Community Designers

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ABSTRACT
Pueblo is a cross-generational, network-supported learning community developed by its own members. This participatory design effort has been different from many work-oriented systems projects and has expanded our view of what participatory design entails in a network community. The technical foundation of Pueblo is a MUD, a text-based, multi-user virtual world, which has been integrated into classroom use in a K-6 elementary school. The design process has been decentralized and open-ended, reflecting the combined efforts of a diverse group of people: researchers in computer science and education, elementary school educators and students, senior citizens, college students, and friends and colleagues around the Internet. As the community has changed, the evolving participation, roles, goals, expertise, and personal and professional relationships have played an important part in the design experience. The history of this community has been marked by increasing social maturity, with transitions from questions of "what can we do" to "what should we do" to "how should we decide what we should do".

Keywords
Learning community, MOO, virtual world, education

INTRODUCTION
Pueblo is a learning community situated on the Internet, centered around a Phoenix K-6 elementary school. This community is built in a MUD, a text-based virtual reality that allows one to move around in and experience a virtual world, extend this world by adding new objects and places, and interact with other people who are connected at the same time. The community consists of local and remote participants: teachers, students, researchers, family members, college students, senior citizens, and Internet participants. The purpose of this community is to support collaborative learning for participants of all ages, from kindergarten to seniors, through innovative on-line projects and experiences. The learning context and the affordances of network communities provide both resources and constraints that help to shape the design process.

This paper is a reflection on the design and evolution of this community by some of its designers, who are also participants and "users." In Pueblo, participants are simultaneously designers of a community and a community of designers. Distinctions between users, designers, and developers are blurred. However, some of these distinctions are still visible in the participation structures of the project. A core design team has taken responsibility for trying to make this environment meet the educational and organizational goals of the sponsors. The core group follows participatory design principles and practices and engages the larger community in developing goals and implementations. The core design team and the community itself are different entities, each with its own activities and politics, though the participants of the core group also consider themselves to be members of the community.

As in a real-world community, the Pueblo network community is constituted through the rules of governance, immigration, social services, and other pieces of infrastructure that are developed over time. It is also strongly influenced by the institutions that support it and the collective activities, interactions, identities, and histories of people who live there. As in a real-world community, the development of Pueblo has been both planned and unplanned. The purpose of this paper is to describe the decentralized, grass-roots process of participatory design in a school-centered network community.

The core group's composition reflects the institutional arrangements that have provided funding and other resources to Pueblo - it has about 20 members from the three organizations that support the work. This group is focused on the Pueblo *project.* When the external grant that funds the project comes to an end, some of the institutional support may disappear, though individuals from these institutions may choose to continue their participation.

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The community is a larger and more amorphous entity. It includes Longview students, teenagers, "grays" (senior citizen volunteers), college students, and people from across the Internet who have found Pueblo and asked to be part of it. Some community members have institutional affiliations that prompted their participation, but many do not.

In the language of Gärtner and Wagner [6], the arena for participation for the core group is designing work and systems. Here, the work includes both the teaching practice of Pueblo teachers and the learning practice of the students and other community members, and the systems include the technical and social mechanisms that support the network community. A significant part of the expected learning in schools goes beyond curriculum content material to include learning how to learn, how to interact effectively with others, and how to develop one's own learning opportunities. The "work" of learning includes play, exploration, and reflection.

In Gärtner and Wagner's terms, the arena for participation of the community is developing frameworks for action - not organizational frameworks, but frameworks that will sustain a cross-generational learning community. For example, the community is exploring ways to support senior citizens in becoming comfortable with new technology and learning to mentor children in an on-line setting.

Crucially, while the intentional design of work and systems is undertaken by the core team, no central authority oversees and directs community design. The community literally designs itself. Any community member can build and change the landscape in which the community operates, or offer services to others. In this way, the network community provides the "design by doing" methods recommended by Ehn [5] for participatory design efforts.

This informal design process varies across different social groups in Pueblo. Participants get on-line at different times, talk with different people there, and spend their time in different work or play activities. The substance of the community emerges in this flux of daily interactions, only some of which are directed by processes that are understood and directed by the design group. In this sense, our community is both emergent and designed. As the designers of Habitat point out, centralized control is neither possible nor desirable in virtual worlds [8].

Pueblo's hybrid nature as a network community growing out of pre-existing organizations adds complexity to design and decision-making processes. Members of the core group have in common a vision of educational change, but they are accountable to different professional standards and face different organizational expectations. The Longview principal is ultimately accountable to the district superintendent and school board for the education of Longview students. The Phoenix College faculty members are accountable to their dean for the use of college resources to meet the needs of people in their college's service area. Xerox PARC researchers are accountable to the funding agency that has made their involvement in Pueblo possible, as well as to Xerox management and the general research community. These institutions represent the third arena for participation described by Gärtner and Wagner, the framework for "industrial relations that define the norms for... work-related issues." [6]

Education as a Context for Design

The education focus makes Pueblo somewhat different from the geographically-centered "community networks" described by Schuler [11], which have a broad objective of bringing members into closer contact with one another. Pueblo is motivated by a particular agenda of educational change, with a constructivist, learner-centered focus.

Pueblo has its roots in MariMUSE, a network community founded by education faculty at Phoenix College in 1993. Longview elementary school students and teachers were brought in a year later, focusing on the affordances of the MUD for improving literacy. In 1995, researchers from Xerox PARC joined the community and helped upgrade the infrastructure to a more technically-capable MUD. Pueblo, the new MUD, has more extensive integration in the curriculum, with a special focus on modeling to support science education.

Sustainability of the Pueblo *community* is a significant concern of the Pueblo *project*. Sustainability is an important criterion of success for innovations in education. For the Pueblo community to be sustainable, it must serve the needs of its participants. Among participants' needs are the ability to take part in discussions of community issues, influence decision-making, and take independent actions that are perceived to add value to community life. As the community grows, it is important to ensure that the participation structures are effective for new members and groups.

The community is participatory, but not egalitarian - as in real-world communities, different people play different roles. The skills and energy people bring and the accountability and responsibility people carry from the institutions that sponsor the community cannot be separated from the voices people have in many decision-making processes. As the community changes its composition, the core design group has found it necessary to distinguish its activities from the legitimate decision-making activities and forums of the broader community, sometimes creating new forums for discussion and action. These shifts have been useful from a project perspective, as well as a community perspective, since they have strengthened the project's understanding of what makes the community viable and sustainable.

At this point, the community has adapted to internal and external pressures and opportunities over three years. Each transition has been accompanied by increasing social maturity and self-awareness, though our understanding is always limited by inexperience with the community's current growth stage and the difficulty of integrating the separate views of individual participants into a coherent picture of where the community is now. Like the proverbial

elephant, a network community is many things to many people. The design process we will describe includes events and changes the authors considered significant. All of the authors are members of the core design team.

Throughout most of the paper we use a single authorial voice, but we recognize that different members of the community would choose to tell different stories about its development. At times we will use attributed comments from one of the authors or one of the Longview students when we wish to highlight a unique, personal viewpoint.

At this time, support for the project is provided by Longview, Phoenix College, the Osborn School District, Xerox PARC, and an ARPA contract for research in MUD-based learning environments. Project money has funded summer camps for Longview teachers and students, and it has provided teachers with some school-year release time.

CHARACTERISTICS OF A NETWORK COMMUNITY

Pueblo is based on a MOO, which is a kind of Internet-accessible virtual world with its own geography, characters, and objects of all kinds ([3, 4]; or see a general description of MUD-based communities in [10]). People interact in the MOO by typing simple text-based commands. Participants can move from one locale to another, talk to other people with speech and gestures, manipulate objects they encounter in each place, and extend the world by creating and describing new places and objects. When people first join the community, they usually begin by creating a character (with name, appearance, gender, and other customized attributes) and building a home for themselves. It is a policy of our MOO that participants are not anonymous. Though the characters people create may be fanciful, each person also records information about his or her real-life identity, which is available to all.

The Ambiance of a Network Community

To give a sense of what it is like to be in a network community, we offer a few students' reflections on the topic. While we worked on this paper, teachers asked some of their 10 and 11 year old students what they thought a community was and whether Pueblo was a community. Here are some of the students' written responses (with minor spelling and punctuation corrections for readability):

> *Dice: I think a community is a group of people that help each other out and do things together and that think of new ideas to improve themselves. To me what makes Pueblo a community is that people get to make new friends when they page each other. You get to learn things that you never knew you knew. You get to drive cars and program things and create things you could possibly never have in the real world.*
>
> *Nefertiti: A community is a group of people who live together in a neighborhood. Pueblo is a community because people build homes there and live there in Virtual Reality.*
>
> *BabyT: A community is when a lot of nice people come together and make fun games for us and we write to our friends. When people like Jim and Hobbes work with the kids that are on. And us too, we make houses that you can go in and look, and cars that you can ride in with us... You can do a lot like talk to people that live in New York and people that are older than you.*
>
> *Coolio: A community is people that live in a spot all together and help each other when needed... and they do things together and have fun.*
>
> *T-boz: People working and helping each other makes Pueblo a community... it's fun and it's like our own little world.*

Several common themes run through these and other students' responses: the impact of the physical world metaphors, especially houses and neighborhoods; the continuity and persistence of the environment, which leads students to talk about people "living" in the on-line world; the idea of helping and being helped as a pointer to community feeling; and the appeal of building, owning things, and leaving a personal mark. These perceptions extend to adults, including teachers and researchers. Many develop close ties and working relationships, with a sense of Pueblo as a place they belong.

The Dynamics of a Network Community

As people build and interact in Pueblo, they are conscious of where they are. It is not a neutral collaboration medium, but a place for a group of people who share common interests and values related to education.

There is a dynamic interaction between individuals and the community, under the influence of the educational theme. Bandura describes the reciprocal relationships between individual actions and social norms [1]. He points out that people are influenced in choosing their own actions by the anticipated and actual reactions of other people in the community. Through these collective actions and reactions in the social milieu, people "create and activate" the community itself ([1], p. 344). In Pueblo, the interpretations different individuals bring to the educational theme sets expectations that help to develop the voice and norms of the community.

To work toward the educational vision, the core design team designs tools and places to support learning activities. Examples include a brainstorming room, a reflecting pool into which reflections can be dropped, journals, teacher utilities, and writing tools. These are the intentional designs of the team.

However, the intentional designs interact with the interests of community members. Individuals across the community often take playful license in construction, such as building a lake in the City Park. These can turn out to be interesting to others, who sometimes adapt them in unexpected ways. (For example, a fourth-grader added fish and fishing poles to the lake.) These "design accidents" (from the perspective of the formal project) are valuable sources of ideas, functionality, and enjoyment for the community. Project

designers did not consciously decide on cotton candy or beachfront property, but interactions with children led to the creation of many objects that combined play and learning in compelling and engaging ways. Designing personal cars and pets has been an especially popular activity.

"Accidental" designs have often led to new intentional designs. An example is the trivia game, which began as a game-show like activity in which a quiz master could collect a group of people together in a virtual room to try their skill at trivia questions. The quiz master determines the "correctness" of answers to the questions, which may be unexpectedly open-ended. The children quickly appropriated this game for themselves, designing trivia sheets on topics of interest to them, doing library research to find stumping questions, and alternating between the roles of quiz director and audience. This impromptu activity gave adults a better understanding of the motivating effects of children being able to follow their own agendas in the MOO.

As part of the dynamics of a network community, it is important to note that the community intertwines the personal and professional aspects of the lives of its participants. Ehn claims that participatory design requires a "shared form of life", which the network community offers to an extreme degree. The nature of the interactions in the virtual environment has led to more intense commitments and involvements of community members than many of us have been accustomed to in other projects. Relationships have an intimacy, depth, and warmth uncommon in design projects, especially those projects in which cross-cultural differences raise communication barriers. Design team members seem more willing to listen to divergent points of view when they live and communicate together on a regular basis, over an extended period of time, informally as well as formally.

The strength of the affective engagement has negative as well as positive aspects. Intense commitments and special relationships are accompanied by more vulnerability and risk. Cherny recounts some of the upheavals and emotional struggles that have taken place in larger and older network communities in [2].

TRANSITIONS IN COMMUNITY DEVELOPMENT

In this section, we will describe transitions in the first three years of the community's development. Some changes were intentional; the design team has planned and implemented significant shifts in population, priorities, and on-line activities. Other changes came about unintentionally as people worked in the environment together.

Overall, the project and community have developed an increased self-awareness. The focus on the question of "what can we do" has expanded to include the questions of "what should we do" and "how should we decide what we should do." Gärtner and Wagner note in other participatory design projects this same kind of shift between the design of work and systems, the design of organizational frameworks for action, and consideration of the political and organizational context [6].

The Pueblo project has developed several pilot projects integrating the MOO into classroom use, and it has begun to create policies, workable practices, and technical support for bringing new people in, getting and giving help, resolving conflicts, making decisions, property rights, privacy, and etiquette, all of which are necessary to maintain a viable community.

1. Opening the MariMUSE Frontier

Jim Walters, Phoenix College: *Once upon a long, long time ago, three faculty from Phoenix College paid a few visits to MicroMUSE, an early on-line community. They ran into Moulton, who talked about informal science education and began telling tales of users who were interacting in a community that existed in this MUD... Moulton and someone called shkoo offered to help load the software on a UNIX machine that we had managed to salvage from an old demo system we had been given, and that was the beginning of MariMUSE...*

The Pueblo community is built on the grounds settled by MariMUSE pioneers Billie Hughes, Jim Walters, and Greg Swan. They were interested in finding effective methods and settings for educational change and saw promise in the MicroMUSE model [7]. MariMUSE was centered around the Maricopa community colleges in the Phoenix area, but it drew participation from across the Internet. The founders recruited active builders who would develop interesting places, objects, and ambiance that would attract others.

MariMUSE gave teachers a different place to work with new approaches - a place that was free of the years of conditioning teachers and students have to overcome to do things differently in a traditional classroom. Phoenix College courses in education and computer science used MariMUSE for non-traditional projects. A Cambridge theologian offered a long-distance course in the New Testament.

Though MariMUSE was successful in encouraging exploration, it had a frontier feeling in some other, less desirable ways. One problem was that it was not clear who was in charge. One of the central characteristics of these communities is that they enable individuals to act independently and communicate freely across boundaries, including those that represent traditional lines of authority. Unfortunately, some of the young students who had power and influence in the community based on their technical expertise did not have the social maturity to match. They used their technical powers to play tricks and reduce the capabilities of others. One turning point was the development of a robot that roamed around and asked insistent interview questions of other (human) characters. When the robot's creator refused to moderate its behavior, a few annoyed participants locked the robot away, changing the robot's software in the process. The robot was never the same afterward, and neither were the relationships between some of the people in MariMUSE.

Hughes and Walters decided to make it clear that an educational vision was the foundation of the community, and the frontier town started to have a sense of being ruled by principles. The founders began to provide leadership in what *should* be done in MariMUSE, as distinct from what *could* be done. This was a necessary step in making MariMUSE a hospitable place for educators and students.

2. Centering on Longview Elementary School

The partnership with Longview developed because its principal's vision for community education matched that of Hughes and Walters.

> ***Jo Talazus, Longview principal:*** *I am always searching for the ways and means to create a community school - reaching out to the local and worldwide communities. I firmly believe that the greater the number of successful adult relationships a child establishes, the greater the likelihood of success for that child in the future...Therefore, our school has business tutors, police mentors, classroom grandparents, Hispanic attorney mentors, Junior Achievement volunteers, Phoenix College partners, and others. All but Junior Achievement provide one-on-one contact between adult and child. It is the village concept.*

When Hughes and Talazus met at a local education think tank meeting, they realized that MariMUSE and Longview might be a perfect match. Longview had a population of limited-English speaking students from poor economic backgrounds; MariMUSE had a world of conversations and descriptions in a motivating medium for language use.

With the partnership came new issues. Safety was a crucial concern of the professional educators in the environment. Children not only needed to *be* safe, they needed to *feel* safe and taken care of, just as they would in classrooms at school. The high-level vision of a learning community, as expressed in an introductory letter to newcomers, now stressed helpfulness, non-violence, and modeling effective ways of resolving conflicts. Throughout the life of Pueblo, the vision of a learning community has guided design and implementation decisions.

The new immigrants from Longview included some very excited students and teachers. Teachers and their students began as novices and fellow learners together, a situation very different from the traditional classroom. They took on roles as active participants and designers of learning activities on-line. Teachers found that creating personal objects such as homes in the MOO was highly motivating for students; students enjoyed writing and revising descriptions of their creations.

> ***Cynde Welbes, Longview teacher:*** *Knowing how MUSE made me feel, watching it affect the kids that I taught, made me a very staunch MUSE supporter. It fired me up inside with possibilities, and I loved to share what it made me feel, and what I had seen it do for others... I was also very personally meshed in this medium. I was able to get on from home, and I started to spend time in the evening on-line, talking to friends, making new friends, creating.*

Welbes' comments are a reminder that a network community is above all a social world, even when its use is related to professional or educational objectives. Most of us in the project have developed friendships on-line. Being in Pueblo sometimes seems like strolling down a busy street in a small town; there is a feeling of walking along, chatting with people in shops or street corners along the way. People find that they sometimes hold personal and professional conversations with the same people at the same time, sometimes using different communication mechanisms to distinguish conversational themes. Because of this mix, personal styles and agendas, as well as professional goals, have an impact on the development of the community.

The inclusion of Longview was a positive move for MariMUSE. Centering on a school with a particularly needy student population gave the network community added energy and focus. It raised the stakes for making MariMUSE a success.

3. MariMUSE to Pueblo

> ***Vijay Saraswat, Xerox PARC:*** *Jim, Billie, and I met at the first MUDshop organized by Kirstie Bellman (ARPA) and her colleagues in December 1994. At that time we at PARC had begun to be fascinated with the possibilities of MUD-based network learning communities. MariMUSE was beginning to reach some of its inherent technological limits, and Jim and Billie were looking to collaborate with "technology" partners. It was obvious to us that a partnership would be mutually beneficial.*

A major shift occurred with the move to Pueblo in 1995. The PARC researchers were strong new voices in the community. The underlying server changed from MUSE to the more sophisticated MOO server. Though the general characteristics of different servers are the same, each one has a different set of commands for users to learn. Another significant difference was that the existing objects in MariMUSE were not moved to Pueblo, so participants could start with an empty world.

There was an exciting new-world feeling in Pueblo for PARC people and some others, with the same broad participation and playful experimentation in building and creating that early MariMUSE participants had experienced. For members of MariMUSE, Pueblo represented a loss of familiarity. While both MariMUSE and Pueblo existed, students alternatively visited both. They went to Pueblo to do projects together, but they went to MariMUSE to tinker with old creations and talk with old friends. When Walters and Hughes decided it was necessary to focus all of their energies on Pueblo, they closed MariMUSE. For many, Walters said, it was "like their dog died." Though by the time of this writing Pueblo has expanded to include most of the Longview students who had been in MariMUSE, many of the scattered Internet participants did not make the move.

Pueblo did not open its doors wide, as MariMUSE had. PARC participation gave Pueblo a group of people who could provide infrastructure support, and from the beginning Pueblo was seen as a second-generation effort that would be more deliberate and intentional in setting expectations. Pueblo looked for members who would contribute to the community's vision of inter-generational learning, instead of recruiting from across the Internet anyone who was interested in building in a MUD, as MariMUSE had. Even at Longview, classes were brought onto Pueblo in small batches as teachers and students were ready. Over time, Pueblo has grown to include Phoenix area senior citizens, Hispanic and Native American college student groups, and adults on the Internet who are interested in education.

Centering on Curriculum

Teachers had integrated a few curriculum projects in MariMUSE, but they had focused primarily on language and literacy. Since the network community was an environment that made students at all levels of academic achievement eager to read and write, the principal and teachers encouraged its use whether or not on-line conversations and activities were thematically tied to curriculum. With the transition to Pueblo and the externally funded project, the goals shifted to place a greater emphasis on curriculum-related work.

During a successful summer camp, teachers and other design team members experimented with cross-grade projects, portfolios, and other ideas that would bring a curriculum focus to Pueblo. At the end of camp, brainstorming about fall curriculum projects was ambitious. Many ideas were proposed, though none of them was developed in sufficient detail to create a timeline.

In the press for the start of the school year for teachers and project meetings for researchers, curriculum projects took a back seat. After several months, the core team decided that something needed to be done. The "important" had taken second place to the "urgent" for too long.

Several of the researchers organized a two-day curriculum retreat at Xerox PARC. The school principal, teachers, technology aides, and Phoenix College faculty traveled to the research setting. This was an important symbolic step; it reinforced the idea that we were design partners.

Each teacher formed the nucleus of a small design group of 4 to 5 people. Each group identified a specific learning objective and created one or two detailed scenarios of a concrete, small-scale Pueblo activity that could help students meet the learning objective. As a large group, we explored the implications of each scenario for assessment, student self-monitoring, new software programming, and the logistics of computer equipment use and classroom activity flow.

Most of the small groups stayed together during the next months, though this had not been planned. The technical people who had helped to create the scenarios became committed to helping them become real. The research computer scientists had to juggle these short-term implementation efforts with other design and development activities associated with their longer-term research agenda (providing support for constraint programming and model-building in the MOO). This was not easy; developing robust and easy-to-use implementations of simple tools is a very different kind of activity than designing new architectures and languages in a research setting. Each of the scenarios was at least partly implemented, facilitated by continued communication between the teachers and their programming helpers.

The curriculum projects teachers designed included a collaborative counting activity for first graders; an in-MOO writing process with peer critiquing for third graders; building solar system models for fifth graders; and building walk-through human body systems for sixth graders. Using what they had learned from MariMUSE, teachers designed activities that were inherently social and that gave students the opportunity to create and personalize.

The results were mixed, from the teachers' perspectives. When the school year ended, the core group met to reflect on the year's experiences in Pueblo and to contrast them with earlier experiences in MariMUSE. MariMUSE had not been supported through any formal project or external grant, and the teachers noticed the difference. They felt that MariMUSE had been play, and Pueblo was work. One teacher said:

> *MariMUSE was less structured, more fun for everybody.... It was much more free - we weren't trying to do things instructionally. It was not as goal-driven or money-driven. Now we have to have a product - this thing has to work because it has to be proven to someone else.*

Another teacher put it this way:

> *If you have a specific goal, it's easier to feel failure. If you're after learning, you look back and see what happened and feel success... We have overfocused on what part of the curriculum [is in Pueblo], but it's really about learning. We took a more global view about facilitating learning before.*

One of these teachers (the first quoted) had designed in Pueblo an activity that was modeled closely on one she had done earlier in MariMUSE. Though the Pueblo and MariMUSE activities were very similar, this teacher's understanding of her own accountability was different in Pueblo and MariMUSE. As an active member of the Pueblo core design team, she had developed a plan that fit the project's goal of curriculum integration. As a teacher and community member, she had enacted the plan in her classroom and in Pueblo, where she was accountable to herself and the school administration as a creative and independent teacher. When there were challenges with managing classroom activity flow and delays in implementing the curriculum project, this teacher and others were uncomfortably aware that people outside their setting were invested in the results.

Since their earliest experiences with MUDs, teachers and researchers in the project have believed that one important factor in students' motivation to participate in MUD environments is having the freedom to choose what to do. After the discussion of differences between Pueblo and MariMUSE, teachers decided that having choices was important for their participation too. As one teacher said, "teachers need their own freedom and independence, just like the kids."

Rather than design specific curriculum projects for the coming year as a group, teachers individually reflected on what would constitute successful implementation of Pueblo in their classrooms. Some of the goals set by teachers included "students seeing ways to create curriculum projects," "teachers and students having active roles in projects," "students looking at their own work and making assessments based on a class-created rubric," "students actively problem-solving," and "Pueblo should be an added tool to use, not feel like one more thing that has to be done." Teachers seem to have appropriated the interpretation and use of Pueblo in a new way; they are focused on learning objectives and finding a fit within the classroom context, rather than particular outlines of student activities. This appropriation is an important step toward long-term sustainability.

For the community to continue beyond the period of the project, people need to have their own reasons for involvement. But because the network community is an extension of the school and community college, the character of involvement is not completely open to individual interpretation. Community members have freedom to choose what to do within the constraints and expectations of the educational setting and the sponsoring institutions. Participants are still accountable for educational value and effective use of resources.

4. Mediation

New community members offer new talents, but they can also bring new stresses because of different languages and different goals. Williams has pointed out that translation is a crucial function in participatory design teams [13, 14]. We have also found this to be true in the design and use of Pueblo.

Mediating style differences

In the move to Pueblo, the three organizations committed to work as equal partners to develop curriculum projects integrated in the MOO. The diversity of the groups could have led to divergence in many aspects of the project, but the most noticeable difference has been in working style. As Schwab, Hart-Landsberg, and Reder have described [12], teaching professionals have highly constrained schedules that can make collaboration challenging. In our project, we noticed differences in people's styles as they related to time: how we paced activities, how we scheduled time, what uses of time we considered productive and what we considered a waste of time.

Hughes and Walters began to play new, central roles as mediators between teachers at Longview and researchers at PARC, drawing upon their background as education researchers to translate in each direction.

Teachers wanted concrete tools and ideas they could use easily and quickly in the classroom; they have little free time for formal planning or curriculum design and are adept at improvisation. Researchers often work at a slower pace, on a more abstract level, with a longer-term view; they try to understand possibilities, processes, reasons for decisions, and implementation effects. Researchers in our team feel a need to design elegant solutions, observe and reflect on activities in the community, and write. Teachers feel a need to be ready to manage lessons for their students each day, cover the many essential parts of the curriculum well, and respond to district requirements for student assessment. On the other hand, sudden short-term deadlines for writing new code or producing a brief position paper for a conference did not bother the research groups, but these deadlines (of which there were several) were a real hardship for the teachers, whose schedules were both full and inflexible.

Some subtler cultural differences were our different attitudes about productive uses of time and tolerance for ambiguity. As part of our design process, the core design team has held monthly all-day meetings in Phoenix since the funded project began. Initially, these meetings were taken up entirely by discussions on issues of common concern - brainstorming about new tools, planning new activities, thinking through the logistics of bringing in new participants. Researchers seemed to feel productive even if a whole day was spent discussing complex issues in detail and making no firm decisions at all. Teachers found this use of meeting time frustrating - one concrete plan, however small, would be preferable to a whole set of ideas that might never be implemented.

Hughes and Walters monitored teacher responses and then named the problem. Once it had been explicitly raised, the trust, good will, and friendships that had been nurtured by our participation together in the network community helped us to adjust our styles with good humor. The team discussed the problems and worked out solutions. After the curriculum retreat, teachers began to focus on specific projects with dedicated research partners and concrete deadlines. To improve meetings, the day was split into large group discussions, small curriculum group discussions, and individual planning and classroom observation, which each group has found helpful.

Mediation in on-line mentoring

In diverse communities, people have different skills and may not always recognize or value the unique things they know. In Pueblo, PARC researchers and others on the Internet were interested in the process of mentoring, so they asked the teachers and school principal how to be a good coach, how to approach a child on-line, how to handle a conflict between two students, and similar questions. But these skills were so natural to the professional educators that it was hard for some of them to see what the researchers were asking or to advise them on mentoring.

This situation continued for several months as a low-level issue, until Anne Mourning (Ladybug), a New York enrichment teacher who was also an active participant of both MariMUSE and Pueblo, wrote an informal guide to on-line mentoring. This guide was concrete and basic, and it was full of examples from Pueblo. It talked about how to engage students in conversation and how to give them help without giving them answers. This guide has been valuable for new mentors, though as with any new skill, mentors need practice in real situations to become adept at coaching.

Ladybug was able to play an important mediation and translation role because of her unique perspective as both a teacher and a remote outsider to Longview. When the school principal and teachers understood what the mentoring technique questions had really been about, some were surprised to learn that the researchers had needed such basic tutoring in how to interact with students.

Though the participants of our network community subscribe to the educational vision and local culture, what each wants from their participation has a different emphasis, depending on background, professional agenda, interaction style, and so on. As the community grows, mediators help to bridge many different gaps.

Missed mediation

> ***Billie Hughes, Phoenix College:*** *I tried to help facilitate development between teachers and PARC researchers, but without much success. What I think happened is that the researchers took responsibility for development and Longview teachers and principal came to grips with what it was they had to do to keep their commitments to the project... the virtual community enabled and empowered the teachers and the researchers to work together. Yet the instructional expertise that Jim and I have is lost. Often, because time is so tight, communications occur solely between researchers and teachers, which can mean that developments may need significant revision to work for other audiences... Yet the virtual community and the strong relationships and loyalties that developed among all team members meant that this changing of roles did not create a serious problem for the community or the individuals in it. The values of the community and the shared vision meant that people did not become obsolete, even if their roles changed.*

As designers of a learning community, we want the community to be strong and self-sufficient, with many open communication paths across boundaries of all kinds. Many in the community of designers feel they would like to be involved in a large number of different activities. Being an intermediary and translator is an emotionally rewarding role, and in this example there were also unique professional skills missing when the intermediary was out of the loop. In Hughes' reflection on this lost opportunity, she considered what her changing role meant to her sense of belonging in the community. She was no longer a gatekeeper for all of the interactions between teachers and researchers, but she was by no means "obsolete."

There is an issue here that has not yet been resolved in Pueblo - how to make sure that appropriate mediators are present in activities where they are needed, without inhibiting the non-hierarchical, open social groupings that form so easily in the network community.

5. Growth and changing participation

As the community grows, individuals have taken on different roles and responsibilities. How people do this and what they are able and willing to do in this environment plays a crucial role in how the community grows, what kinds of growing pains it experiences, and how these are addressed.

Different levels of participation

> ***Cynde Welbes, teacher:*** *So I made sure that I made it to every meeting, added in my thoughts, listened to others thoughts, and after the meetings, continued to talk to those who stayed on-line afterwards. I felt like a sponge, and I just couldn't get enough information. All of this, I thought, was a positive thing. But soon I started hearing things like, "You don't have to be on-line as much as Cynde is to be involved." Suddenly my being on-line a lot was a negative thing...because I had taken part in on-line discussions and therefore had information that others didn't have...*

Though there are many effective styles of participation, you have to show your presence and participate in live conversations to be part of a network community. "Face time" has been an issue for most members of the community at one time or another; it has not just been a problem for classroom teachers with constrained schedules. (The school principal has been an exception; she is rarely in Pueblo but retains a strong voice in the design team.) Even when design team members were active in email or doing other activities for the benefit of the community, they began to feel left out if they were absent for a period of time from Pueblo. Those who spent time on-line together simply knew more about what was going on. They were present and could be consulted when on-the-spot decisions had to be made or when interesting design discussions began spontaneously.

Some of the tensions around missed opportunities for participation were eased through technical means. Optional recorders were added to public communication channels. (A channel is a mechanism for talking with a group of people who are not in the same room together in the MOO.) Certain channels were routinely recorded, including the "core" channel for members of the core design team and channels dedicated to discussion topics such as pedagogy and programming. With recorders, core channel discussions left a reliable trail. The core channel became a synchronous communication tool for people who were present and an asynchronous tool for people who were absent. Even with this tool, however, interacting with others on-line is still

very important for maintaining relationships in the community.

Governance

As the community grew, it became apparent that it needed more wide-ranging discussion of certain public issues, such as who could become a member of Pueblo or when someone should be granted additional quota (a built-in building allowance). There were no advertised policies in these areas, and the rationale for individual decisions was not always clear to those who stood outside the decision process. The administrators of the community were interested in developing policies and guidelines, but they were also sensitive to the implied questioning of past decisions, which they had made for the benefit of the community.

Through a series of email discussions and face-to-face meetings, new immigration and guest visitation policies were specified. New technical commands were built into the system that would allow people other than technical wizards to do appropriate administrative tasks, such as invite guests, adjust quota, and change students' passwords. A "teacher utilities" package had always been planned, but its priority was raised during this process. These sensitive discussions were held partly in email, but the core team made the final policy decisions in a face-to-face meeting. A more detailed account of the co-evolution of some of Pueblo's social policies and technical mechanisms is given in [9].

Recognition and status

Recently, governance structures and the function of the core design group have been challenged by a group of pre-teens and teens in Pueblo, prompting new attention to the question of status in the community. This group formed a "secret club," an exclusive group with a clubhouse, special communication channel, and rules for voting on membership applications. The secret club wasn't really such a secret, and signs of its existence occasionally spilled out into public view. One member left in a dispute. This prompted discussion among the core team - what action, if any, should be taken? The teachers and school principal had a united response. Since they would discourage this kind of club if it emerged on the playground or in the classroom, they would also discourage it in Pueblo, since they saw Pueblo as an extension of these other places.

In discussion with the club members themselves, the heart of the issue seemed to be status, authority, and responsibility - who had each and why. Though the core design team had thought through these same questions as it considered immigration policies and teacher utilities, the wider community had not been involved in that discussion. When the teenagers defended their secret club, they drew comparisons to the core team itself and the staff of admins (wizards), as an exclusive group of people with special powers which regularly held closed discussions on its own communication channel. The teenagers asked why they could not be admins or core members too, so they could "actually count as someone on the MOO," as one said.

In the core group itself, there are clear areas of responsibility and corresponding status based on the organizational structures of the project and the participating institutions - there are principal investigators for the grant, a school principal, and a department head, for example. In the network community, status is not clear and there are few visible markers of difference in responsibility or expertise. The teenagers were anxious to become wizards probably because this is the most visible status indicator in the MOO.

The timing of the secret club affair was perfectly aligned with the formation of a new documentation project, which *did* provide more opportunities for power, responsibility, and recognition. This team is open to anyone who will take seriously the responsibility of creating high-quality help text, and many of the secret club members have joined. The team has its own meeting place and communication channel, some of the external signs of being a group. It also has real power and responsibility (both technical and social), since the new help text created by team members replaces the standard help text. This is the first extension of MOO-caretaking responsibility to non-core members, and though the group is still new, it appears to be very successful so far.

The community will not be sustainable if students do not choose to build and participate in the development of the community. Their creativity, engagement, and independence of action are crucial. And they will not want to be there unless they see how they have an impact and are part of decision-making. In this community design project, there is a strong mutual need between the community and the project. As a school-centered community, the community needs organizational and technical support from the institutions around it. But without the children, teachers, grays, and other adults who are not on the core team, the community would be a very dull place.

Keystone players

One special community member, Kimberly Bobrow (Hobbes), became a unifying member of the team.

> ***Kimberly Bobrow**: Cynde Welbes and I feel so strongly about the idea of welcoming members to the community that we created an on-line Welcome Wagon, complete with brownies in a foil covered plate. We keep a close eye on who logs in, and we are both on regularly enough to know instantly when someone new shows up. When that happens, we both hightail it to the wagon, step on the virtual gas, and zip off to the Visitor's Center to spread some of that Pueblo feeling.*

Hobbes has used the strength of her personality and her expertise to turn Pueblo into a place where children create worlds of their own. She has provided easy and popular ways for children to make custom cars, adopt pets, and create and consume vast amounts of virtual food. Her constant on-line presence allows her to stay in touch with what is going on all around Pueblo; one of the roles she

has adopted is to make connections between people with common interests. Her background as a teacher, technical wizard, and all-round confidante have made her one of the central mediators in the community. We suspect that every network community needs such "keystone" people who migrate easily between roles and social groups.

Evolving niches

Soon after Pueblo opened, different kinds of expertise began to emerge in the network community. One of the teachers (Welbes) worked on developing technical skills in the MOO and acquired a "wizard" character, which gave her the ability to do on-site MOO administration at Longview. This suited her own aptitude and changing goals, since she had earlier decided that she was interested in a technical career. Another teacher (Cyndy Olson) who was particularly good at articulating teachers' viewpoints was named a member of a small cross-organization executive committee that was formed to handle broad project and community issues.

These new roles were a visible recognition of particular kinds of expertise. The changes were sensitive because they seemed to place value on some kinds of expertise more than others. Each of the seven teachers in the core team had unique strengths, but only some were being openly recognized. The Longview principal addressed this by explicitly announcing to the core design team each teachers natural leadership areas (writing, science, cooperative learning, and so on). This move eased tensions, and by exposing teachers' special strengths to non-Longview team members it also lay groundwork for new conversations and partnerships.

In Pueblo, the core team consciously sought to recognize and nurture the many talents needed for the project to succeed. One person became a vocal champion of educational assessment and outcomes, another of usability. The special interests and talents of each person emerged, often informally through the cumulative effect of interactions in different social groupings, rather than through people being appointed into particular roles.

CONCLUSION

In many work-oriented design projects, designers work closely with users for a time to develop a significant new technology-based system. Participatory design in/of our network community has been distinctive in several ways:

- Boundaries between users, designers, and implementors are fuzzy. Everyone in Pueblo is both a builder and a community member. People's roles and responsibilities evolve over time.
- Social interactions and relationships are important aspects of community life. Some social concerns (such as immigration and property rights) became explicit elements to be addressed in the design process. An ongoing issue is finding ways of recognizing, leveraging, and making visible the different kinds of value that community members bring.
- Rather than a large design with many contributors, people work toward a set of independent goals in the context of a larger vision of a learning community. Design is decentralized and open-ended. Participants learn from the emergent properties of the medium and its evolving use, and they design new activities as their understanding of current experience grows.
- Projects in the community require collaboration among people who have different backgrounds, professions, agendas, styles, and interaction patterns. The community benefits from mediators and translators to cross these many boundaries.

Major transitions in Pueblo's evolution have been marked by cyclical periods of action and reflection, as the community looks outward, inward, and outward again. The community increases in complexity, becomes aware of the effects of complexity (such as changing roles or social tensions), and makes adjustments. The reflection itself is an important part of the process and is a key to how a community of designers intentionally affects the design of the community.

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