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An online system for tracking class participation

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AN ONLINE SYSTEM FOR TRACKING CLASS PARTICIPATION

A Project

Presented to the

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In Partial Fulfillment

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ABSTRACT

Teachers value class participation. Students learn best when they are actively engaged in learning. Teachers use a variety of methods to encourage class participation. This paper examines an online system for tracking class participation points, which presents interfaces for students, parents, and teachers. The online system is web-based, with a back-end database containing data about students' daily individual participation in the classroom. The database is organized to permit teachers to maintain data about their classes and their students and to give students and parents easy access to this data. According to a small group of teachers who participated in a beta test using actual classroom data, the system is powerful and easy to use.

ACKNOWLEDGMENTS

Thank you to Brian Newberry and Eun-Ok Baek for their patience. Thanks also to my wife Janet for trusting me to spend a summer developing myCP.

DEDICATION

Dedicated to Dr. Margaret Steen, who teaches us that no student heads off to school planning to mess up your class.

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CHAPTER ONE

BACKGROUND

Introduction

Participation by students in a classroom is universally valued by teachers. Research supports teachers' popular belief that learning involves "active participation by learners in which they construct and progressively improve their understanding" (Wells & Arauz, 2006, p. 379). Knowing this, effective teachers incorporate elements in each lesson plan which are designed to engage students, drawing them in to the material being studied and encouraging them to make the material their own.

Teachers who choose to make their lessons interactive and engaging are subscribing to the popular theory of *Social Constructivism*, hinted at by Socrates and formalized early in the 20th century by Vygotsky. An excellent summary of Social Constructivism has been summarized like this: "Learning is a constructive process in which the learner is building an internal representation of knowledge. ... Learning is an active process in which meaning is developed on the basis of experience."

The author was inspired to develop an online system for tracking class participation in response to personal observation in his own and other teachers' high-school classrooms, where there is often a tendency for students to file in, plop down in their seats, passively copy down notes from overhead projections, and to try to stay awake until the dismissal bell. It was felt that by awarding and publishing points for participation, students would be encouraged to take a more active role in their own education and would thereby learn more and learn better.

Statement of the Problem

This paper examines myCP, a web-based system for tracking individual participation by students over the course of a semester or quarter. The author developed myCP to provide a convenient system that would allow a teacher to objectively record class-participation points and present current point scores to both student and parent through multiple online channels. The goal was twofold: by collecting and publishing a student's level of participation, the teacher dramatizes the importance of class participation, and through objectivity and transparency, the mystery about the teacher's expectation (regarding amount and type of participation) is removed,

allowing the student to make informed choices about his or her own behavior.

Purpose of the Project

To maximize class participation, an online system for tracking must address two primary issues: how to quantify class participation and how to report class participation. This will serve all stakeholders: for students and parents, quantifying participation conveys a sense of objectivity (crucial if participation is to be fairly included in the grade); for teachers, the daily collection and collation of participation data ensures that the data is reliable, i.e., worthy of including in a student's grade.

To be a valuable tool for the teacher, an online class-participation system needs to improve on existing systems. Traditionally, teachers track participation through three popular means:

1. The clipboard. The teacher carries a clipboard around during the class and makes notes about participation. This is most effective if the teacher announces participation points or demerits as they are awarded (Mierzwik, 2005, p. 31).
2. Token economies. The teacher hands out tickets, printed to mimic money, in exchange for various acts

of participation. At the end of a specified period (week, quarter, semester, unit), students turn these in for grade points. (Alternatively, students start the semester with tickets and turn them in when they choose to participate.) (Dugan, 2006)

3. Informal, subjective impressions. When filling out report cards, the teacher makes comments about extraordinary class participation (good or bad), based on a general impression since the last report card.

In addition to these, several modern methods have also become popular:

1. The PDA. In this update on the clipboard method, the teacher carries a PDA, makes marks for points good or bad, and uploads these daily to a spreadsheet or some other system for tallying participation points.
2. The clicker. In an Audience Response System (ARS), each student uses a wireless handheld device to respond to prompts from the teacher, usually informal multiple-choice questions. The teacher uses this system primarily for formative assessment. It also encourages class participation without

actually providing a means for tracking (Kenwright, 2009).

To justify its existence, any online system for tracking class participation should improve on existing, low-tech methods. The next section includes a detailed discussion of these improvements.

Significance of the Project

Maximum class participation is widely recognized by teachers at all levels as a critical goal to successful learning. Dewey famously claimed that students learn by doing (1916). Bean and Peterson (1998) surveyed a range of schemes for measuring and prioritizing student participation in the university classroom. They defended the importance of class participation and the need to make it a component of a student's grade: "We believe that grading class participation can send positive signals to students about the kind of learning and thinking an instructor values, such as growth in critical thinking, active learning, development of listening and speaking skills needed for career success, and the ability to join a discipline's conversation" (p. 33).

Gresalfi, Martin, Hand, and Greeno (2009) see participation in a high-school mathematics classroom as

an integral component of a multidimensional "system of competence" present in all classrooms:

> Classrooms in which students are accountable for demonstrating their understanding only to the teacher require convincing only one person (who, ostensibly, already understands the mathematical content) that an explanation or solution makes sense. In contrast, classrooms in which students are accountable to their classmates as well as their teachers often require that students do much more work in order to convince their peers that their solutions make sense. As a consequence, students in such classrooms may have many more opportunities to respond to questions and revise their solutions. (p. 53)

Even Sunday School classrooms can benefit from overt encouragement of class participation. Oliveri offers tips for improving class participation in children's ministry programs using methods in common use throughout secondary schools, such as token economies, games, and props (2007).

Online tracking of class participation can theoretically accomplish more than traditional methods several ways. Objectivity is maximized when participation is quantified, and collated totals are used

directly as a component of a student's grade. On an ideal system, students and parents can get immediate feedback, including passive notification through standard web interfaces or even active notification via email or SMS. This feedback is available anywhere a client has access to cell-phone networks or Internet.

Researchers have found "improvement in motivation to learn" by providing content through video games (Rosas, Nussbaum, Cumsille, Marianov, Correa, & Flores, 2003), so it's plausible that, by providing running totals of participation points, a system could appeal to adolescents as an interactive "game," allowing them to interact and compete with their peers and against themselves. (With optimal cooperation and planning by schools and districts, a widely adopted system could even be "played" throughout the day, with each teacher contributing that period's score to a student's daily total.)

A properly designed, research-backed online class participation tracking system will provide accountability and motivation for students. Class participation managed through a system that is viewable 24x7 will be perceived by the stakeholders as concrete, reliable, objective, and malleable. The student will feel in control, rather than

without hope, and will be willing take responsibility for this component of his grade.

Limitations

Over the three years of development and use of myCP, a number of challenges to the power and facility of any online system became apparent:

- Limited access: any online system depends on the availability of networks and client computers. From a technological standpoint, this is not an issue: server and network technology in 2009 has grown and stabilized to the point where most Americans use the Internet at least once each week. However, there are still households where Internet access cannot be assumed: fewer than one third of all Americans who live in households with annual income below $20,000 access the Internet at all in any given week (U.S. Census Bureau, 2009). The prevalent model - the TCP/IP-based Internet connecting servers with stand-alone personal computers at home, work, or in public sites such as libraries - may or may not be eventually supplanted by something else; however, it's conceivable that there will always be students and parents who do not have basic access.

- Freedom of choice: although it's theoretically possible for a teacher to require students to use an online system for tracking participation, forcing the students' *parents* to sign up is less practical. Since the usefulness of the system is dependent on parent involvement, each parent who opts out weakens the overall effectiveness of the system.
- Latency: distribution of information in any network is delayed to a certain extent. Ideally, students whose participation in a classroom is being tracked by an online system would know instantly whenever their participation score (and those of their classmates) changes. However, there are technological barriers to instant notification: do you use cell phones? a public display system? what about access limitations due to school-district privacy safeguards? Even if there were not technological barriers to instant notification of participation scores, there are possible issues of distraction (as students pay more attention to their participation score than to the current classroom task).

Definition of Terms

The following terms are defined as they apply to the project:

- Database: a collection of information that is organized so that it can easily be accessed, managed, and updated (SearchSQLServer.com, 2008)
- Formative assessment: "Formative Assessment is part of the instructional process. When incorporated into classroom practice, it provides the information needed to adjust teaching and learning while they are happening. In this sense, formative assessment informs both teachers and students about student understanding at a point when timely adjustments can be made" (National Middle School Association, 2009)
- Online system: for the purposes of this paper, an "online system" is a server which is available to one or more client computers which connect via the Internet and/or another standardized, public data network.
- SMS: "Short Message Service," the most common messaging protocol used for sending text messages, also a synonym for text messaging itself. "The SMS text messaging is the most widely used data

application on the planet, with 2.4 billion active users" (Wikipedia, 2009).

- Social constructivism: "Constructivism assumes that students learn as they work to understand their experiences and create meaning. In the social constructivist model, teachers are knowers who craft a curriculum to support a self-directed, collaborative search for meanings" (Innovate: Journal of Online Education, 2009).
- Stakeholder (in education): individuals and groups who stand to benefit from the products of the educational system, specifically the student, the parent, the community.

CHAPTER TWO

REVIEW OF THE LITERATURE

Introduction

Teachers discuss *class participation* with colleagues and constituents, and plan for maximizing it each day and throughout the year. It may or may not become a required part of a grade, depending on individual teacher preferences. However, a review of the literature reveals different interpretations of the term. A useful starting point for any discussion of class participation, then, would be to define it and to place it in a broader context of learning in general.

What is Class Participation?

On the surface, the meaning of *class participation* is obvious. Some researchers consider it obvious enough that they leave it undefined, and the act of hand-raising becomes an implicit sign that participation is occurring (Hartley, Bray, & Kehle, 1998) and (Education Digest, 2007).

Petress claims that one of the reasons participation might be lacking in a class is the lack of definition. "Too frequently, students are unsure about what is expected of them under the rubric: 'class participation.'

Consequently, students try to anticipate what teachers mean and the results of such inferences are too frequently nightmarish" (2006). Petress proposes measuring three dimensions of class participation: "quantity, dependability, and quality" (p. 821).

Engagement

Engagement is another issue that's important to consider in a discussion of class participation. The authors of "The role of engagement in inspiring teaching and learning" (Bryson & Hand, 2007) discuss "engagement," which they define as "the interaction of the student with the learning environment." They list several ways that engagement is measured in the literature (e.g., "to self-report about 'mental' activities involved with learning such as memorising and analysing") and what have emerged in the literature as different *levels* of engagement. The deepest level is one that "emphasises the relationship between the perception and experience of the student, and how they make sense of that, and their engagement with education—a dynamic and constantly reconstructed relationship" (p. 352).

Is engagement the same as participation? No, in fact what we often think of as class participation (e.g., hand-raising, following directions, helping peers) can be

seen as merely one aspect of engagement (Buhs, Ladd, & Herald, 2006). A simple working definition of class participation was provided in the paper from a recent large Australian study: "I get involved in things we do in class" (Martin, 2007). (By the way, the authors of this study found a negative correlation between disengagement - "I often feel like giving up at school" - and such constructs as enjoyment of school, educational aspirations, and class participation.)

Value of Class Participation

Why do we value class participation? Is it a habit? Something that "seems good" but which we actually know little about? The author of "The 'Why?' of Class Participation" (Jones, 2008) discusses this. He analyzes different classroom exercises, such as Think-Pair-Share, and locates them on a two-dimensional matrix, using two criteria - high-level vs. low-level thinking and proportion of students actually involved in the activity. Jones finds a positive correlation between high-level thinking and active learning.

Likewise, the authors of a Portuguese study found a dramatic increase in academic performance (along with self-reported feelings of achievement and socialization) after implementation of a radical new curriculum,

stressing collaborative projects, universal inclusion of all students, and respect for cultural diversity (which in turn encouraged discussion among peers in all phases of classwork) (César & Oliveira, 2005).

The authors of a study regarding motivation and school-athletics participation concluded that "what people want out of physical activity participation is related to who they are in a psychological sense." After measuring students' metamotivational states, they claim that knowing about an individual's psychology "would provide a framework for appreciating that person's expressed reasons for activity participation and could help the practitioner in guiding him or her" (Sit & Lindner, 2006, p. 382).

Encouraging Class Participation

Teachers who value class participation naturally want to encourage it. What systems have they built to do so? Since it's perceived as crucial to student learning, how are we maximizing class participation?

A popular method for encouraging class participation and other on-task behavior is the so-called "token economy," a system linking desired behaviors with points which can be redeemed for rewards such as pencils, stickers, or free time (Dugan, 2006). Butera et. al.

(2008) have studied a variant on the traditional token economy, supplemented with a reflective journal to help students recognize what disruptive behaviors they are engaging in.

In their summary of the requirements and problems of grading class participation, Bean and Peterson recognize that some scholars advise against including class participation in students' grades (due to subjectivity, unfairness to shy students, and several other factors), and then they defend the practice on the grounds that "grading class participation can send positive signals to students about the kind of learning and thinking an instructor values, such as growth in critical thinking, active learning, development of listening and speaking skills needed for career success, and the ability to join a discipline's conversation" (Bean & Peterson, 1998, p. 79). They describe three prototypes of a participatory classroom:

1. Instructor-facilitated whole-class discussion, in which most of the conversation should be between students directly;
2. "Cold-calling," in which the instructor asks the class a question, and then randomly calls on individuals for answers;

3. Collaborative learning, in which teams work on problems posed by the teacher, and then share and discuss their findings in a whole-class session.

Parental Involvement

Outside of the teacher-student and classroom-student relationships, many teachers and researchers are studying the importance of parent participation in student success. Common sense says there should be a correlation between student engagement and parent participation, from both a discipline standpoint - "you did *what* in class today?!" - as well as a more organic standpoint, where the student perceives the value of education by recognizing that his or her parents choose to be involved in it. Endya B. Stewart argues that "through [parent involvement], parents demonstrate the importance they attach to schooling and academic achievement. Parental involvement may thereby become a powerful influence on school and academic policies that may have a direct influence on their child's in-school activities and academic success" (2007, p. 183). In an analysis of a large body of recent data (American secondary-school students, N=11,999), Stewart found that "parent-child discussion was found to be significantly associated with

academic achievement, thereby suggesting that parental engagement in education-related discussion with their children was an effective tool for increasing students' academic achievement" (p. 198). In a similar large study (American seventh and eighth graders, *N*=1,971), Mo and Singh found that "highly involved parents would motivate their children to higher engagement in their academic work, and in turn, the students' engagement in school will lead to higher achievement" (2008, p. 7).

Many educators make a point to actively encourage participation by parents, especially fathers, who have traditionally been less involved than mothers. In "Engaging Modern Dads in Schools," John Badalament discusses the issues of participation by fathers – who can sometimes feel unwelcome, for example, in a traditionally "feminine" school environment – and describes methods that educators can use to establish and promote "dads' clubs" on campus (Badalament, 2008).

In addition to clubs, other educators have discovered creative ways to get parents involved in their children's curriculum. Math teachers in Akron, OH, are working with local family destinations, such as the zoo and the minor-league baseball park, to plant educational activities in menus and other literature (Fawcett &

Shannon-Smith, 2007). The authors say, "We are sending a message to those who have bought into the belief that math is hard and that not everyone can do it."

Motivation Provides the Direction and Intensity of Behavior

An educator who wants to use any system to change the behavior of his or her students - whether it be informal or formal, high-tech or low-tech - needs to understand what motivates them. Is it parental influence, peer pressure, some kind of internal ambition? Does students' motivation change during the course of a school year, or within a week or even a class period?

In "Motivation: the Mainspring and Gyroscope of Learning" (1970), Jack Frymier summarizes motivation simply: "Motivation gives both direction and intensity to behavior" (p. 23). He describes motivation as a two-dimensional characteristic of a living organism; like a vector in science or mathematics, motivation has direction ("toward what goal is the organism directed?") and intensity ("how motivated is the organism to reach that goal?") He asserts that, much like intelligence, you cannot directly measure a student's direction or intensity of motivation, but you can theoretically *infer* these characteristics through indirect measurement.

Frymier claims that measurement and analysis of motivation has taken a back seat to intelligence: "IQ scores appear to be exact, while other variables such as motivation or personality or cognitive style seem slippery and difficult to pin down with precision."

Many researchers have been interested in studying motivation as a concept which can be used to fill in the gaps between cognition and academic success (Entwistle, Thompson, & Wilson, 1974). Teachers recognize the crucial role motivation plays in student learning; however, most teachers have not been trained in student motivation and so commonly make informal guesses about what motivates their class as a whole or select individuals within a class (Middleton, 1995).

Motivation in the Mathematics Classroom

Motivation is a particularly crucial issue for the secondary mathematics teacher, since overall student attitudes toward mathematics decline during the secondary years (Wilkins & Ma, 2003). One of the most important findings about mathematics motivation is that "students' perceptions of success in mathematics are highly influential in forming their motivational attitudes" (Middleton & Spanias, 1999).

Because of the importance of mathematics in modern society and the predictably negative attitude toward mathematics, teachers have developed creative ways to encourage students to get involved in their own math education. These include such diverse solutions as using M&M candies to model equations (Borlaug, 1997), animated online games (Green, 2009), and borrowing methods from other cultures (Murray, 2008).

The best of these techniques offer students intrinsic motivation. However, many teachers create elaborate systems of extrinsic (vs. intrinsic) rewards.

Usefulness of Extrinsic Rewards

As mentioned, many teachers develop token economies for their classrooms that are meant to provide guidance and, more importantly, motivation for students to engage in productive behavior. On the surface, this would appear to be a win-win situation for students and teachers; however, researchers disagree on the usefulness of extrinsic rewards as motivational tools in the classroom. "Gold stars, best-student awards, honor rolls, pizzas for reading, and other reward-focused incentive systems have long been part of the currency of schools. ... [A] few commentators have questioned their widespread use" (Deci, Koestner, & Ryan, 2001, p. 1).

In his review of the existing research of the time, Bates described the doubts this way: "[The] fear is that the supplying of the student with extrinsic incentives for learning may be an artificial procedure, unlikely to be paralleled outside the classroom, which may ultimately undermine the inherent human desire to learn for the sake of learning" (Bates, 1979).

Deci, Bates, and a host of other researchers have engaged in a decades-long battle to identify the value - positive or negative - of extrinsic motivators. Danner and Lonky (1981) controlled for age, sex, level of interest in the skills to be learned, and cognitive ability in an experiment designed to measure the effect of extrinsic rewards, including praise, on intrinsic motivation. They found that "rewards had little effect on intrinsic motivation among children whose motivation was initially low and decreased it among children whose motivation was initially high" (p. 1043).

Diffusion of Innovation

The computer program being studied in this paper can only succeed if it's used by all three primary stakeholders in education: teachers, parents, and students. Likewise, on another level, the program can

only succeed if it can grow and reach enough users to warrant ongoing development and support. Analyzing the process of how, why, and at what rate new ideas and technology spread through cultures is the study of "diffusion of innovation."

Software developers have adopted a number of popular and well-known strategies to reach the widest audience. Unsurprisingly, many of these strategies are supported by the diffusion of innovation literature. Software companies give out trial versions of their products, or offer fully-functional versions for a trial period, in order to get it onto as many desktops as possible. This can be understood as an effort to leverage people's willingness to imitate others, a deeply ingrained human trait. "The propensity to imitate is presumably an evolutionary adaptation that has promoted survival over thousands of generations by allowing individuals to take advantage of the hard-won information of others" (Bikhchandani, Hirshleifer, & Welch, 1998, p. 152).

The commercial realm and other free-market settings may provide valid answers for some questions regarding adoption of software in an educational setting. However, the match is not perfect. An obvious example is the fundamental choice of what software to install: although

many users of computer software outside education (such as those who are self-employed or who are using software at home) have complete control of their own desktops, most school districts in the United States enforce strict limits on what their users can do, especially regarding software installation. Likewise, access to Internet resources is usually restricted by school districts.

Zhao and Frank (2003) use the extended metaphor of the introduction of zebra mussels in the Great Lakes to understand technology use in schools. According to their metaphor, "(a) Schools are ecosystems; (b) computer uses are living species; (c) teachers are members of a keystone species [that is, they influence other species significantly beyond their numbers]; and (d) external educational innovations are invasions of exotic species" (p. 811). By establishing this model as a framework, Zhao and Frank are able to apply ecological constructs to analyze computer use in schools. Teachers "exert pressure," for example, on one another and thereby co-evolve. In other words, the researchers claim, the spread of technology (the "invasive species") in schools is greatly encouraged by informal relationships (shared play time and casual conversations are specifically recommended) among teachers.

One advantage a producer of educational software has is that teachers are a partially captive audience; that is, many of their decisions (including adoption of software along with other technology) are in the hands of their administration and their districts. So, a software producer who wants to convince teachers to incorporate his software can market to districts. Mintrom (1997) studied diffusion of innovation in government agendas and determined that "policy entrepreneurs" (lobbyists) can be effective tools for policy innovation.

Summary

The literature relevant to the project was presented in Chapter Two. Among the findings, several will necessarily define the characteristics of any online system developed for tracking class participation:

1. Extrinsic motivators are short-term solutions at best. If an online system is meant to motivate students to work, it should do it intrinsically.
2. Engagement with activities in the classroom is crucial to a student's success. An online system should encourage active involvement by both student and parent in the student's class participation success.

3. Students do best in a classroom when they understand what is expected of them, so a successful system will provide "transparency." A student should be able to uncover the details of his score in as close to real-time as possible, including his raw numeric score (in any granularity) and his score in comparison to the rest of the class.
4. To be effective, an online system should be adoptable by districts, schools, and individual teachers (as publishers of information) and by parents and students (as consumers of information).
5. Any online system for tracking class participation must improve on existing low-tech methods. The Analysis section of the next chapter will study these potential improvements in detail.

CHAPTER THREE

PROJECT DESIGN PROCESSES

Introduction

The well-known ADDIE instruction design model was used to develop myCP. The five steps of ADDIE are Analysis, Design, Development, Implementation, and Evaluation. Each step feeds the next. The steps are described in detail in this chapter.

Analysis

Having identified "class participation" as an area of concern which might be addressed by an automated system, it next becomes important to define and categorize the users of such a system. As the primary consumer of the data, the student is obviously a key user of the system; the teacher, who produces the data, is also crucial. Two other groups are obvious: the parent, a "secondary" consumer who is ultimately responsible for the activities and welfare of the student, and the large group of other on-campus adults - administration, counselors, coaches - who are interested in the welfare of the student but who may not be directly involved in behavior in the classroom in question. In order to restrict the focus of this project to a manageable level,

it was decided that only students, teachers, and parents would be official roles recognized by the system.

A discussion of the characteristics of these three user roles follows:

1. The most important user is the student. This is the user whose behavior is being directed. There would be no need for the system without a student. The brings attitudes, habits, knowledge, and skills to class the first day, all of which have been acquired in previous classes. Students in the 21st century will have at their disposal a huge range of technical resources: some will have no cell and no computers at home, while on the other end of the spectrum, some will carry fully connected smart phones (with Internet and text-messaging) and have multiple, Internet-connected computes at home. Depending on the teacher and school, students may or may not have access to the Internet in the classroom; however, nearly every school library (National Center for Education Statistics, 2008) and community library (American Library Association, 2005) in the U.S. has free Internet access. To serve this population completely, a system must minimally be useful on computer systems in community and

school libraries, including the range of operating systems, network speeds and installed web browsers.

2. The parent or guardian of the student is the next most important user. As someone who by definition lives with the student, the parent has similar access to the Internet (from no home access to fully wired at home, but with possible Internet access through a community library); however, some parents may have additional Internet access through resources at their work sites. For this user again, the desktop is unpredictable (as with most Internet applications), and the system being developed has to accommodate this.
3. The last user is the teacher. In order for a system to effectively update individual data for each student daily, this user must have ready access to the Internet. In the U.S., nearly all teachers have access to the Internet in their own classrooms (NCES, 1999). Teacher knowledge and sophistication varies, so an online system should be as intuitive and self-documenting as possible.

In terms of categories of use, students and parents are consumers of the data; they will not directly create

or modify any of the data in the system. The individual teacher publishes all data for the use of the consumers.

Having discussed *who* will be using the system, the next item to decide about is what the system will "look like" - how it will work, what features it will have, what kinds of computers it will run on, what it will do. Since the system is meant to run on computers and to motivate adolescents, an obvious model is video games, infamous for engaging the user for hours at a time. What is it that makes video games so successful at keeping their players actively engaged? Can these characteristics be used in an online class-participation system?

One feature of video games that seems valuable is the immediate feedback the user gets, through online monitors of status. According to Aguilera and Méndiz, "the immediate feedback provided by video games, and the need for a continuous response during play, challenge and a stimulate children and adolescents and arouse curiosity" (2003). In the traditional elementary classroom, students usually get immediate feedback (positive and negative) on their behavior through the use of cards: students pull or turn a card from a wall chart to indicate a change in their behavior status. Through

multiple discussions with teachers on one high school campus, we discovered that instant-feedback techniques such as this are rarely used in secondary classrooms.

Many researchers see video games as an exercise whose primary activity is learning, or even equivalent to learning:

> Good game designers are practical theoreticians of learning, since what makes games deep is that players are exercising their learning muscles, though often without knowing it and without having to pay overt attention to the matter. Under the right conditions, learning, like sex, is biologically motivating and pleasurable for humans. (Gee, 2005, p. 5)

In this context, games are compelling because of the intrinsic motivation built into every click. Any system, then, designed with the goal of motivating adolescents to use it might want to exploit as many features of video games as possible.

Parents, too, need immediate feedback. The author was able to attend multiple parent-teacher conferences during the course of this project and recognized a persistent theme: that is, it's frustrating for a parent to go to an online grading system and find information that's days or even weeks out of date. School districts

provide software for teachers to record gradebook data; this data is viewable over the Internet by authorized parents. Although school districts and site administrators often require teachers to use these systems, not all teachers do, and a significant minority use them so rarely that they become worthless. Parents described the need to keep student information as current as possible as one of the highest priorities of any online system. Parents are thinking of grades, but any data - including class participation - would naturally fall under this requirement.

During the course of recruiting teachers to provide opinions and test software, it was discovered that a common impediment to adopting new electronic systems was the real or perceived possibility that the new system "would not work" with systems already in place. The teachers described files they had come to depend on for their daily activities which would become useless once new software was installed on their machines, or useful processes they would be required to re-learn or change. The teachers who contributed to this project were wary of these efforts because of having been "burned" in the past.

Based on this, the following *strategic* requirements were chosen to be included in version 1.0 of an online

system for tracking and reporting class participation of individual students:

1. Support for intrinsic motivation. As described in the Literature Review, for maximum effectiveness, the system should inspire and depend on the intrinsic motivation of the students as a means to promote class participation. Although a system that tracks participation points is inherently an *extrinsic* motivator, research shows that "effective teachers can learn to use both extrinsic and intrinsic rewards in personal, thoughtful, and complementary ways to heighten students' academic engagement" (Bowman, 2007, p. 83). The best system for motivating students to participate should be to cause extrinsic motivation to become internalized, as described by Deci and Ryan, who claim that "extrinsically motivated behaviors that were initially externally prompted can become increasingly internalized, resulting in greater self-regulation" (1996). In other words, if the system is to be most effective, the students whose participation is being documented should be encouraged (through the system) to participate for

the joy of participation, rather than strictly through external rewards such as grades or money.

2. Immediate feedback. To maximize engagement, the system should provide immediate feedback to all stakeholders; i.e., it should be "ubiquitous" to both students and parents. Students should be able to see their scores any time they're at school, home, or elsewhere. Parents should also be able to see their children's scores any time. Ideally, this means scores should be visible anywhere on the web, as well as on classroom computers and - to the extent possible - even on mobile devices such as PDAs and cell phones. Although there are currently numerous school policies in districts across the nation which might impede use of mobile devices in the classroom, the developer of such a system must consider that technology and school organization will change, and that it might change to the point where students have the ability to read data from the Internet on their own personal mobile devices (whatever those may be).
3. Currency of data. As described previously in this section, conversations with parents who are daily users of online grading systems reveal frustration

with teachers who rarely update their students' grades online. In addition to general ubiquity, participation data should be as "fresh" as possible so that information is considered to be *reliable* by all users.

4. Compatibility with existing systems. An online system should be compatible with software it is intended to replace or work with. The adoption of the new system should not create work or undue confusion. Any effort required in the adoption should be outweighed by the benefits of the system, and that balance should be obvious to the user.

Rogers defined diffusion of innovations as "the process by which an innovation is communicated through certain channels over time among the members of a social system" (1998, p. 20) and listed the five chief characteristics that determine how rapidly the innovation is adopted. These are:

> (a) relative advantage, defined as the degree to which a new idea is perceived as superior to the idea that it replaces; (b) compatibility, defined as the degree to which a new idea is perceived as consistent with the existing values, experiences, and needs of potential

adopters; (c) complexity, the degree to which an innovation is perceived as difficult to understand; (d) trialability, the degree to which an innovation may be experimented with on a limited basis, and (e) observability, the degree to which the results of an innovation are visible to others (Ibid.).

Using the five characteristics cited above as a guide, we developed a list of detailed characteristics for an online participation system. So, in addition to the four strategic goals listed previously, the following specific features each met one or more of the five "diffusion of innovations" characteristics and were deemed necessary in the initial version of the online participation system:

- 24x7 availability from anywhere on the Internet, to users of any connection speed, operating system, or web browser;
- An easy-to-use interface for users of any level of technical sophistication;
- Automated sign-up process to speed spread of the adoption of the system to as many users (teachers, students and parents) as possible;

- Automated user-controlled password maintenance;
- Support for non-web interfaces, such as for PDAs or other connected hardware;
- Support for non-traditional web interfaces, such as Google Gadgets, Yahoo Widgets, and Facebook API;
- Limited student and parent access, to protect private data.

During informal interviews with teachers, the author was introduced to a comprehensive system in use throughout the school district by teachers, parents, students, counselors, and administrators. The Zangle student information system, developed and marketed by C Innovation (www.cinnovations.net), can be used to "manage student enrollment, scheduling, attendance, mark reporting, transcripts, discipline, health, test history, services & programs, English Learner and Special Education programs, student accounting, textbooks, communications, food services and more," according to the web site. (In informal interviews with teachers, it was clear that the most important features are grade maintenance and communication with parents.)

In comparison to the feature set of a mature commercial software product such as Zangle, the potential

list of features above is a relatively short. It's useful then to "check" the work up to this point using an independent list of basic components of an online support system.

In "Learning to Think Spatially: GIS as a Support System in the K-12 Curriculum," the editors of the Board on Earth Sciences and Resources (BESR) developed a list of five functions common to a computer support system:

1. Database construction and management: provides a capacity for data acquisition, entry, formatting, storage, and management (the functional equivalent of long-term memory);
2. Data analysis: performs operations and functions for data manipulation, analysis, interpretation, representation, and evaluation;
3. Memory: provides working memory for tracking the flow of computations and the storage of working and final results (the functional equivalent of short-term memory);
4. Assistance: provides prompts, feedback, hints, and suggestions to guide the choice of data analysis steps and to manage the flow of work;
5. Display: provides a flexible display system for the representation of working and final results to

oneself and to others – in physical form (e.g., a graph on paper, a three-dimensional model of molecular structure) or in virtual form (e.g., on-screen, for hard-copy printing, for export to other software packages) (2005).

Using these functions to "check" the preliminary list of features developed previously, we can see how each of these features satisfies one or more of the functions described in the "GIS" book:

- 24x7 availability from anywhere on the Internet, to users of any connection speed, operating system, or web browser (Function #5, Display);
- An easy-to-use interface for users of any level of technical sophistication (Function #5, Display);
- Automated sign-up process to speed spread of the adoption of the system to as many users (teachers, students and parents) as possible (Function #4, Assistance);
- Automated user-controlled password maintenance (Function #4, Assistance);
- Support for non-web interfaces, such as for PDAs or other connected hardware, for the convenience of

teachers who maintain the data (Function #1, Database Construction and Maintenance);

- Support for non-traditional web interfaces, such as Google Gadgets, Yahoo Widgets, and Facebook API, for the use of students and parents who need to read data entered by the teacher (Function #2, Data Analysis; Function #5, Display);
- Limited student and parent access, to protect private data (Function #1, Database Construction and Maintenance).

It's probably helpful here to explain what is meant by an "easy-to-use" interface. Although the average user may think that the thousands of web pages he or she sees each year represent a sort of graphical diversity, in fact, things are more homogeneous than that. Lynch and Horton explain, "As the web has matured over the past decade, the structure of web pages in text-driven information sites has become more uniform and predictable" (2009). They enumerate ten major features, organized into four regions, which are included on most web pages: a header at the top, providing the page title, a prominent link to the home page, and internal-navigation links; a column containing local-navigation

links, along with search, banner, and contact information; a column of content; and a footer, containing copyright and information. Other than a disabled search box, version 1.0 of myCP contains all of these. The predictability of these components is what makes the myCP site easy to use. According to Lynch and Horton, web site visitors "spend the overwhelming majority of their time on sites other than yours. Any site design should consider the larger design norms and user expectations of the web" (p. 152).

Once a system is designed, developed, and implemented, there must be some way to determine whether it has been successful. The designer should be able to tell if the system is practical to use and if it was successful at motivating students, among other things. One way to measure the success of this online system is by surveying the opinions of the users responsible for the data - the teachers. For this project, a small group of teachers was selected to use the system in their classrooms for three weeks. Teachers were asked to voluntarily use for three weeks, in actual classroom settings, and then report on its success. Details of these results are in the Implementation section of this chapter.

Design

Based on the findings in the Analysis phase, it was determined that the project should be designed as follows.

The product was developed as a simple database-driven system with a series of web interfaces for maintenance and reporting of class participation points. The pages were built using PHP4, with mySQL back-end. The system was originally built on privately hosted Linux/Apache web server and then was moved to a commercial, low-cost hosting service, still using Linux, Apache, mySQL, and PHP 4.0. Login sessions were maintained using the set of built-in routines in PHP 4.0, with sessions supported using either cookies or URLs, depending on the user's browser settings.

During this implementation, any teacher could sign up for a free account with email validation. On creation of a teacher account, a unique site ID was assigned; teachers kept this for the use of parents and students.

myCP was selected for the name of the product - the "CP" standing for "class participation" and the "my" serving both as a familiar prefix (on web sites requiring login to an individual account) and as an acronym with

multiple meanings ("*m*anage *y*our [class participation]," "*m*ultiply *y*our...," "*m*onitor *y*our...," etc.).

The site was designed to be useful for the first-time visitor. All pages on the site had a standard toolbar along the top and a similar set of standard links in the right column. There was also a context box in the top-right corner of each page that shows the username, school, and site ID of the user (teacher) currently logged in. Fonts, line spacing, margins, colors, and other formatting characteristics were consistent throughout the entire site.

All date-sensitive forms used standard HTML text fields for dates, with an optional JavaScript calendar navigation system, similar to those commonly found on airline-ticketing sites and elsewhere throughout the web.

Once a teacher account was created, each teacher would log in to configure his or her profile (contact info, school, etc.), class periods and subjects, and class rosters, where student names are mapped to the school's pre-assigned student IDs. The teacher also chose a default daily point value, used whenever the teacher left a student's point field blank.

During normal daily use, the teacher entered participation points for each student, along with

optional comments about individual students. (See Figure 1 - myCP Teacher Entry Form.) During the first week of class, the teacher announced the site and informs students and parents of the site's URL and the teacher's individual site ID.

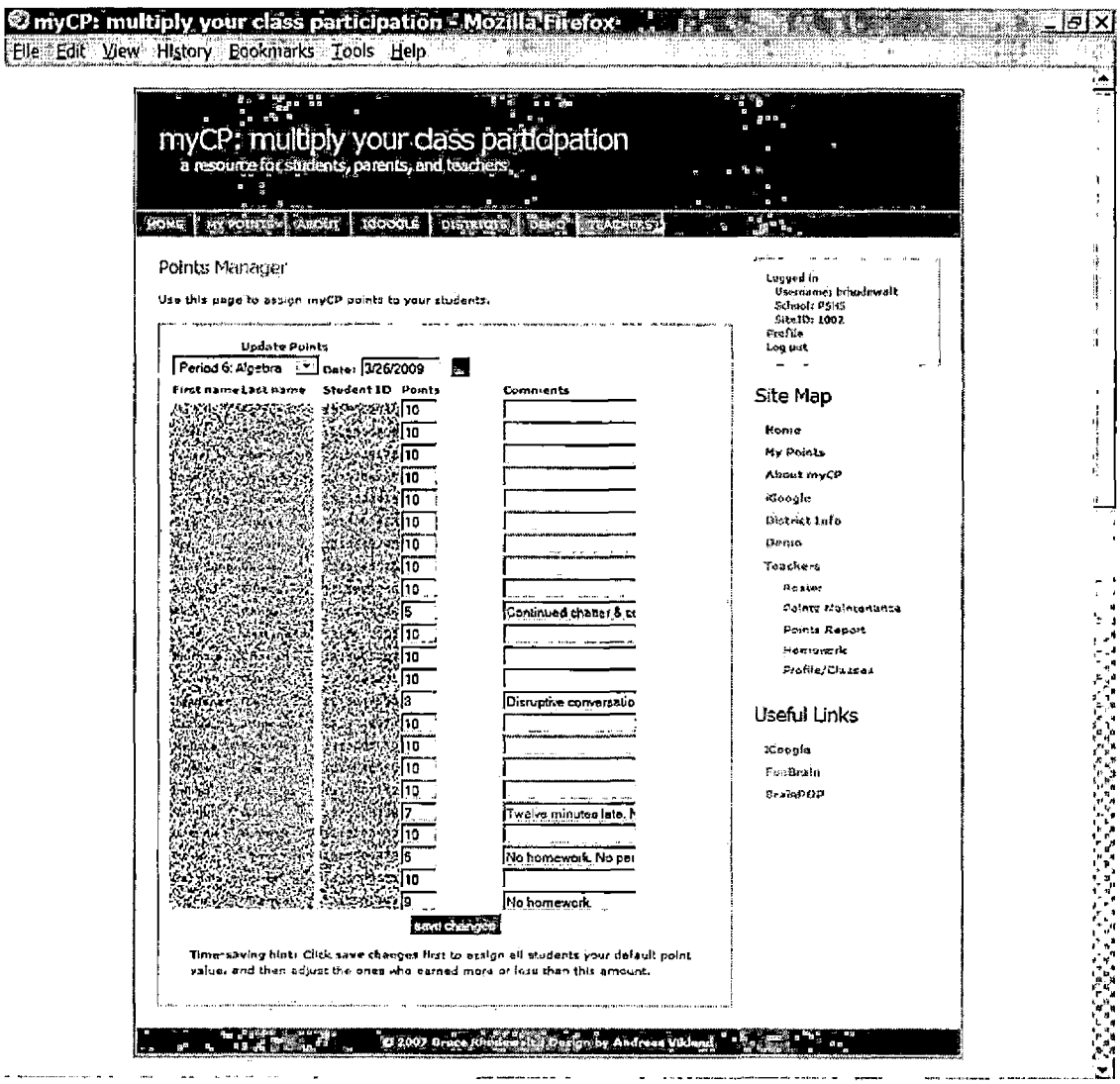

Figure 1. myCP Teacher Entry Form

Students used their teacher's site ID and their own student IDs to look up their class participation points for any selected day. (See Figure 2 - myCP Participation Points Report.) For student and parent activity, there was no security or validation other than this. (This is

the level of privacy expected in the classroom: current scores and grades are typically posted inside and outside the classroom for public viewing, with students identified only by school ID.)

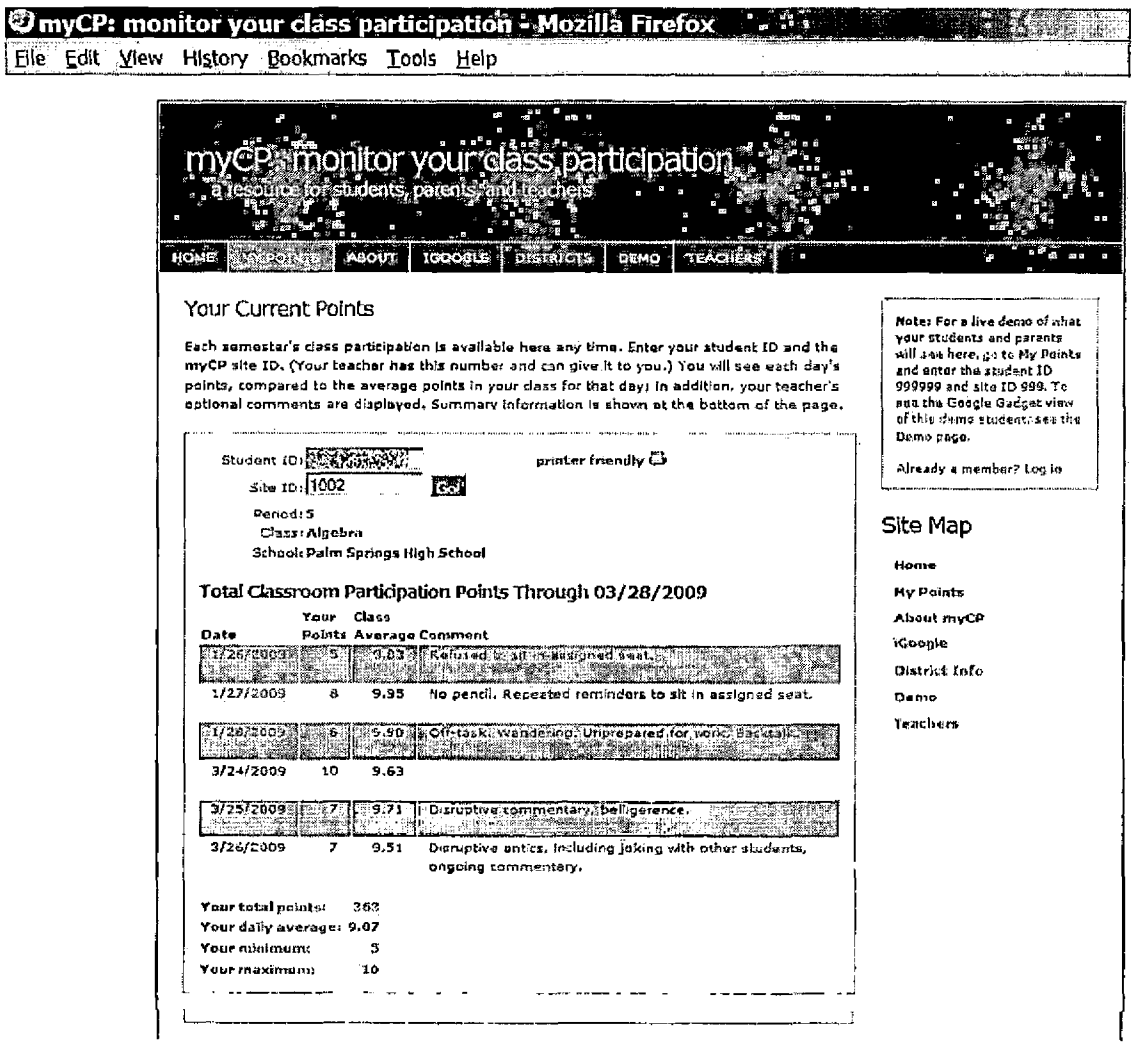

Figure 2. myCP Participation Points Report

For teachers who chose to require regular parent feedback, a parent signature form was linked to the Points Report. (See Figure 3 - myCP Parent Signature Form.) In this form, the student name was displayed and a blank field included for signature. The five records from the previous week were displayed, including comment data.

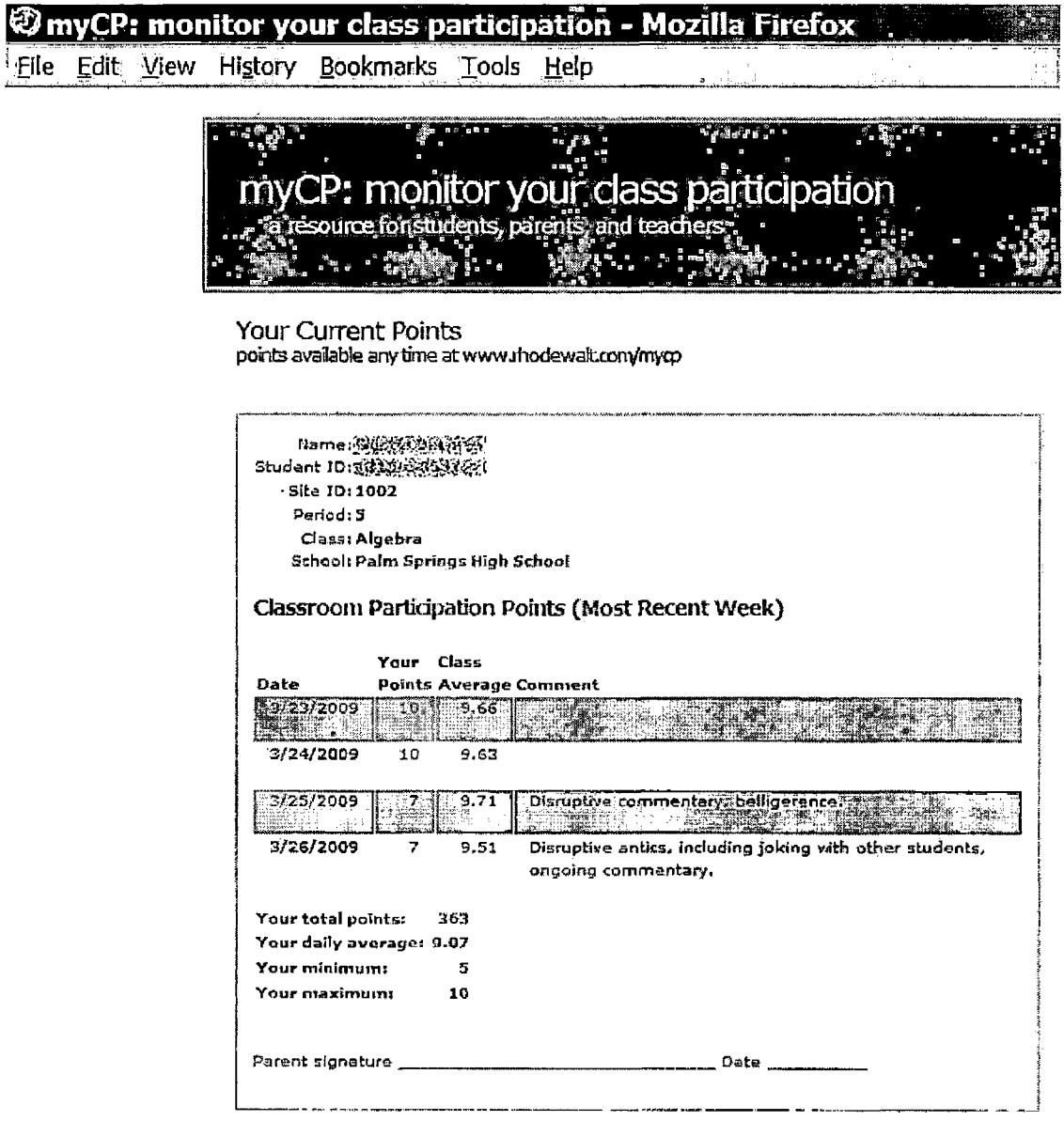

Figure 3. myCP Parent Signature Form

Development

The system was developed by the author over the course of two months. The Linux/Apache/mySQL/PHP

environment was used during earliest development and continues to be the host environment for the system. An open-source template was used for the graphic design, selected for simplicity and cross-browser compatibility. Formatting was done using CSS, vs. HTML tables and font tags, as much as possible.

An iGoogle "gadget" was developed to provide a mini-interface for reporting only. iGoogle is an application for Internet users who want to have a customized "home" or "start" page for their web browsers. Users set up an account with Google, log in, and then choose backgrounds and styles for their home page, adding dynamic gadgets of their choice to the page, including local weather, headlines, clock, mini-Wikipedia search, calendar, joke of the day, etc.

Development of the gadget took approximately twice as much time as the tasks of developing the web system itself. The myCP gadget allows a student or parent to enter identifying information (optionally saved as defaults for subsequent visits) and see the day's participation points and comments, along with related information, such as student name, class name, class point average, and homework.

The "myCP Today" iGoogle gadget periodically checks the status of the central database and has three indicator lights which reflect connection status. All three indicator lights are gray by default and are reset as each connection detail is successfully surveyed. The status lights are: gold (indicates whether or not the gadget was able to connect to the myCP database and look up the individual student), green (indicates whether any myCP data has been updated for the day), and blue (indicates whether the gadget was able to download current data for the individual student). The Google gadget was developed with a very specific purpose: to provide complete "transparency" for student and parent users, who might have a web-enabled mobile device (or desktop) that they check repeatedly during the day and which could effortlessly provide up-to-the-minute, individual class-participation information.

Development plans included adding at least one PDA interface to simplify the teacher's task of adding data to the system each day. Working with a Palm device which supported synching over USB and Bluetooth but had no TCP/IP connectivity (hard-wired, wifi, or otherwise), an inexpensive commercial Palm OS application was tested. Using this application, a small matrix of student names

is displayed on the PDA screen for each class; by tapping a name, the point count associated with that student is incremented. A set of PHP scripts was developed to automate moving data from the PDA desktop (on a Windows machine) to the online database. This allowed the teacher to maintain class-participation points in real time and then upload them at the end of each class or during prep time.

Prior to implementation, the live system was tested on what was to become the production server using real data during the first four weeks of the school year. The purpose of this phase of development was to test for reliability, what is commonly considered the "alpha" test. No students or parents were notified of the existence of the system during this test. Multiple browsers were tested on roughly a dozen different client workstations (running various versions of Windows, Mac, FreeBSD, and SUSE Linux operating systems). The following browsers were used for testing: Mozilla Firefox, Microsoft Internet Explorer, Opera, Apple Safari, and Konqueror. All testing was done over broadband connections, using both Ethernet and WiFi. In addition to commercial home networks, clients were tested on internal networks at two different school districts;

both networks used Internet filtering software (both client and router).

Beyond the usual background of extremely rare page-request timeouts, there were no significant issues with client/server connectivity during the alpha test. There were very few issues with page formatting; as actual data was added, some of the longer student names had minor effects on formatting, and these problems were fixed as they appeared.

The PDA interface was both unwieldy and insufficient to include comments. This and the fact that it depended completely on a piece of third-party software which had no guarantee of existing through the year made the PDA interface into a "weak link" in the whole system, so it was completely dropped by the end of the month.

The iGoogle gadget required repeated adjustment because of issues with data cacheing both on the Google server and the client. Google's development environment for gadgets was in the earliest phase of its life cycle and was, to put it plainly, flakey. However, with persistence, the modifications to the gadget improved its reliability to the point where it too could be considered ready for production. (There was a tease on the myCP home page about a low-cost upgrade for the iGoogle gadget;

this would have incorporated a series of scripts to move data from the PDA to the web site. Informal versions of the scripts were developed; however, no users signed up for this service, so development of a commercial package was never an issue.)

Implementation

Development of myCP ended in time for implementation at the beginning of spring semester. Addition of new features had been halted purposefully more than a month before, with the result being that the system was stable enough for beta test. Teachers were selected from several schools in Southern California; they provided rosters from several classes for upload. They were then trained by email and phone. Teachers were encouraged to promote the system actively to the other stakeholders (students and parents). Most of the teachers, however, did not make promotion a priority, most likely due to the daily distractions of the classroom.

Since this prototype system operated in production on the same server used for development, there were no technical implementation steps beyond development itself. A key part of implementation is the publication and promotion of the system. This was done more consistently

in some test classrooms than others. Ideally, teachers would have taken a little bit of time to mention myCP during lessons, posted signs in the classroom, and printed reminders to give out to students, parents, and other teachers, all including the URL of the site. In some classrooms, students were reminded regularly of the site's existence and the importance of the data. As was anticipated, the teacher who promoted the system the most was the one who saw the largest effect on class participation, while the teacher who promoted the system the least saw no effect on class participation. (See Table 1 - Teacher Survey Results.)

Table 1. Teacher Survey Results

Teacher Survey Results

Teacher	The myCP system was easy to set up.	I incorporated the myCP system into my students' grades.	I provided the location and usage instructions of the myCP system for my students.	I informed my students' parents of the existence and purpose of the myCP system.	I provided the location and usage instructions of the myCP system for my students' parents.	The myCP system motivated my students to participate actively in classroom activities.	My students were informed of the existence and purpose of the myCP system regularly.	The myCP system was convenient to use for tracking daily participation.
Teacher 1	5	5	1	1	1	1	1	1
Teacher 2	4	4	3	3	2	2	1	1
Teacher 3	5	5	5	5	5	4	5	5
Teacher 4	5	5	3	3	3	3	3	5
Mean	4.75	4.75	3.00	3.00	2.75	2.50	2.50	3.00
Std. Dev.	0.43	0.43	1.41	1.41	1.48	1.12	1.67	2.00

Legend

5	SA	Strongly Agree
4	A	Agree somewhat
3	N	Neither agree nor disagree
2	D	Disagree somewhat
1	SD	Strongly Disagree

The system had a reliability of about 99.9%, dependent only on the availability of the web server. (The web server was hosted by an extremely competitive commercial organization named Dreamhost. Server outages occurred about once a month for an hour or so each time, equating to 99.86% availability.) As mentioned in the Development section, maintaining points through the PDA interface turned out to be too complicated to use in real-time; additionally, there is no way through the Palm OS application to include comments. For this teacher, it made more sense to track participation on the day's paper attendance form and then enter each day's data in the system at the end of the day. With the default-points feature of the system, on good days it took only five minutes to transcribe all points and comments for five classes.

More importantly, there was no simple way in version 1.0 of the myCP system to make flexible text-only printed reports. A "previous week" option was available, with a field for parent signature, but this left no simple print report for the days after long breaks (including winter and spring breaks). Subsequent versions of the system need to include a Print option for students and parents, which will allow filtering by date, as well as a

teacher's Print option, with filtering by date, class, and student.

Another issue for users was CSS compatibility in Internet Explorer. The system was originally developed and tested using several recent versions of Firefox, Opera, and Internet Explorer; however, some users of Internet Explorer reported "blank screens" on key pages. Specifically, all content within the main region of the My Points page appeared to be completely missing in some versions of Internet Explorer. The data arrived on the client computer but then was not rendered by the browser. The user would see only context information, such as navigational menus and help text. For the next version of myCP, this problem needs to be identified and corrected.

An unanticipated problem arose regarding user expectations and habits. Seeing a "Log In" option - intended to be used for teachers who maintain the data - some students and parents tried to log in instead of just using the My Points page. This would be a frustrating experience for the user, who would try to create an account, only to be denied access (since teacher-account creation was subject to manual approval by the myCP developer). Although myCP was developed with the intent

that individual students would not need an authenticated account to access their points, some users see the "Log In" link and click it. In future versions, color signage should grab the attention of students and parents and direct them clearly to the My Points tab.

Evaluation

Two seemingly important features of the system turned out to have no value and probably didn't need to be developed in the first place: the PDA interface and the iGoogle gadget. In the first case, the PDA interface was impractical. There may be a PDA application that is more practical for the purposes of myCP, but it would need to be able to accommodate all students in a room (around 40) for both numeric input and comments, a real test of available real estate on such a tiny screen.

In the second case, to add value to the myCP system, the iGoogle gadget is dependent on a critical penetration of the Internet-user market by iGoogle itself. In 2009, iGoogle as a portal has come into direct competition with Facebook, and it isn't clear that Google is actually winning that contest (see "Google's Game Show: All About Facebook?" 2009).

The fact that two large components of the system were developed when they ended up not being useful points

to the validity of the ADDIE model itself. Through more thorough research, it probably could have been determined, at least in the case of the iGoogle client, that the audience was not large enough to warrant consideration of iGoogle at all. Although it's impossible to predict with 100% certainty where a rapidly developing technology (in this case, the Internet) will be a year down the road, the purpose of the Analysis phase of ADDIE is to define *current* need. The mere existence of "interesting" technology - e.g., customizable portals such as iGoogle and Pageflakes - even with an enthusiastic pool of developers, does not actually serve as evidence that an audience of end-users exists.

As mentioned in the Development section, flexible text-only printed reports are needed. There is no way to run a report the day after winter or spring break for the school week preceding it. To resolve this, most likely a new Print page should be developed with a set of fields to guide parents through filtering by date. This should happen without losing the "quick print" option that currently exists. (This might require adding one or more settings to the teacher settings, allowing the teacher to specify holidays, break weeks, etc.) The Print page

could be sensitive to whether or not the user is an unauthenticated student or parent or an authenticated teacher, and presenting additional filtering options to authenticated users, such as class and student.

Regarding the CSS compatibility issue in Internet Explorer, although it would be nice to isolate the problem and re-code to fix it, it's possible it only appears in a tiny minority of the systems on the Internet, for example if it's an obsolete version of Internet Explorer in use by fewer than 1% of the users. If this could be determined, then the most practical approach might be to define this version of Internet Explorer "not supported," rather than spending additional time fixing the bug.

Summary

In summary, the myCP product is solid technology and may prove useful to some teachers as a tool for motivating participation by students in the secondary classroom. Before any concerted effort is made to roll it out on a large scale, however, end-user tools for custom reporting must be developed. Users at all levels should be provided with more training.

CHAPTER FOUR

CONCLUSIONS AND RECOMMENDATIONS

Introduction

With a working version of the myCP system installed and tested, what lessons have been learned, and what might have been done differently? If someone were starting development of such a system today, what could be done better? As for the future, what should happen next to better address the needs of the stakeholders?

Lessons

What could have been done differently, to produce a better V1.0 product? Although parents are acknowledged in Chapter 2 as stakeholders, very little actual attention was spent during literature review or alpha test to understand parent involvement. Use of the product by parents is key to product acceptance, and so soliciting parent opinion from the earliest phase would have been useful.

A better understanding of what interface components make software "easy to use" would have helped to focus limited development resources on the most important features. A body of research exists for measuring and analyzing user interfaces for several metrics, including

ease of use; this research was undiscovered during the course of myCP development (Davis, 1989).

Perhaps the biggest surprise from the myCP project was the complete lack of interest in the iGoogle gadget. With more cell phones (traditional or "smart") in the classroom each day, it's reasonable to assume there will be a point of critical mass: effectively, most students will have real-time access to the CP points maintained on the web server. There's a dilemma, however: although the technology exists to improve the state of engagement in the classroom, the personal devices to make this happen are banned or otherwise restricted in a majority of American classrooms (Obringer & Coffey, 2007). In recent years, some educators have lobbied for the use of these devices as educational tools (Manzo, 2008, Rawaswami, 2008, and Docksai, 2009); however, students' imaginative choices of inappropriate use of cell phones (e.g., taping teachers' tantrums and posting the video to YouTube) continue to make the devices unpopular with administrators, teachers, judges, and legislators (Simpson, 2008).

If a "gadget" won't reach a critical mass of students in the classroom, what about their parents, in offices and cubicles? With over 250 million Americans

now using Facebook (Lyons, 2009), couldn't this popular social-networking site be a convenient way to reach parents, especially those who spend most of their day at a desktop computer? Research has found that many Facebook users are obsessive - college students in one study, for example, showed a significantly lower GPA if they were Facebook users (Riley, 2009) - so it's reasonable to imagine parents tied to their children's myCP scores in real time. Analysis of this opportunity would perhaps be a useful component in any future myCP developments.

Anticipated Improvements

As a version 1.0 piece of software, myCP does what it was intended to do. It was shown to be reliable, with general availability of the system competitive with large commercial products. Teachers who used myCP during beta test generally needed less than an hour of training in total. Based on printed weekly reports submitted by students in class, students and parents who used the system had very few problems with it. (Two issues have been described in Chapter 3, and these are addressed below as opportunities for improvement.)

For version 2.0, anticipated improvements fall into three categories: (1) cosmetic and navigational changes,

to bring users and data together more expediently, (2) fundamental changes to fix issues of security and privacy, and (3) "promotional" additions, to make adoption of the system more attractive, especially to districts.

The following are cosmetic or navigational improvements which should be considered if the myCP product continues development:

- Online help. It is customary to provide a series of help screens for an application such as this. These are typically accessible through multiple means, such as clicking on context-sensitive balloons and through a set of help files, organized into an index and a table of contents. The most thorough online help available in the current version of myCP is a demo page. (Visitors can see live data set up in a "demo" account.) There is also the traditional About page, which includes an FAQ sidebar. All of these support pages are essentially sales tools, not intended for supporting the efforts of active users. Each input or reporting screen used by the stakeholders included static instructions; however, context-sensitive help would be more useful.

- Text brevity. Most of the original pages in myCP are organized in full-size paragraphs which span 80% of the width of the page and avoid most formatting, very atypical of web sites in 2009, especially commercial web sites. In the next version of the product, consideration should be given to rewriting all web pages, with special attention given to breaking up the large, gray blocks of text.
- Roster import. Currently, teachers populated their classes in myCP manually, adding each student manually to the roster for each class, with one field each for first name, last name, and school ID. This is the biggest step for any teacher new to myCP and could conceivably be the step that prevents a teacher from adopting the system. A simple import method, where a teacher browses to a standard-format tabular file (e.g., CSV or XLS, created in advance from a spreadsheet program), would make this process significantly quicker.
- Links which directly address stakeholders. The main navigation screen in myCP (see Figure 4 below) should be redrawn to indicate which options

are useful to which stakeholder. The most important issue to address here is the problem of students attempting to log in, described in Chapter 3. The My Points link should be additionally tagged with the word Students. Maybe this means there should be a level of hierarchy added to the main navigation, so that the main menu (currently along the top of the screen) would read (in a condensed version:

Students: My Points, FAQ || Parents: My Points, About || Teachers: Log In

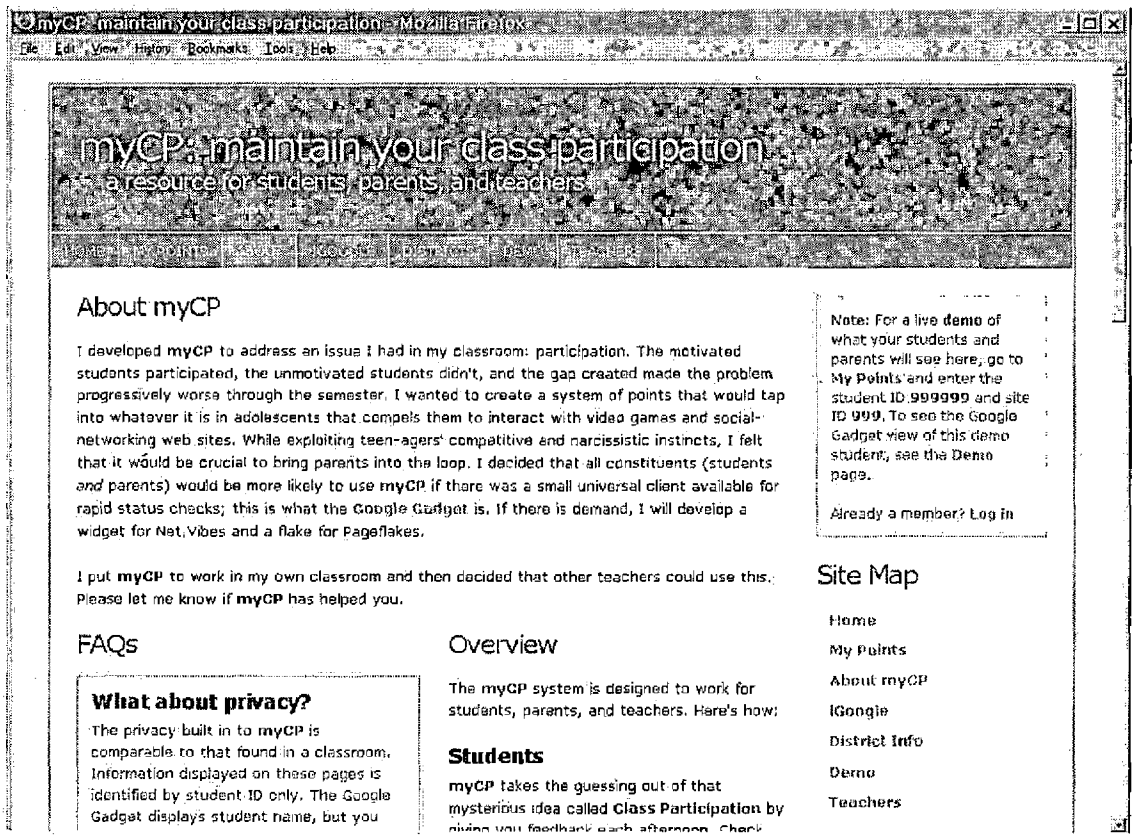

Figure 4. "About myCP" Page

The following are improvements which could be made to improve security and privacy:

- Improved privacy for student information. In the current system, the only information needed to look up a student's points is the school ID number of that student. This level of privacy is based on the model in use in schools, where the teacher posts scores on a wall or window, indexed by student ID. Most students don't know anyone else's ID other than their own, so privacy isn't compromised. However,

on the Internet, with so many thousands more strangers within a local geography, and no one needing to actually walk onto a campus in order to poke into others' business, the potential for unwanted access is much larger. An additional piece of identifying information - such as the library code on the student's textbook - could make this private information more secure.

- Secure transactions for data input. Currently, myCP uses standard HTTP to send information between teachers and the myCP server without encryption. By adding a common secure-data feature to the myCP server, teacher data would be encrypted and protected from the numerous hacks available to unscrupulous web users.

The following are steps which could be undertaken to hasten adoption of myCP in the education community:

- Promote adoption by districts. Although there is a page on the current myCP web site, linked to the main menu, which discusses points about myCP meant to encourage district adoption, the effort stops there. In order to get to a critical mass of users, there should be a concerted promotional campaign to sell the product to districts, with promotional

rates and free technical support if needed. This leveraged approach would have the potential to reach more teachers than a haphazard word-of-mouth campaign directed at the teachers themselves.

- Promote competitiveness. Fundamental to myCP's original design was the assumption that students would want to get as many participation points as possible, whether from the natural inclination of most students to get good grades or from the opportunity to compete with classmates. However, some research has shown that neither individualistic nor competitive goals are the most motivating for students; the opportunity to improve the score of a group, as a member of that group - what's called a "cooperative goal structure" - is more effective than either an individualistic or a competitive goal structure (Ke, F., 2008), so myCP might be set up to support this. In support of a cooperative goal structure, the system could possibly be organized so that students could be assigned to groups within a class. This would be an optional setting that individual teachers could control.

Summary

Class participation is a crucial ingredient in a well-run classroom, and the first version of myCP shows that it is possible and practical to hand over nearly all aspects of tracking this to an automated system. The step from version 1.0 to version 2.0 is important and could either be the moment when the system languishes or could be the point where the system takes off and gets widely adopted. The difference might amount to what kind of research gets done and how carefully that research is used to choose the next direction. Alternatively, the experience of the myCP product could be used by an enterprising individual or organization to begin fresh and develop something radically different from the ground up.

APPENDIX A

SURVEY INSTRUMENT

This survey was administered via email. Participating teachers were sent this survey and given three days to complete and return it. All participating teachers completed the survey. For reporting, answered were coded as follows: SA=5, A=4, N=3, D=2, SD=1.

MYCP SYSTEM SURVEY

Thank you for agreeing to be part of this study, which is designed to investigate student motivation. This study is being conducted by Bruce Rhodewalt under the supervision of Dr. Brian Newberry, Department of Science, Mathematics and Technology Education. This study has been approved by the Institutional Review Board of California State University, San Bernardino.

You used the myCP participation-tracking system in your classroom for at least two weeks. Please rate your experience with the myCP system by choosing the best answer for each of the following questions.

SA=Strongly Agree
A=Agree somewhat
N=Neither agree nor disagree
D=Disagree somewhat
SD=Strongly Disagree

1) The myCP system was easy to set up.

2) I incorporated the myCP system into my students' grades.

3) I provided the location and usage instructions of the myCP system for my students.

4) I informed my students' parents of the existence and purpose of the myCP system.

5) I provided the location and usage instructions of the myCP system for my students' parents.

6) The myCP system motivated my students to participate actively in classroom activities.

7) My students were informed of the existence and purpose of the myCP system regularly.

8) The myCP system was convenient to use for tracking daily participation.

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