Building Virtual Community in a K-6 School: An Action Research Project

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ABSTRACT

Virtual communities (VCs) potentially increase community interaction, social support, civic engagement, and social capital. Concurrently, education research suggests that one important factor in improving student achievement is community and parent involvement. Would building a VC in a K-6 school to support information exchange facilitate parents' involvement in school activities? How can a K-6 public school with limited resources build a VC? This paper reports on an action research project conducted in a public school to build a VC including such components as dynamic website and discussion forum. Findings suggest that school and community's access to technology, teacher training and static websites are not enough to attract parents. Extensive analysis of needs and facilitation by a change agent is necessary to design and implement VC technology, to encourage community information exchange and interaction, and to ultimately realize the benefits of building social capital and increasing parental involvement.

Keywords

Virtual Community; Parents' Involvement; Technology Implementation; Action Research; Social Capital

INTRODUCTION

Virtual Communities (VCs) are computer mediated-spaces where people communicate and interact to generate member-driven content (Lee, Vogel and Limayem, 2003; Li, 2004). In VCs, people share interests, build relationships, pursue fantasies, and conduct transactions (Hagel and Armstrong, 1997). They do this supported by VC technology such as e-mail, bulletin boards, newsletters, and forums (Lee, et al.). VCs are beneficial to physical communities because of the potential effects of increasing information exchange, interaction, and social capital (Blanchard and Horan, 2000; Hampton and Wellman, 1999; Kavanaugh and Petterson, 2002; Wellman and Gulia, 1998).

K-6 schools constituents, who share a common interest in children's education, may benefit from building VCs. Educators know that to ensure student achievement, schools need to have high levels of parent participation in school activities. However, schools face the challenge of finding means to increase involvement (Chaboudy and Jameson, 2001). This project explores VCs as a way to increase parents' participation and investigates the implementation of VCs in a K-6 school.

BACKGROUND

Because technology facilitates the communication and information exchange among members of social networks, VCs may contribute to building social capital and ensure civic engagement (Blanchard and Horan, 2000; Hampton and Wellman, 1999; Wellman and Gulia, 1998). Social capital is the set of features social organizations have that facilitate the coordination and cooperation of members for mutual benefit. These features include social networks, reciprocity, and trust (Putnam, 2000). Putman found that social capital in the form of civic engagement (i.e., participation in organized groups) is positively related to the performance of social institutions. Hampton and Wellman found that in a local community, "online activity led to increased local awareness, high rates of in-person activity, and rapid political mobilization" (1999, p.490).

Blanchard and Horan differentiate geographically-dispersed VCs from physically-based VCs. They argue that although both types of VCs may have a positive impact on social capital, physically-based VCs' impact may be stronger. When members of a VC meet both face-to-face and virtually to exchange information, discuss their interests, and support each other, "over time, networks, norms and trust will be strengthened and social capital … will increase" (2000, p. 14). Accordingly, physically-based communities such as K-6 schools where members share a common interest (i.e., their children's education), meeting both face-to-face and virtually may build stronger social capital.

Parents' involvement is a critical factor in student achievement and overall school experience. Henderson and Berla (1997) reported that an accurate predictor of student achievement is "the extent to which the student's family is able to become

involved in their children's education at school". Similarly, Lopez (2004) explains "parent participation enhances student self-esteem," "improves parents-child relationships", and "helps parents develop positive attitudes towards school." As a result, "teachers gain confidence in their achievement", "administration strengthens community relations as they interact with parents," and "schools become more collaborative and less hierarchical" (p.139). The challenge for schools becomes finding ways and means to attract parents to participate.

Technology can provide connections between home, school, and community. The Blacksburg community network demonstrates how middle-school teachers can reach students and parents and get homework via e-mail (Kavanaugh, Cohill, and Patterson, 2000). Blanchard and Horan found that members of local communities were interested in using community networks to get information related to the community and the education of their children. Keyes and Gregg (2001) conclude there are identifiable "ways technology may build connections between home, school, and community." However, as they state, this is not yet a reality. This project is one attempt to turn these possibilities into realities by using VCs to facilitate connections and information exchange among these constituents.

RESEARCH QUESTIONS AND METHODOLOGY

The boundaries of what a VC encompasses seem unclear. For the purpose of this study, VCs comprise two components: a "hard" or technology component, characterized by a Internet-based applications to support group interaction, and a "soft" component that includes the group of people using the "hard" component to fulfill virtual interaction. This definition is in agreement with Preece's (2000) definition of the components of VC: people, purpose, and policies as the soft components and computer systems as the hard components. These two components, we contend, are important to building social capital. Our research questions in this project are:

Q1. What types of information do parents, teachers, and school administrators need to exchange?

Q2. How can a K-6 public school build a VC to facilitate information exchange and to attract parents' involvement in school activities?

Q3. Once built, how does a VC continue to benefit the members of the K-6 school community?

AR Stages / Timeline	Data Collection Technique	Research Questions
1. **Diagnosis** February 2004 to April 2004	Interviews Observation Document analysis Literature review	**Q1: What types of information do parents, teachers, and school administrators need to exchange?** -What are the goals of the school regarding parents' involvement? -What is the current flow of information among school constituents? -What are the benefits/flaws of the current flow? -What are the information needs of parents?
2. **Action Planning** May 2004	Observation Interviews Document analysis Website analysis	**Q2: How can a K-6 public school build a VC to facilitate information exchange and to attract parents' involvement in school activities?** -What are the resources available for streamlining the process? -What are the technological alternatives to streamlining the communication process?
3. **Action Taking** May 2004 to June 2004	Tool development	-What should the technological platform be? -What should the functionalities of the VC be? -What are the VC success criteria for the school?
4. **Evaluation** September 2004 to February 2005	Interviews Observation Document analysis Analysis of use statistics	**Q3: How does a VC benefit the members of the K-6 school community?** -How does the VC respond to parents' needs? -What is the perception of school constituents regarding the VC? -How does the VC impact parents' involvement?
5. **Specifying Learning** February 2005 to March 2005	Literature review	-How does this project's finding relate to current research? -What are the lessons learned? -What are the issues to be considered for a future AR cycle?

Table 1. Research Method and Data Collection

To address these questions, this study used Action Research (AR). In AR, the researcher acts as a change agent and becomes an active participant who influences the process under study. With an interpretive approach, the researcher promotes change and reports the effects of planned changes. S/he is a facilitator, not an outside observer, who engages and intervenes in the entity under study. As a result, s/he understands in greater depth the "socio-technical system" under investigation (Gummesson, 2000; Walsham, 2002).

Five stages comprise AR cycles: diagnosing, action planning, action taking, evaluating, and specifying learning (Susman and Evered, 1978). In each stage, new questions arise, and a variety of data collection techniques are used to answer those questions. In this project, the researcher worked with parents, teachers, and school administrators to identify school goals and assess information needs (*diagnosis*), to analyze different alternatives to satisfy these needs (*action planning*), to design and implement a solution (*action taking*) to improve the communication and involvement process of parents in school activities; to evaluate results (*evaluation*); and to report findings (*specifying learning*). Table 1 lists the stages, questions, and data collection techniques used in each stage. A set of questions derived from this project's research questions guided the AR change process. **Q1** is explored in the diagnosis stage. **Q2** is explored in the action planning and action taking stages. **Q3** is addressed in the evaluation stage.

Sycamore School

Sycamore school is a public elementary school within the Claremont Unified School District in Southern California. Sycamore has 350 students and is described as a child-centered multi-aged learning community where parental participation is of primary importance (Sycamore Official Website, 2004). Therefore, teachers continuously look for ways to attract parents' support.

RESULTS AND ANALYSIS

AR interventions, observations, and findings throughout the project are presented by AR stages.

AR Stage 1. Diagnosis

The initial proposal to the school principal was to update the existing school website to add relevant content that was useful in supporting parents. The principal welcomed and authorized the project. School goals and information flows were analyzed to identify information needs and to outline a framework to guide the development of the technology to be used. The outcomes of this stage would answer this project's research question **Q1**. Data collection included interviews, observation, document analysis, and technology assessment.

AR Stage 1. Findings

Sycamore School teachers appreciate different learning styles and make every effort to teach students accordingly. Therefore, teachers and administrators welcome and encourage parents to aid and participate in every classroom and school activity. This is expressed in Sycamore's philosophy, as follows:

> "Parent involvement is an integral aspect of Sycamore's philosophy. By volunteering in the classroom, coordinating school wide events, participating in curriculum development, and assuming leadership positions in the shared decision-making process, parents have an important voice and role in the success of Sycamore..." (Sycamore Handbook, 2004).

Actual Communication Flow

Table 2 lists the current flow of information in the school. All constituents are information sources. Administrators, teachers, and parents share information via printed documents, face-to-face communication, informal word-of-mouth exchanges, and occasionally e-mail messages and phone calls. Face-to-face and word-of-mouth methods are encouraged and customary. However, these are frequently not an option for working parents. Phone calls and e-mail communication are used rarely.

Parents' Information Needs

To ensure that community needs were considered, a sample of 20 parents (one per classroom (15) and five PTA representatives) were contacted with a request for an interview. Fifteen responded. Reasons and objectives for the interview along with a guiding questionnaire were provided prior to the interview. All interviews were conducted face-to-face except for one phone interview. Notes were taken and transcribed immediately. Data indicate that the communication mechanism in place was not efficient. Parents expressed a need for more information and for an articulated and broader-in-reach

information flow. Table 3 summarizes information needs. These findings were obtained by observations, interviews, and document analysis and help to answer research question Q1 in this project.

Source	Content	Means	Limitation
Principal	Calendar of Events Needs Announcements	Hard copy E-mail, occasionally	Overloaded Lost or misplaced Not read
Office Manager	Events Extracurricular activities	Hard copy	8 to 15 a week Multiplicity (siblings) Misplaced or discarded
Governance Council	Decision Making General	Hard copy	Available upon request
Communications Coordinator	Decisions and events Contact information	Phone calls Word-of- mouth	Limited reach
Teachers	Class activities, learning Needs Homework documents	Hard copy	Lost / Misplaced
Parents	Q&A Announcements	Face-to-Face Word-of-mouth	Limited reach

Table 2. Information Flow

Communication Flaws	Additional Information Needs
- Excessive number of flyers (multiple copies for siblings) - Lost/ruined homework documents - Isolation from the school community - Missed event - Last-minute cancellation of parent participation in classroom activities - Miscommunication between teacher and parents - Untimely distribution or loss of important documents - Offers to volunteer never called upon - Teachers and parents not always aware of school traditions and events - Ineffective word-of-mouth - The same close group of parents running school activities.	- Pictures of school events and classroom news (working and traveling parents) - Available talents in the parents community to share in every classroom - Cultural events - City events, extracurricular activities - Tips on helping kids learn - Reminders of deadlines and scheduled events - How their experiences at school are like for other families - Parenting tips

Table 3. Information Needs

AR Stage 2. Action Planning

Resources necessary to satisfy this community's information needs were technology access, infrastructure, staff, skills, and funds. Statistics on access and use of technology in schools and homes indicate that they have become widespread. By 2000, 98 percent of all public schools had Internet access. A review of the Sycamore School Directory showed that 90% of families have at least one e-mail address. In interviews, parents expressed their willingness to receive school information electronically. All teachers had school-provided e-mail addresses.

Sycamore is connected to a School District-Wide SONET through T-1 lines. A hub connects all classroom computers at a transfer rate of 100 Mbps. Each classroom has a 5:1 student-to-computer ratio.

In theory, an on-site technology coordinator and limited on-call support should be available. The technology coordinator is in charge of assessing needs and providing first-hand support. At Sycamore, two teachers fulfilled these tasks. Unfortunately, these teachers left prior to this project, therefore no on-site support was at hand. On-call support was very limited and restricted to one network manager who serves eight different schools.

All teachers had training and experience with basic computer applications including e-mail. Funds from the State were precarious and schools raised private funds to upgrade IT infrastructure. Findings in this stage suggest that the school has access to computers and Internet connection. However, network server access, technical support and skills, and funds were very limited and scarce.

Alternative Actions

Two previous attempts at using technology for communication had occurred prior to this project. The first required the technology coordinator to be responsible for updating the school Web-site. This responsibility was assigned to her in addition to her regular teaching duties. Consequently, the Web-site was not updated regularly, if at all. Any updating the Web-site ceased when she relocated.

The second attempt involved a service-learning project. College-students volunteers trained teachers in developing and updating classroom webpages. This attempt failed for two reasons: teachers felt overwhelmed by this additional task, and the network administration access policy restricted the access to the web-hosting server to one user-id per school.

To answer research question **Q2** in this AR project, four new alternatives to satisfy the communication needs were considered. These were:

1. To evolve the actual static site to include the identified communication needs with the help of on-site work-study student support.
2. To provide facilitation and ongoing support for teachers to develop and update classroom Web pages.
3. To add flexibility and maintainability to the existing school website with tools such as blogs, distribution lists, and bulletin boards so that any school constituent could post information using e-mail.
4. To develop a new website independent from the school and district resources that could accept input from any school constituent.

Table 4 shows the evaluation criteria used before selecting alternative 4. These criteria helped discriminate unfeasible alternatives, resulting with the selection of one that would meet all requirements (Table 4). Alternative 4 would meet all of the information requirements. Access to the school network would not be necessary, and support, funds, and skills would be secured by this AR project, as explained in the next stage.

Alternative	Requirements Met	Technology	Support	Funds	Server
1	Most	Available	Non-Continuous	Available	Not Available
2	Some	Available	Not Available	Not Available	Not Available
3	All	Available	Available	Not Available	Not Available
4	All	Available	Available	Available	Available

Table 4. Implementation Alternatives

AR Stage 3. Action Taking

The selected alternative involved the implementation of a VC. A VC would offer functionalities to allow input from all information sources, information exchange, archives, 24/7 availability, and reach. This VC would include electronic tools such as dynamic content Web-site, e-mail list, dynamic calendar, discussion forum, bulletin board, and newsletters. These tools would be used by parents, teachers, and administrators to interact and exchange information. According to Lee, et al. (2003), these are the most common components of a VC.

IS students from California State Polytechnic University, Pomona, developed and assembled the technology to build the VC. This researcher acted as the school-team liaison and worked with the students in the design of the tool. The tool was to include all VC components deemed necessary to satisfy requirements at a low cost.

The IS Success Model (DeLone and Mclean, 2003, 2004), and a framework based on the "fitness for use" and "gratification" concepts (Katerattanakul, 2002) were considered in the development. These models offer a comprehensive set of design and evaluation criteria for web-based IS success. Three categories of parameters are determinants for systems' use and success. These include information quality, system quality, and service quality. According to this model, in order for the VC tool to be used, the information content should satisfy the needs for information and also should be accurate, reliable, timely,

interesting, and gratifying. These represent parameters of both system and information quality. Furthermore, in order to be successful, the system needs to be used and the users need to experience both quality service, and satisfaction with its use.

Other considerations for the design of the VC include:

- the incorporation of the requirements expressed by constituents
- the incorporation of technology components with the appropriate functionalities to support community's information sharing at the lowest cost possible
- the use of consistent layouts and templates on all Web pages comprising the VC
- the ease of use and maintainability of the VC including intuitive navigation menus and fill-in-the-blank forms
- the restriction of access to ensure community privacy

These considerations correspond to those stated by Preece (2000) as community-centered development, usability, and sociability measures.

Section	Content	Updatable Content
Home page	Menu to other sections of the site Latest news and announcements Calendar of upcoming events	News and announcement Calendar of Events
Classrooms	For each classroom: Teacher name, pictures, grade, and teaching philosophy. Homework forms Newsletter Links to educational sites approved by teachers Needs Sample student work	Newsletter Documents Forms Assignments Pictures
Forum	Registration-based forum Topics of interest include: - Members introductions - Extracurricular activities - Book recommendations	Every family has user id and password to access the forum
Calendar of Events	Listed in calendar format - Name of event - Date and time - Description of event	All
Volunteers	Listed by room number: - Name of event - Date - Description - Contact information	All
Downloads	Office forms School Newsletter	All
Governance	Responsibilities of Governance Council Password protected content	Agendas Minutes

Table 5. Sample VC Content

The functionalities of the resulting VC responded to information needs expressed by parents in the diagnosis stage (Table 5). Functionality was provided for visitors, contributors, and administrators. The password-protected administrator interface uses fill-in-the-blanks forms, and therefore it does not require programming language knowledge. Figure 1 displays the VC home-page.

Sections suitable to attract involvement and interaction are the volunteer section and the forum. The volunteer section lists opportunities for parents to participate in the school; this can be updated by the administrator or any other authorized user. All classroom pages redirect visitors to that section.

The Forum (Figure 2) was expected to attract the most interaction and participation. It is password-protected and accepts input from any member of the community. All families were issued user ids and passwords to access the Forum. Discussions

were encouraged with two initially identified categories of topics: one related to the school and the other related to parents' interests.

Continuous provision of quality content, service and support, all determinants of IS success, is of primary importance. All teachers (15) were approached both by letter and in person with a request to provide classroom/home communication documents. The letter explained the objective of the project and asked for their cooperation in this task. Ten teachers responded with printed copies. These documents were scanned and uploaded into the website server. Three e-mail addresses were available to communicate with the administrator with questions, requests, and materials to post. Communication opt-out options were also available. The web host provider was a reputable company, which guaranteed close-to-zero downtime.

The VC was released to the school community at the beginning of the 2004-05 school year. E-mail announcements were followed by formal presentations.

Figure 1. VC Home Page

These events support parents' opinions regarding the close-door way in which the Council traditionally conducted their activities. Council members felt threatened in their authority and in their role as school/parents liaison.

Opinions expressed by parents about the Web-site were very positive. Comments, e-mails messages, and forum postings welcomed the VC. One of these comments was very clear:

> "…the website is great, it is about time somebody did this…"

The reaction of teachers was mixed. Some were enthusiastic and supportive, others were skeptical, and still others remained quiet. Some teachers felt burdened by the additional task of posting content. Therefore, once again, they were approached with a request to provide their weekly documents in electronic form to the website administrator so that she could post them regularly. Initially, two of the fifteen teachers provided printed copies; others did so only after they were approached in person.

After a few weeks of non-continuous response, three teachers were interviewed. They acknowledged being hesitant to use the classroom computers due to technical issues that made them unreliable. They said they preferred using their personal e-mail at home rather than the district-provided e-mail. The experiences teachers had had with their classroom technology negatively impacted their perception, motivation, and ultimately the use of the available infrastructure.

The VC administrator agreed to receive printed documents and scan them to post on the Web-site. Surprisingly, after a few weeks, eight of the fifteen teachers were e-mailing their letters. The school principal explained this behavior:

> "when we ask them to do an extra task that requires multi-steps, [teachers] are reluctant to do it. After a while they start talking about it and asking questions, and then they start doing it."

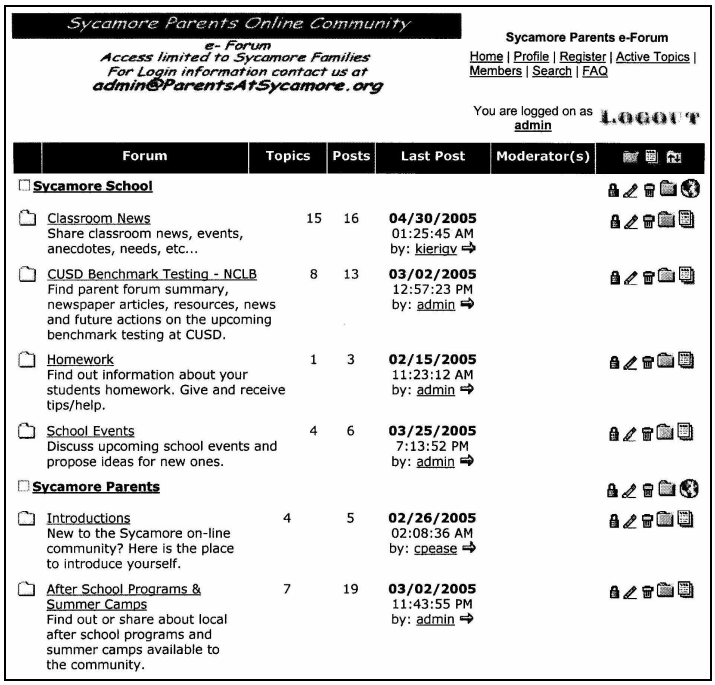

Figure 2. User Interface – Forum

At the time of this writing, all classrooms' pages had updated information; teachers were also announcing the website in their printed newsletters. Furthermore, some teachers sent classroom pictures and sample student work to be posted. One teacher finally said:

> ".. the website is beautiful. The kids were very excited to see their work displayed there."

The challenge remained, though, to have all fifteen teachers e-mail their documents as they generate them.

In addition to teacher-generated content, the Parents-Teachers Council's, administrators', and the Principal's content has to be secured. After discussion with the Parents/Council liaison official on the benefits of the VC and the subsequent agreement that the roles of the school printed newsletter, the official website, and hers were kept intact, she agreed to send content to the administrator of the VC. The principal started sending electronic copies of newsletters to the VC administrator as well. He did this, though, only after he either released the printed copy to students or had sent it himself directly to parents by e-mail. Although he said he recognized the effectiveness of the VC to reach a broad audience at once, he seemed to want to keep the role as primary source of information. Ironically, though, at some point, he used information on the VC website to add content to the printed newsletter.

Information Needs	Met by VC section / electronic tool
- Excessive number of flyers - Feeling of isolation from the school community - Word-of-mouth ineffective - Pictures of school events and classroom news - Reminders of deadlines and scheduled events	Home page / Dynamic content newsletter
- Lost/ruined homework letters - Last minutes cancellation of parent participation - Miscommunication between teacher and parents - Pictures of school events and classroom news - Homework letter	Classroom Web pages / Links to downloadable materials
- Available talents to share at every classroom - Cultural events and recommendations - City events, extracurricular activities - Tips on helping kids learn and parenting - Experiences of other families - School Directory	e-Forum / Discussion forum
- Missed event dates - Reminders of deadlines and scheduled events	Calendar of Events / Dynamic content calendar
- Parents' offers to volunteer never called upon - Word of mouth, phone calls	Volunteers Dynamic content Web page
- New teachers and parents not always aware of school traditions and events - School Handbook	About Sycamore Static Web page
- Important documents not received timely or are lost	Downloads
- Perceptions of same group running school activities - Agendas and Minutes	Governance / Static Web page
- City events, extracurricular activities	Useful Links

Table 6. Information Need vs. VC Content

AR Stage 4. Evaluation

The functionalities framework generated in the diagnosis stage and the review of the IS success models both guided the evaluation of the VC. Information content, information quality, user support quality, system quality, user satisfaction, system use, and benefits were evaluated. Table 6 shows how the design of the VC included all information requirements. The structure of the VC could receive and display content as needed. Table 7 lists the IS success criteria used to evaluate the VC along with evaluation findings.

Teachers and administrators were a very important source of information. Their input would have a high impact in how the quality of information is perceived by users. The action researcher encouraged input from them, but timeliness is a function of the sources' willingness to provide it and the speed with which they would do it. The administrator has had to take a journalist role to gather information to report and find pieces of the information him/herself. This task is difficult given the fact that she is not present at the school grounds at all times when the information is generated.

After six moths, the discussion forum activity is low. The Forum is the place where parents could contribute content to the VC. During diagnosis, 290 families were identified as potential users. A review of the statistics of use ascertained that in the six months since the VC was announced about 25% of potential users had signed in and read content. Less than 10% have actually posted information. Explanations for this low activity from parents included fear of appearing too critical, uncomfortable feelings, or no time to do it.

Since its release, the home page has been visited over 3,000 times (250 unique hits/month). We expect this number to increase as time goes by and a critical mass of users is reached.

Systems support and system quality seem to be adequate. A total of 45 e-mails with questions have been received by the administrator. All of these were solved within one hour of the time they were sent. Many of these messages were requests for

Forum login information. The website has not experienced downtime; on average, it takes two to four seconds to download a page using a high-speed Internet connection (i.e., cable).

Success Dimension	Findings
System quality: usability, availability, reliability, response time.	- "I like the layout of the pages; they look clean, not cluttered." - Zero downtime and 2-4 seconds to download pages - Table 6 shows how the VC meets information needs. - System responds to information needs and task performed by the community. All content is provided by the major sources such as principal, teachers, and parents.
Information quality: complete, relevant, timely, interesting, gratifying.	- "I think is well created, the categories make sense, and it's pleasing to the eye." - "The website is beautiful. The kids were excited to see their work displayed there." - "I got all the information [I needed] off of the website." - "It was nice to see the pictures of my daughter at Outdoor Science School." - "It is great to be able to download the weekly spelling list."
Service quality: support delivered by service provider	- 45 mails with questions solved within one hour.
Usage: visits to the site	- 3,000 total hits (250 unique hits/month)
User satisfaction: users' opinions	- "Wonderful idea." - "We are fortunate to have a website of this nature."
Net benefits: parent involvement	- Classroom network connection fixed by a parent - Donation of materials for classroom project

Table 7. Evaluation of VC with IS Success Model

Forum comments such as:

> "Wonderful idea, we are fortunate to have a website of this nature"
> "I got all the information [I needed] off of the website"
> "I like the layout of the pages; they look clean, not cluttered"
> "I think it is well created, the categories make sense, and it's pleasing to the eye"

have been received from visitors who expressed their satisfaction with the website. However, there was one complaint:

> "it is tremendously underutilized...How can we get more people involved?"

We expect that as a critical mass is achieved, we will be able to measure the net impacts of the VC on the school and on parents' involvement. Preliminary findings are encouraging. One teacher called this researcher on the phone after she had requested a volunteer to fix her classroom computer:

> "I just wanted to tell you that Mr. [x] and his son spent two hours fixing my network connection. I had not been able to access the Internet on that computer for over a month. Now, it is fixed. Thank you for your vision to build the website..."

The important issues of how to get more people involved in populating the VC (i.e., teachers and parents), how to "nurture" the VC, and how to sustain the VC beyond this research project still need to be addressed. Findings from interviews in this stage show that there are varied reasons why people do not get involved. These adoption issues are exposed in the next stage but need to be further explored in future AR cycles at Sycamore.

AR Stage 5. Learning Specification

VC boundaries are not clear. Some view a VC as technology that facilitates members' interaction, while others assume that a VC is a group of people interacting virtually using information technology. In this project, we found that it is necessary to acknowledge these two views and clarify that VCs are a combination of two components, one "hard" or technical, the other "soft" or social. Kling and Courtright (2003) and Preece (2000) support this combined view of VC. Therefore, building a VC

is a multitask effort. The first task is to identify, procure, and make operable the technology required to support the VC. Then, constituents of the VC must experience, appreciate, and adopt the features and benefits of the VC.

The hard or technical component of the VC can be developed like any other information technology application. Iterative methodologies and community-centered development, as suggested by Preece, can be used to develop a dynamic Web-site with virtual community components by identifying the site content, structure, and functionality. The development should include user input, and the design should promote community ownership. ParentsAtSycamore.org's "hard" component satisfied information needs and the interests of parents, teachers, students, and administrators.

However, this was not enough to secure virtual interaction in Sycamore. This project's findings (Table 8) show that Sycamore has appropriate access to Internet and e-mail communication, and most parents have access to e-mail at home or at work. However, the school does not have the proper technology support to develop, host, and manage a VC. Community partnerships and action research projects can help K-6 public schools in providing access to IT support. In this project, through service-learning, California State Polytechnic University, Pomona, IS students developed the VC Web-site. Donations helped paid for the hosting of the VC at $100 per year, and the action researcher administered and managed the implementation process.

Building the "soft" or social component of the VC is more complex. Potential members do not know how to behave, or feel threatened or afraid in the virtual space. Members of the Parents-Teachers Council regarded the VC as a threat to their present hierarchical structure where they feel empowered; teachers, at first, did not want the additional burden of having to post content, or they struggled with technical problems. Furthermore, parents, including some who initially were supportive of the idea of a VC for the school, are hesitant to post because they fear appearing critical or ignorant, lack motivation, perceive it as an inconvenience, do not believe this fits their lifestyle, or do not see the use for it.

Research Question	Findings
Q1: What type of information do parents, teachers, and school administrators need to exchange?	- The majority of school communication is done through printed notes and word-of-mouth. This has proven ineffective. Parents need timely and up-to-date information exchange with other parents
Q2: How can a K-6 public school build a VC to facilitate information exchange and to attract parents' involvement in school activities?	- Community partnerships including service learning and action research - Freeware - Volunteers and donations - Community-centered development
Q3: How does a VC benefit the members of the K-6 school community?	- Parents' involvement - Parents' skills as school resource - Faster integration of new families - Information currency - Resource to study at home
Adoption barriers, including psychological, social, and cultural issues	- Initial reluctance of content providers (teachers) - Sense of threatened authority - Technical problems - Habit and lifestyle - Motivation - Inconvenience - Fear of criticism - Lack of time

Table 8. Summary of Findings

ParentsAtSycamore.org is experiencing success in terms of content quality, support, use, and satisfaction. Teachers are posting content regularly while parents, with 3000 hits in five moths, are visiting the VC to download materials and enjoy reading news regarding their children's education. However, social barriers still limit the realization of the higher level benefit of a VC: to build social capital and, in this case, parents' involvement. At Sycamore, future AR cycles must address these barriers to realize the expected benefits.

LIMITATIONS

As in any interpretive research, findings presented in this project were subject to the interpretation of participants. Also, as a field study, findings can only be generalizable to theory and not to different settings.

CONCLUSIONS

This project investigated the proposed benefits of VCs and matched them with needs in a K-6 public school. A VC implementation was facilitated following AR. We found that VCs have the potential to increase civic engagement in physical communities; parents and schools are interested in articulating communication flows among them, and strengthening relations for the benefit of students. VCs are comprised of two components: one "soft" or social, and one "hard" or technical. Extensive work to surpass implementation barriers for the technical component is necessary. Members of the community are experimenting with the technology, and steadily migrating to becoming a virtual community. However, it will take additional efforts to have a critical mass of members in the VC at Sycamore and to overcome adoption barriers. This study is directed to increase our understanding of the need for VCs, the limitations and benefits of implementing VCs, and the application and relevance of VCs in K-6 schools settings.

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