Effectiveness of an Online Community of Practice for Learning to Teach Elementary Science

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Abstract

The purpose of this study was to understand how well pre-service teachers and in-service teachers can be supported by an online community of practice (NETwork) for learning to teach. Dependent-samples t-tests were employed to examine the significant differences of members' perception of their social experience, while content analysis was utilized to identified members' perception of their growth of learning to teach after participating in NETwork. The results show positive significant changes of members' perceptions of social navigation, perceived ease of use and usefulness of Sakai tools, and satisfaction with NETwork experiences. Also, members expressed the effectiveness of NETwork for their current/future teaching and reported that changes in their sense of community resulting from interacting with others in NETwork.

Introduction

The development of Internet technology and concepts of CoP offer potential for diminishing the gaps and disconnection between the stages of teachers' professional development. Previous studies have recognized the importance of a professional continuum of learning that spans pre-service teacher education, induction of beginning teachers, and continued professional development (e.g., Feiman-Nemser, 2001). Some cases of applying online systems to support the continuum of teachers' professional development have been found effective but not easy to sustain. (Job-Sluder & Barab, 2004; Gray & Tatar, 2004; Roup, Gal, Drayton, & Pfister, 1993; Steele, 2002; Desimone, Porter, Garet, Suk Yoon, & Birmnan, 2002). NETwork (Nurturing Elementary Teachers' work), an online community of practice for learning to teach, was established in Sakai 2.0 to support the collaboration and professional discourse between university teacher educators, pre-service teachers, and in-service teachers. To better understand how teachers can be supported and sustained while participating in an online community of practice, this study investigated the effectiveness of NETwork for teaching in the online learning community, NETwork.

Theoretical Perspectives

Professional Continuum in Teacher Education

The problems that lead to teachers' shortage of knowledge and skills are identified as the deficiency of collaboration and connectedness between schools of education and K-12 education, isolation during teachers' induction year, and the discontinuity of teachers' professional development across their career-long lives (Goodlad, 1990; Kahle & Kronebusch, 2003). Feiman-Nemser argued teacher education programs represent only a "weak intervention compared to the influence of teachers' own schooling and their on-the-job experience" (Feiman-Nemser, 2001, p. 1014). To better sustain teachers' learning through stages of professional development, Feiman-Nemser (2001) identified the

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central tasks (Table 1) across stages of teachers' professional development as they progress throughout their careers. She also emphasized that teachers need to be facilitated in these tasks through each stage.

Table 1 *Central Tasks of Learning to Teach (Feiman-Nemser, 2001)*

Pre-service Teacher Education	Induction of Beginning Teachers	Continuing Professional Development
Examine beliefs critically in relation to vision of good teaching	Learn the context- students, curriculum, and school community	Extend and deepen subject matter knowledge for teaching
Develop subject matter knowledge for teaching	Design a responsive instructional program	Extend and refine repertoire in curriculum, instruction, and assessment
Develop an understanding of learners, learning, and issues of diversity	Create a classroom learning community	Strengthen skills and dispositions to study and improve teaching
Develop a beginning repertoire	Enact a beginning repertoire	Expand responsibilities and develop leadership skills
Develop the tools and dispositions to study teaching	Develop a professional identity	

From the perspective of the social theory learning, teachers may face barriers to their social development though they may be committed to personal development. Mostly, teachers work alone in their classrooms and feel isolated from colleagues by norms of autonomy and noninterference (Little, 1990; Lortie, 1975; Feiman-Nemser, 2001). However, it recognizes that taking advantage of synchronous and asynchronous communication in the virtual space, teacher online learning communities promoting a continuous and collaborative learning environment for teachers in their career lives may enable innovative solutions to bridge the gap of teacher education and school practice.

Measurement of Teachers Professional Development in Community of Practice

For some online professional learning communities that are particularly integrated with workshops (i.e. web-supported community) or online courses (i.e. online courses provided by teacher education programs), it is possible to collect members' grades or required assignments or projects to assess how well members learn in the Community of Practice (CoP). For example, Yang and Liu (2004) used individual assignments, one individual final report, and three group projects as sources to assess students' growth from the learning activities. In addition to these artifacts of participating in the community, content analysis of members' discussion was employed and a survey was administered to explore members' attitudes about participating in the community. Brett (2002) collected data from database notes, math content test, interview, questionnaires, and portfolios of 20 students. Based upon the experience of previous studies and the constraints of studying an online CoP, interviews, surveys, and content analysis of discussion content to examine teachers' perception of their learning and how their learning influenced their current or future teaching seem appropriate methods.

Research Question

The purpose of this study was to understand how well pre-service teachers and in-service teachers can be supported by an online community of practice for learning to teach. The effectiveness of NETwork for teaching focused more on the process of members' participation and experience. Thus, members' perception of the social nature of learning in the community and their experience and feelings of learning to teach were the primary consideration of this study. Below are the two research questions for this study.

1. How do members' perceptions (sense of community, social ability, ease of use, usefulness, satisfaction with their NETwork experience, and of the effectiveness of NETwork for supporting teaching) change through participating in the community?
2. How do members experience and feel about the effectiveness of NETwork for their current or future teaching?

Research Method

Research Context and Participants

An online teacher community, NETwork (Nurturing Elementary Teachers' work), has been in place using the Sakai 2.0 course management system to support K-8 science teaching since August 2006. There were a total of 92 members in NETwork and 49 of 92 members participated both in the first and final surveys.

Instruments

The items for assessing the social constructs were adapted from previous studies. Below are the social constructs included in the survey.

Technology Acceptance (TA). The 10 items of two constructs, perceived ease of use (PEU) and perceived usefulness (PU), were adapted from an online learning experience survey (Authors, 2006a; Authors, 2008) based upon Davis's technology acceptance instrument (Davis, 1989).

Sense of Community (SOC). The 20 items for sense of community were adapted from Rovai's Classroom Community Scale (Rovai, 2002), which measures sense of community in an online learning environment.

Social Ability (SA). The 18 items of social ability were adapted and modified from a 30-item instrument of online learning experience (Authors, 2006a), including 3 constructs: social navigation (SN), social presence with instructor (SPi), and social presence with peers.

Satisfaction with NETwork Experience (S). Nine items to measure members' satisfaction with NETwork experience were modified to meet the context of this study from a previous online learning experience study (Author, et. al., 2006; Authors, 2006a) which developed items based upon Alavi's (1994) learning and evaluation scales.

Effectiveness of NETwork for Teaching (ET). The 10 items about how members perceive the value of participating in NETwork were developed by the authors to address how members feel about their teaching knowledge, skills, and confidence after participating in NETwork.

Data Collection

A set of semi-structured serial interviews implemented, a final interview, first survey, and a final survey were employed for data collection. Table 2 shows the number of members who participate in the surveys and interviews.

Table 2 *Research Participants*

Types of NETwork Members		N	Serial Interviews	Semester-end Interviews	First Survey	Final Survey
Experienced Members (Since Aug. 2006)	Pre-service Teachers (PO)	38	2	2	25	32
	In-service Teachers (IO)	17	1	2	2	4
New Members (Since Jan. 2007)	Pre-service Teachers (PN)	30	2	4	23	30
	In-service Teachers (IN)	7	0	0	0	0
Total		92	5	8	50	66
Time for Participation			During Spring 2007 semester	End of the Spring 2007 semester	5th week of the Spring 2007 semester	End of the Spring 2007 semester

Note. "P"=Pre-service Teachers; "I"= In-service Teachers; "O"=Old Members since Aug. 2006; "N"=New Member during Jan. 2007

Data Analysis

The quantitative data, collected from the first survey (pre-test) and final survey (post-test), were analyzed by dependent-samples t-tests to examine if members' perceptions of social constructs changed after participating in the NETwork. The qualitative data were analyzed via content analysis. More explanation of process of content analysis will be presented in the final paper.

Results

The dependent-samples t-tests include two phases. In the first phase, the comparison focused on pre-test (first survey) and post-test (final survey) from Spring semester 2007, while some analyses in the phase II were made using data collected from the pilot study in Fall semester 2006. In the interest of the brevity needed for the proposal the detail results for the phase II analysis and content analysis will be included in the final paper but are excluded from this proposal.

Dependent-samples T-tests

In the first phase, the dependent-samples t-test was to examine if both in-service and pre-service teacher in the NETwork community perceived social constructs differently after participating in the NETwork. The results shown in Table 3 indicate SN, PEU, PU, and S have significant differences between the pre-test and post-test. Additionally, the eta squared values for SN (.05), PEU (.08), PU (.04), and S (.07) indicate moderate and large effects, which support the finding that NETwork members perceived greater SN, PEU, PU, S, and SE after participating in the NETwork for one semester.

Table 3 *Results of Phase I Dependent-samples T-test*

Constructs	Survey07-Pre		Survey07-Post		T-test			
					90% C.I.		t	Sig. (2-tailed)
	M	SD	M	SD	Lower	Upper		
Sense of Community (SOC)	4.74	1.05	4.91	.99	-.39	.05	1.27	.21
Social Ability (SA)	4.87	1.25	4.98	1.26	-.36	.14	.75	.46
Social Presence with Peer (SPp)	4.90	1.29	5.08	1.37	-.50	.15	.92	.37
Social Presence with Instructor (SPi)	4.98	1.28	4.90	1.36	-.20	.36	-.46	.65
Social Navigation (SN)	4.73	1.45	4.97	1.35	-.49	.02	**1.55***	**.13**
Perceived Ease of Use (PEU)	4.72	1.69	5.10	1.51	-.68	-.07	**2.07*****	**.04**
Perceived Usefulness (PU)	4.62	1.70	4.87	1.50	-.54	.05	**1.41***	**.16**
Satisfaction with NETwork experience (S)	4.55	1.62	4.83	1.66	-.61	.06	**1.37***	**.18**
Effectiveness of NETwork for Teaching (ET)	4.64	1.69	4.93	1.72	-.67	.10	1.26	.22

*Note. N=49; * p < .20, **p < .10, *** p < .05*

However, the length of time participating in a community of practice may be influential on how members experience the community and on the impact of community. For example, a time period of one semester may be too short to find any changes in members' perception of sense of community. Thus, the purpose of implementing the phase II dependent-samples t-tests were to examine if time length between implementing pre and post surveys impacts the significance of members' perception change. The pre-test survey data collected in Fall semester 2006 (Survey06 Pre-test) in the pilot study were used to pair with the survey data collected in the final survey collected in Spring semester 2007 (Survey07 Post-test) for one dependent-samples t test, and the data collected in the final survey for Fall semester 2006 (Survey06 Post-test) were paired with the Survey07 Post-test for another dependent-samples t-test. The results of the first dependent-samples t-test presented in Table 4 indicate that four variables, including SOC, PEU, PU, and ET, had significant differences between the survey06 pre-test and survey07 post-test (8 month difference). The results of the second dependent-samples t-test shown in Table 5 indicate three variables, SOC, SN, and PEU, had significant differences between the survey06 post-test and survey07 post-test (5 month difference). By comparing the results of the first and second examination, it is found that the level of the significant difference of SOC and PEU was reduced when the time difference between implementing two surveys changed from 8 to 5 months. Also, the level of the significant difference of ET and PU were found to be significantly different in an 8-months period. The results of the comparisons indicate the possibility that some social constructs needed longer time periods to have changed perceptions.

Table 4 *Results of First DS T-Test (Phase II)*

Constructs	Survey06-Pre		Survey07-Post		T-test			
					90% C.I.		t	Sig. (2-tailed)
	M	SD	M	SD	Lower	Upper		
Sense of Community (SOC)	4.48	.49	5.25	.60	-1.14	-.412	**3.92*** **	**.00**
Perceived Ease of Use (PEU)	5.08	.90	5.73	.96	-1.29	-.01	**1.86** **	**.09**
Perceived Usefulness (PU)	4.53	.91	5.88	.91	-1.85	-.85	**4.97*** **	**.00**
Effectiveness of NETwork for Teaching (ET)	4.28	1.18	6.26	.86	-2.46	-1.51	**7.69*** **	**.00**

Note. N=10, old members participate in survey06-pre & survey07-post; * $p < .20$, ** $p < .10$, *** $p < .05$

Table 5 *Results of Second DS T-test (Phase II)*

Constructs	Survey06-Post		Survey07-Post		T-test			
					90% C.I.		t	Sig. (2-tailed)
	M	SD	M	SD	Lower	Upper		
Sense of Community (SOC)	4.99	.56	5.31	.51	-.60	-.04	**2.14** **	**.07**
Social Ability (SA)	5.73	.59	5.55	1.09	-.29	.66	-.73	.49
Social Presence with Peer (SPp)	5.59	.69	5.54	1.37	-.65	.76	-.14	.89
Social Presence with Instructor (SPi)	5.68	.76	5.70	1.23	-.47	.44	.08	.94
Social Navigation (SN)	5.93	.72	5.41	.98	-.11	1.15	**-1.53***	**.16**
Perceived Ease of Use (PEU)	5.42	.65	5.92	.94	-1.06	.06	**1.66***	**.14**
Perceived Usefulness (PU)	5.53	1.13	5.89	.95	-1.02	.30	1.02	.34
Effectiveness of NETwork for Teaching (ET)	5.91	.75	5.99	.84	-.47	.30	.40	.70

Note. N=9, old members participate in survey06-post & survey07-post; * $p < .20$, ** $p < .10$, *** $p < .05$

Content Analysis for Serial Interviews and Semester-end Interviews

The results of the content analysis for serial and semester-end interviews yield seven themes regarding members' perceptions of social constructs after participating in NETwork. These eight themes are: 1) members expressed that NETwork provided them access to diverse insights about teaching and to practical experiences; 2) members felt that they were not alone when facing teaching problems or issues because NETwork provided a safe space for them to share positive and negative teaching experiences; 3) members felt that NETwork provided them wide opportunities to connect to other teachers across the nation; 4) members indicated an increase in teaching confidence resulting from participating in NETwork activities; 5) members perceived NETwork as part of their teaching support system; 6) members expressed how their participation helped build a sense of community in NETwork; 7) in-service teachers/old members and pre-service teachers identified advantages of the notification tool, daily email digest, to facilitate their participation in NETwork.

Discussion

Although members' perceptions of ET, SOC, and SA were not significantly different in the quantitative data, members who participated in interviews expressed the effectiveness of NETwork for their current or future teaching, changes in their SOC via interacting with others in DB or CR, changes in their perception of other members' social presence via Sakai tools, and how effective they used the Sakai tools to socially interact with other members. These qualitative results may indicate that some changes take longer to develop or perhaps are not as widespread across the community as others.

After participating in NETwork activities, members expressed their teaching confidence were enhanced by seeing others' experience, questions, and concerns about teaching and by answering or providing help to others in the NETwork community. These findings are consistent with what Brown and Duguid (2000). In Brown and Duguid (2000), they concluded that "practice is an effective teacher and the community of practice is an ideal learning environment." Also, the result confirms that pre-service and in-service teachers benefit from being members of a community with a sense of belonging and having others to ask for support (Wellman & Gulia, 1999).

Further, members expressed that the more they kept themselves exposed to or participated in the NETwork, the more they felt an increase in their SOC and felt comfortable interacting with other members. This finding is consistent with prior studies (Wang, Sierra, & Folger, 2003; Brown, 2001; Moller et al., 2000) showing that students' active participation can sustain a learning community and establish a sense of community.

Importance of the Study

This study has significant potential for theoretical and practical implications for online learning and teacher education. The results of this study should help researchers better understand the effectiveness of an online community of practice for teaching and how members act and interact in an online learning community without course-based requirements. Members' perceptions of how the NETwork help them to learn to teach contribute to advancing theory about CoP and social learning and can be utilized to improve the activities and tools of CoP to provide members a comfortable and supportive online learning environment.

References

Alavi, M. (1994). Computer-mediated collaborative learning: An empirical evaluation. *MIS Quarterly, 18*(2), 150-174.

Authors. (2006a). Exploring the relationships between students' academic motivation and social ability in online learning environments. *Internet and Higher Education, 9*(4), 277-286.

Authors. (2008, April). Differences in student-instructor and Student-peers social interactions in explaining satisfaction in online learning. Paper presented at the 2008 Annual Conference of American Educational Research Association, New York, USA.

Brett, C. (2002). *Investigating online engagement and community among preservice mathematics teachers.* Unpublished doctoral dissertation, University of Toronto, Toronto, Canada.

Brown, R. (2001). The process of community-building in distance learning classes. *Journal of Asynchronous Learning Networks (JALN), 5*(2).

Brown, J. S., & Duguid, P. (2000). *The social life of information.* Cambridge, MA: Harvard Business School Press.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340.

Desimone, L., Porter, A. A., Garet, M., Suk Yoon, K., & Birman, B. (2002). Effects of professional development on teachers' instruction: Results from a three-year longitudinal study. *Educational Evaluation and Policy Analysis, 24*(2), 81-112.

Feiman-Nemser, S. (2001). From preparation to practice: Designing a continuum to strengthen and sustain teaching. *Teachers College Record, 103*(6), 1013-1055.

Goodlad, J. I. (1990). *Teachers for our nation's schools.* San Francisco: Jossey-Bass.

Gray, J. H., & Tatar, D. (2004). Sociocultural analysis of online professional development:

A case study of personal, interpersonal, community, and technical aspects. In S. A. Barab, R. Kling & J. H. Gray (Eds.), *Designing for virtual communities in the service of learning* (pp.404-436). New York, NY: Cambridge University Press.

Job-Sluder, K., & Barab, S. A. (2004). Shared "We" and shared "They" indicators of group identity in online teacher professional development. In S. A. Barab, R. Kling, & J. H. Gray (Eds.), *Designing for virtual communities in the service of learning* (pp.377-403). New York, N.Y.: Cambridge University Press.

Kahle, J.B., & Kronebusch, M. (2003) Science teacher education: From a fractured system to a seamless continuum. In D. D. Kumar, & J. W. Altschuld (Ed.), *Science and technology education policy, a symposium issue of policy studies review* (20, pp. 585-602).

Little, J. W. (1990). Teachers as colleagues. In A. Lieberman (Ed.), *Schools as collaborative cultures: Creating the future now* (pp. 165 - 193). Bristol, PA: The Falmer Press, Taylor & Francis Inc.

Lortie, D. (1975) *Schoolteacher: A sociological study.* Chicago: University of Chicago Press.

Moller, L. A., Harvey, D., Downs, M., & Godshalk, V. (2000). Identifying factors that effect learning community development and performance in asynchronous distance education. *The Quarterly Review of Distance Education, 1*(4), 293-305.

Roup, R., Gal, S., Drayton, B., & Pfister, M. (Eds.). (1993). *LabNet: Toward a community of practice.* New Jersey: Lawrence Erlbaum Associates, Inc.

Rovai, A. (2002). A preliminary look at the structural differences of higher education classroom communities in traditional and ALN courses. *Journal of Asynchronous Learning NETwork, 6* (1).

Steele, J. H. (2002). *A descriptive case study of a virtual language learning community.* Unpublished doctoral dissertation, University of Pennsylvania, Indiana.

Wang, M., Sierra, C., Folger, T. (2003). Building a dynamic online community among adult learners. *Education Media International, 40*(1/2), 49-61.

Wellman, B., & Gulia, M. (1999). Virtual communities as communities: Net surfers don't ride alone. In M. Smith & P. Kollock (Eds.), *Communities in cyberspace* (pp.163-190). Berkeley, CA: Routledge.

Yang, S. C., & Liu, S. F. (2004). Case study of online workshop for the professional development of teachers. *Computers in Human Behavior, 20*, 733-761.