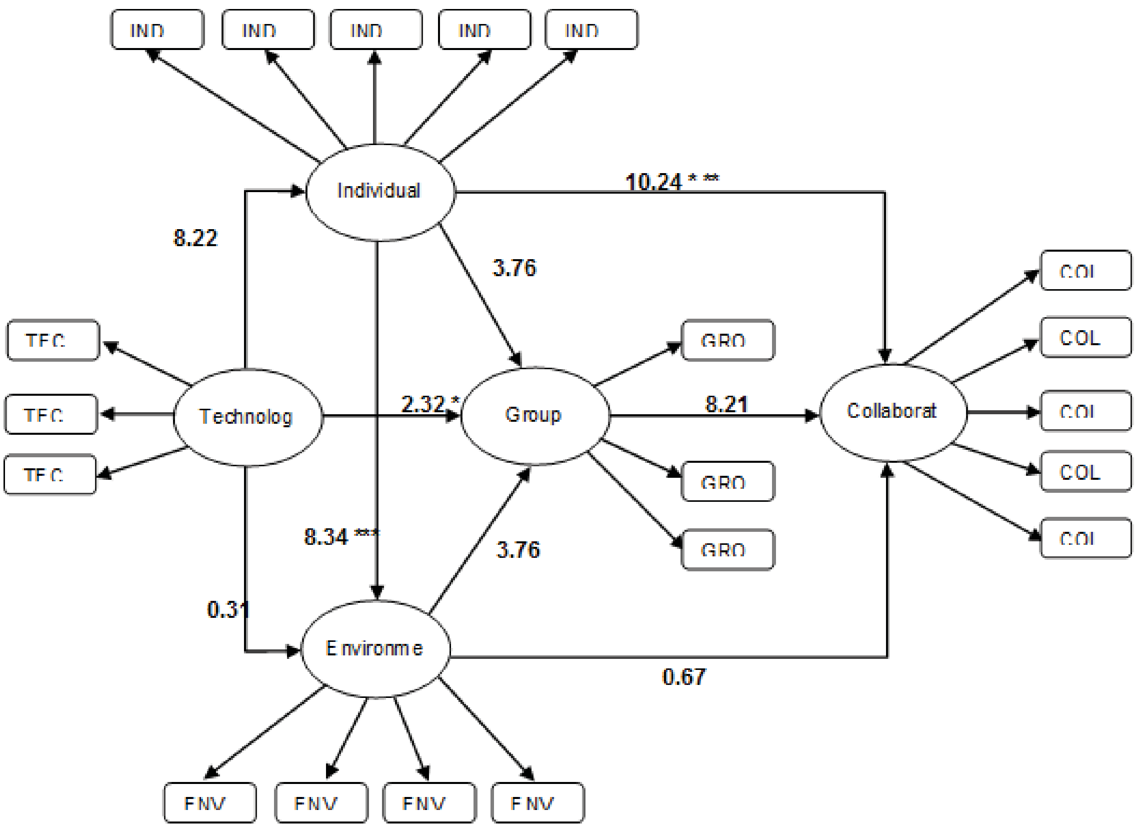


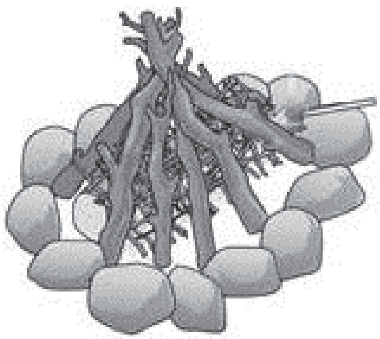
Figure 2: The structure model (PLS bootstrapping). * significant at 0.05 level (1.96); ** significant at .01 level (2.58); * significant at 0.001 level (3.29)**

8 Discussion

We conceptualized and validated our proposed framework for understanding academic collaboration among researchers using electronic collaboration settings, linking technological, individual, context and group/team interaction as they relate to collaboration. Our study further covers important aspects behind contribution and support for collaboration in e-research as a case study of Educational & Technology European project.

Overall, our understanding for academic collaboration originates from technology acceptance, which is mediated by individual needs, group interaction, and environment support and leads to academic collaboration in e-science. This view is consistent with the view of Meyer & Schroeder (2009) that e-research revolves around tool development and how academic communication as a system has become a key component of building, creating, sharing and collaborating as it pertains to knowledge (p.249). Such an understanding leads to the socio-technical components of e-research, which encompasses infrastructure, resources, and tools. On the other hand, trust and privacy are two factors that can hinder distributed collaboration. Therefore, collaboration cannot be easily created via an internet site. (Farooq et. al., 2009, p.306). This could be interpreted as a lack of motivation, which is known as social loafing (Turel & Zhang, 2011, p.63), or the matter of being careful vis-à-vis legal intellectual property issues or escaping from peer pressure, which is known as the behavior of lurkers and defectors in online collaboration (Skatova & Ferguson, 2011, p.238;Wang,2009, p.1). We think that the Technology Acceptance Model (TAM) and a Technology Acceptance by Group (TAG) (Turel & Zhang, 2011, p.63) could off a solution for the issue of technology acceptance by individuals. The variety of solutions presented by web 2.0 technologies is more likely to simulate human relationships, such as face-to-face interaction and thus they provide opportunities for individuals' social presence, reputation, collaboration and sharing (Mason & Rennie, 2007, p.199).

The technology strongly predicts individual and group interaction. At the same time, technology mediated by individuals needs and group interaction could strongly predict academic collaboration. The revolution of web 2.0 technology since 2005 presents media that enhances individuals and groups structure, communication, and builds relationships (Maranto & Barton, 2010, p.36). Our results for technology development are consistent with the suggestion of Farooq, Ganoe, Carroll & Giles (2009, p.304). These hold implications for the proper design of an online portal for e-collaboration, including: (a) visualizing query-based social networks to identify academic communities of practice; (b) providing an online collaborative tool to support specific academic tasks and duties; and (c) support activity awareness with recent information related to academics' interest. This suggestion was recommended by HCI & CSCW. We also recommend analyzing individual and group-based technology acceptance. Accordingly. Our study coincides with the findings of Turel & Zhang (2011) who stress the need to account for group-based use of technology (p. 66). This point of view could reduce the amount of social loafing and the behavior of lurkers and defectors. Academic group characteristics (in our case PhD candidates) are factors that should be considered by designers and users of web-based collaborative tools. The ideas to reinforce cross-community bridges (Farooq et. al., 2009, p.303) or employ networking gatekeepers (Nahm, 2003, p.13) represent two solutions for dealing with and creating connections between two different scientific communities. A bridge or gatekeeper is a researcher who is part of two different communities. Overall, acceptance of technology, both individual & group-based, is a key factor for successfully building an academic research online collaborative portal. Technology acceptance and function have a direct affect on and strongly contribute to individual's attitudes and group interaction.



Our understanding of academic collaboration. It is like starting a fire. Starting with facilitation and media, then increasing effort and organizing work among individuals, groups' interaction and environmental support, once they blow and blow on the fire and increase effort, the fire will become stronger strong. Once it gets strong, it will be adequate for cooking, producing and post-production of knowledge. Accordingly, we suggest three process for posing academic collaboration: 1) Facilitation, 2) Effort & 3) Producing & post-production of knowledge.

Figure 3: Our understanding of academic collaboration: Fire as a metaphor for conceptualizing academic collaboration.

Our contribution goes through the tier of technology as an important factor which encourage and support scientific collaboration, and primarily those scientific tasks which could shape the functionality of technology. Our researchers suggested such activities as brainstorming new ideas, planning joint projects and writing joint papers as ways to increase collaboration. Technology is needed to provide more collaborative spaces for scientifically sustained activities. Once we defined a vital process in knowledge production, it is easy to follow it up with the proper technology. Ynalvez & Shrum (2011) report that a successful research project could translate into new resources, facilitation, social action and academic activities (p.205). The layers of collaboration that our researchers requested and quoted include publication productivity and research training, and this was recorded across experience levels, from beginners and professionals, scientists and novice researchers. While asynchronous discussion forums are a proper solution for open-ended discussion, it does not fit process such as joint authorship and whether or not technology readiness is adequate before developing a sophisticated advanced collaborative tool (Farooq et. al., 2009, p.305). Blank, Hedges & Dunn (2009) reported that "technology and the digital world are still notable to fully mimic the analogue world" (477). Since web 2.0 technology could enhance scientific knowledge (Shang et. al., 2011, p.178), and this is the key factor in researchers' analogue life, we agree with Carmichael & Burchmore (2010) that it is important to employ and reuse this kind of participatory technology to encourage scientific collaboration with regard to interpersonal processes such as privacy and trust (p.236). Thus, careful understanding is necessary for training and research, and institutional support is also required for coordination and academic incentives (Figure 4).

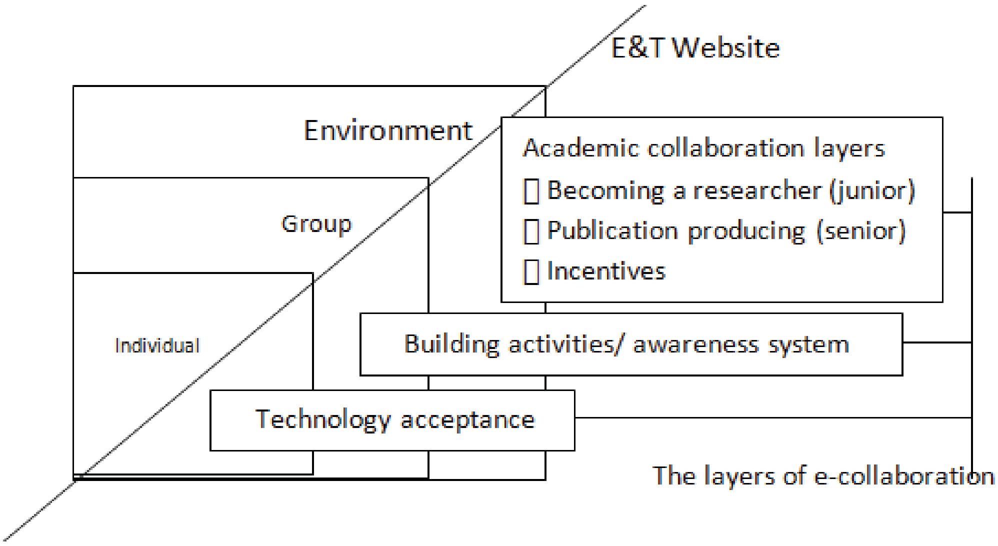


Figure 4. Our recommendation for understanding and enhancing sustained academic collaboration on our E&T website

9 Conclusion

Since ICT and web 2.0 technologies have changed social life and have molded a social revolution, it is challenging to find ways for scientists to communicate and collaborate. This study contributes to finding a solution for this difficulty, including developing a conceptual framework for scientific e-collaboration among novice researchers and scientists as a case study of our Education & Technology European project. The context, interpersonal, intrapersonal factors and sub-factors through the factor of time, are the main concepts that could enhance or hinder scientific e-collaboration among researchers. This work has been carried out in the context of E&T website platform as an endeavor to develop our website and to properly deal with the concept of e-science and e-research. We believe that scientific e-collaboration is a complex phenomenon with multiple sites of interaction between factors. This model provides a description of relevant factors and sub-factors which institutes can use to think about e-science and scientific e-collaboration and how novice researchers and scientists currently collaborate, in order to mimic analogue scientific collaboration in a digital online version.

Furthermore, this study contributes empirical results from the administered online survey. Our novice researchers and scientists were asked about being collaborators and their views and ideas for developing the E&T website portal to effectively deal with the junior/senior layers of scientific collaboration. We found that high-quality technological design could predict an adequate level of scientific e-collaboration. This could make a clear translation of real scientific collaboration into a digital form. Furthermore, one must take into account intrapersonal aspects like technology adoption process, interpersonal aspects mainly privacy, trust, social presence and group technology acceptance, contextual issues related to the real tasks of researching and sustained technological and administrational support. We suggest dual layers of e-collaboration between juniors (those becoming a researcher) and seniors in the form of co-authoring. Incentives are needed and thus represent an important issue in order to have sustained collaboration among novice researchers and scientists.

References

[Blank et al., 2009] Blank, T., Hedges, M. & Dunn, S. (2009). Arts and humanities e-science- Current practices and future challenges. Future Generation computer systems 25, pp.474–480.

[Bordemer & Dehler, 2011] Bodemer, D. & Dehler, J. (2011). Group awareness in CSCL environments. Computer in Human Behavior 27, pp.1043–1045.

[Boone & Ganeshan, 2001] Boone, T. & Ganeshan, R. (2001). The effect of information technology on learning in professional service organizations. Journal of Operation Management 19, pp.485–495.

[Cai & Kock, 2009] Cai, G. & Kock, N. (2009). An evolutionary game theoretic perspective on e-collaboration: The collaboration effort and media relativeness. European Journal of Operational Research 194, p.821–833.

[Carmichael & Burchmore, 2010] Carmichael, P. & Burchmore, H. (2010). Social software and academic practice: Postgraduate students as co-designers of web2.0 tools. Internet and Higher Education 13, pp.233–241.

[Daradoumis et al., 2006] Daradoumis, T., Martinez-Mones, A. & Xhafa, F. (2006). A layered framework for evaluating on-line collaborative learning interactions. International Journal of Human-Computer Studies 64, pp.622–635.

[Dehler et al., 2010] Dehler, J. , Bodemer, D, Buder, J.,& Hesse, F-W. (2010). Guiding knowledge communication in CSCL via group knowledge Awareness. Computers in Human Behavior.

[Farooq et al., 2009] Farooq, U., Ganoe, C.H., Carroll, J.M. & Giles, C. L. (2009). Designing for e-science: Requirements gathering for collaboration in CiteSeer. Human-Computer studies 67, pp.297–312.

[Maranto& Barton, 2010] Maranto, G. & Barton, M. (2010). Paradox and Promise: MySpace, Facebook, and Sociopolitics of social networking in the writing classroom. Computers and Compositions 27, pp.36–47.

[Mason& Rennie, 2007] Mason, R. & Rennie, F. (2007). Using web2.0 for learning in the community. Internet and Higher Education 10, pp.196–203.

[Meyer& Schroeder, 2009] Meyer, E. & Schroeder, R. (2009): Untangling the web of e-research: Towards a sociology of online knowledge. Journal of informatics 3, pp.246–260.

[Patel et al., 2011] Patel, H., Pettitt, M. & Wilson, J. R. (2011). Factors of collaborative working: A framework for a collaboration model. Applied Ergonomica, pp.1–26.

[Pawan& Ortloff, 2011] Pawan, F. & Ortloff, J.H. (2011). Sustaining collaboration: English-as-a-second-language and content-area teachers. Teaching and Teacher Education 27, pp.463–471.

[Ringle et al, 2005] Ringle, C.M., Wende, S., & Will, S. (2005). Smart PLS 2.0 (m3) Beta Hamburg 2005, [Online] available at (http://www.smartpls.de).

[Sargent& Waters, 2004] Sargent, L.D. & Waters, L.E. (2004). Careers and academic research collaborations: An inductive process framework for understanding successful collaborations. Journal of Vocational Behavior 64, pp.308–319.

[Serce et al., 2011] Serce, F-C, Swigger, K, Alpaslan, F-N., Brazile, R, Dafoulas, G., & Lopez, V. (2011). Online collaboration: Collaborative behavior patterns and factors affecting globally distributed team performance. Computers in Human Behavior 27, pp.490–503.

[Serenko, 2008] Serenko, A. (2008). A model of user adoption of interface agents for email notification. Interacting with Computers 20, pp.461–472.

[Shang et al., 2011] Shang, S., Li, E-Y., Wu, Y-L, Hou, O-C-L. (2011). Understanding Web2.0 service models: A knowledge-creating perspective. Information & Management 48, pp.178–184.

[Skatova& Ferguson, 2011] Skatova, A. & Ferguson, E. (2011). What makes people cooperate? Individual differences in BAS/BIS predict strategic reciprocation in a public goods game. Personality and Individual Differences 51, pp.237–241.

[Turel& Zhang, 2011] Turel, O. & Zhang, Y. (2011). Should I e-collaborate with this group? A multilevel model of usage intentions. Information & Management 48, pp.62–68.

[Wang, 2009] Wang, Q. (2009). Design and evaluation of a collaborative learning environment. Computers & Education 53, pp.1138–1146.