Designing Interesting Learning Environments When the Medium isn't enough

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Abstract Educators broadly agree that interest plays an important role in learning. In our work, we develop learning environments that align learner interest and important adult-defined learning objectives. Through this work we have come to recognise the complexity of the enterprise of this kind of learning environment design.[1] At this stage, we have a relatively stable design model in the passion curriculum design approach.[2] Missing, however, is a basis for analysing the interests and engagement of individual learners as they interact with a learning environment over time. This paper describes the theoretical and design frameworks we use, and recounts our most recent curriculum implementation, Multimedia Studio, and how it exposed this critical gap in the design model. We found that designing for learner interest is an even more complex undertaking than we originally understood. The lessons learned demonstrate the challenges of interest-centred approaches to curriculum design and can inform the work of other learning environment designers and researchers working in similar contexts.

Introduction The use of electronic media as a content source in education, though mildly controversial, is already widespread. Increasingly, electronic media are being offered to young students not only to provide content but also as production tools. Learning to create as well as consume media can open economic doors for young people, as well as opportunities for self-expression and political participation. Research suggests that by engaging in media design, students can develop important cognitive abilities such as planning and problem solving,[3] and collaborating with peers.[4] Other researchers have found that challenging students with design tasks provides an authentic, social context for learning science content as well as understanding the process of design.[5] Media development is a powerful learning context that allows students to make connections to their personal interests as well as 'epistemological connections' to important domains of knowledge.[6]

We use media development activities for all of these reasons, and especially because such activities easily serve our need to centre learning environments in experiences that will be interesting for

learners. We are learning environment designers concerned with issues of motivation and learning. Our goal is to construct theories and blueprints for creating learning environments that make effective and efficient use of learner motivation to press toward ambitious learning.[7] We use a curriculum design model called the passion curriculum design approach. Our first two curriculum designs have used new media development, specifically videomaking and website design, as core activities that we expect to draw learners' interest.

In our learning environment design work, we are committed to two strong goals: using learner interest as the primary driver of activity (for reasons we will explain in detail), and providing activities that address learning objectives defined by adults as important. A tension exists between these two goals, in that some learning objectives that adults think of as important are not inherently of interest to all learners. We work toward resolution of this tension by developing learning environments grounded in theories of motivation and learning, and testing those learning environments in the real world, using a research and development approach known as design research.[8]

We have found that the strength of our students' interest tends to waver over time.[9] Others have seen the same phenomenon in their work with interactive media design curriculum.[10] In our most recent curriculum design effort, Multimedia Studio (MMS), we anticipated the wavering of learner interest. We used the passion curriculum design approach[11] to create activity designs that included preventive measures in advance of any wavering of student interest. Based on the passion curriculum model, we developed specific activity designs that used motivations such as reward, social motives, challenge, and progress to move work forward when interest was low. While the passion curriculum model supported our development of activities, we did not have in place mechanisms to track and support learner interest and engagement over time. Learners interacted with the curriculum in ways that highlighted this gap, and helped us to zero in on three areas of work to address in ongoing development of the passion curriculum approach: understanding and addressing instability in learner interest, understanding and addressing slow-downs in learner activity, and creating relevance for specific activities. This paper is about how we designed a learning environment intended to handle the tension between learner interest and adult-defined learning goals, and how our students' experiences in that learning environment taught us hard lessons about the complexity of the problem.

This paper documents our design research on the passion curriculum approach. In educational design research, investigators create interventions in collaboration with real world practitioners, test those interventions in the real world, and use the real-world testing to

formatively evaluate the intervention. Findings feed back into a new cycle of design, testing, and formative evaluation. In addition, these findings help to build theories regarding design of such interventions and regarding novel situations created by the intervention. The goals of design research include creating improved interventions tested in the real world, increasing capacity on the part of practitioners and researchers, and developing theories grounded in real-world experiences. The intentions, methods and possible outcomes of design research differ from those of experimental research. Design research provides a powerful context for the development of design theories – general principles for design of particular kinds of learning environments, and design methodologies – guidelines for development of learning environments.[12] The work we relate here began with an existing design theory, the Interest-Driven Learning Framework, and an existing design methodology, the passion curriculum design approach. This design cycle used learner behaviour in a real-world passion curriculum to raise questions that will guide the next generation of passion curriculum design, addressing on-the-fly analysis of learner motivation by teachers.

Why learner interest matters

We are committed to developing learning environments that centralise learner interest. Progressive educators and learning environment designers have recognised this goal for a long time. Some of the strongest arguments for this position come from motivation research.

Many motivation theories break down motivation into a variety of motivational 'constructs', like reward, social motives, challenge, and interest. When we use the term interest, we mean a specific kind of motivation having to do with an attraction to the specific content or processes involved in an activity. This differs from other kinds of motivation, such as wanting money offered for doing the activity, or wanting to be friends with the others involved, or feeling that the activity offers a good challenge. Psychological research on motivation, particularly in the area of reading, has shown that interest leads to increased engagement, attention, and learning.[13] In fact, interest is particularly important with respect to deep learning, by comparison with surface-level memorisation.[14]

These findings align well with theoretical expectations in motivation research, from several important perspectives. A key distinction in research about motivation learning is between intrinsic motivation, and extrinsic motivation. Intrinsic motivation is considered to arise directly from personal connection and enjoyment. Extrinsic motivation is instrumental, for example, learners might complete an activity in order to receive a reward. Extrinsic motivation is very powerful for motivating behaviour – extensive research on reinforcement makes this quite clear. However, it is problematic for motivating learning in terms of how it

organises attention – learners attend to the reward (or punishment) and strategies for acquiring it (or avoiding it), rather than to the content of the learning activities or the learning objectives. Even more problematic is the tendency of extrinsic reward to actually disrupt intrinsic motivation.[15] Interest is an important form of intrinsic motivation.

A second important distinction in motivation research is between motivation for mastery, and motivation for performance.[16] Learners who are oriented toward mastery focus on the task at hand, while learners oriented toward performance focus on judgments of others. A performance orientation tends to focus learners on concerns about outperforming others, and leads to selection of less challenging tasks.[17] Interest is very much connected with mastery orientation.

Some theories focus directly on interest as a motivational construct. Researchers have considered interest as a sustained personal phenomenon, and as 'situational interest', an experience akin to curiosity, arising from the occurrence of something surprising. In the passion curriculum work, we are mainly concerned with personal interest. Interest has been associated with feelings (enjoyment) and values (a sense of importance of the content or activity). An interest could be related to one or the other of these attractions, or to both. It stands to reason that an activity or idea that is inherently interesting (ie enjoyable and valuable) to a learner would be a very powerful context for learning – motivation arising from interest is very close to a desire to know more about the activity or idea, not just a desire to do the activity. Interest carries with it an implicit motivation to learn.[18]

Several theories address basic needs and desires that provide reasons for engagement.[19] People are more willing to do things in areas where they have confidence.[20] They are more willing to engage in activities that allow them to feel in control of their successes and failures. This sense of control emerges from perceptions of personal competence and autonomy.[21] People seek activities that provide a sense of self-determination by hitting the right level of challenge to provide stimulation and a sense of personal causation.[22] With these basic desires satisfied, engagement is more likely. Mastery-oriented motivations like interest are more likely to foster confidence, control, competence, autonomy, and challenge. By playing to learner interests, these other powerful motivators are likely to come along.

It is important to note that we are speaking here of motivation for learning, rather than motivation for action. Learning environments are developed to address precisely those areas where learners do not yet know very much. Under these circumstances, learners are particularly *un*likely to feel confident, in control, and self-determining. Interests may therefore be particularly fragile in contexts designed for learning. One

thing we can do in designing learning environments is to highlight opportunities for self-efficacy, control, and self-determination. Our framework for designing learning environments around learner interest makes use of this strategy, as we will describe below.

Much of this research can be characterised as 'achievement motivation'. In other words, the theory and research we have been describing has been developed in the context of thinking about learning in school, where activities are organised around achievement (of grades, graduation, future opportunities). However, many powerful opportunities for learning, such as after school programmes, are organised around other goals (social connections, interest, etc). It is possible that some of the theories and relationships between types of motivation would appear different in environments organised around goals other than achievement.

hy the problem is hard

Given the power and importance of interest to drive learning, it seems obvious that we should design learning environments to serve learner interests. The growing press for learner-centred education reform[23] can be interpreted as evidence for the appeal of this idea. If all we need to do is to provide interesting content, then multimedia design is a great resource. Media development comes with built-in capabilities to engage students' personal interests as a way to explore new ways of thinking and doing.[24] Unfortunately, while interest is an extremely powerful motivator of learning, it is not especially robust. No matter how interesting it might be, media development involves extensive commitment, challenging work, and adopting identities that may or may not be attractive to particular learners. Any of these influences can undermine interest and pull learners away from interest-based activities.

The interest-driven learning framework

The Interest-Driven Learning Framework provides a basis for making direct use of motivation research in the design of learning environments. We have argued that interest is a key motivator for learning, but that its fragility calls for great care in designing to centralise interest. Edelson and Joseph[25] have developed the Interest-Driven Learning Framework (IDLF), a design-based perspective on motivation. Edelson and Joseph consider learning environment design as involving two major categories of work: designing content – the core ideas and activities that learners encounter; and designing context – the surrounds of the learning activities (including degrees of difficulty, working groups, and incentives). Interest is the motivational construct most strongly associated with extended attention, background knowledge and retention of learning.[26] Interest is a powerful motive in its connection to learning, but brittle in that its strength can be reduced when activities take a long time, or when they are difficult. Though they do not seem to provide the same cognitive value, other motivators can be strong in generating activity, and are sometimes more reliable than interest. Reward, for

example, can induce students to engage where they might not have otherwise. At the same time, reward and other non-interest motives can distract from interest and learning.[27]

The IDL framework therefore proposes that the design of content be connected with interest as much as possible given circumstances, and that the context be designed to use other motives in support of interest-based work. Using this analysis, the IDL framework divides existing motivational constructs from the research literature into two major categories that align with the tasks of learning environment design: interest is associated with the design of content, and other motivators are considered 'context-based' with regard to their role in design.

Learner motivation tends to waver after an extended period of time, even in a curriculum that intends to connect with learner interest.[28] As a solution to precisely this problem, the IDLF proposes consciously making use of motivational constructs in curriculum design. A second problem can also emerge in learning environment design: in some cases, students do not know enough about a new task to understand its relationship to their interests. Interest problems thus arise at the beginning as well as in the middle of learning tasks. The IDL framework proposes two key strategies to support learning environments in the case of initially low interest, and in the case of wavering interest after an extended period of time: *initiation* and *maintenance*. Initiation entails using context-based motivation to kick off a project that will eventually lead to interest. For example, a learning activity might not immediately appear relevant to learners. In this case, a teacher could create an activity such as a competition in order to create social motives that would engage learners in activity until they learned enough to understand how it had relevance to their interests. Maintenance involves using context-based motivation to prop up learner motivation in moments where interest wavers. For example, a designer might place interim deadlines at strategic points where interest could be expected to lapse. These deadlines would create motivation to complete activities, thus maintaining learner engagement.

The IDL framework organises the context-based motivators, derived from the psychological research on motivation, into four major categories: effectiveness, progress, social motivators and extrinsic motivators. Effectiveness is derived from the literature on self-efficacy[29] and self-determination,[30] and includes two constructs that have been previously considered the design of learning technologies:[31] challenge, and control. The literature argues that people seek a level of challenge that is sufficiently stimulating without being overwhelming. Furthermore, in order to be truly engaged, people need to experience a sense of being in control of their success. This means that activities need to be structured sufficiently so that learners feel they have a sense of what to do, and also open-ended enough that they feel they can exercise choice. This means

that in order to design for effectiveness, designers and teachers must consider students' *perceptions* of their capabilities and desires for freedom, as well as their *actual* capabilities and desires for freedom. Progress is motivation resulting from a sense of motion across a sequence of activities, and relates to the proximity of goal.[32] Motivators include a desire to experience completion, as well as a desire to protect 'investments' of time and effort – in other words, people are motivated not just to complete for completion's sake, but also to complete in order to avoid wasting time and effort. The motivation to reach a deadline falls into this category. Here, design means setting appropriate milestones to ensure that the experience of completion happens at intervals appropriate to particular students and particular projects.

Learners are impacted by social motives as well. For example, social factors such as pleasing parents and spending time with friends are critical in how learners determine whether a task has utility for them.[33] Social motives connect with performance motivation. Key constructs in this category include role motivation, affiliation (the motivation to be a member of a desired social group), and obligation (the motivation to fulfil a perceived obligation to others). By recognising these constructs, designers and teachers gain access to a variety of design possibilities around assigning or offering choice regarding working groups and roles within them. The final category in the IDLF is extrinsic motivation, which Edelson and Joseph frame as including reward as well as advancement motivation – the motivation to do something in order to become eligible for a new opportunity (for example, a high school student who does not like maths might be willing to take a maths class in order to earn the right to attend a desired post-secondary institution).[34]

The passion curriculum design approach

Having introduced the IDLF, we now describe the passion curriculum design approach, a theoretical and practical guide to developing effective interest-centred curricula. The approach relies on key learning environment design theories including Cognitive Apprenticeship[35] and Goal-Based Scenarios.[36] This guide was the formal design basis for our instantiated case of interest-based design, the Multimedia Studio. Developed concurrently with the IDL framework, the passion curriculum design approach is a guide for capitalising directly on learner interests in the design of curriculum. The approach was initially conceived as the curricular basis for a new kind of school, a 'passion school', in which (1) students are assigned to curricula on the basis of their interests; (2) students learn through active engagement in meaningful works in interaction with expert adults and more and less advanced students; and (3) through this work, learners grapple with important ideas, including adult-defined core competencies such as those found in state and national standards. Four core design principles organise passion curriculum development:

- Honour learner interests in all elements of the learning environment (the interest principle);
- Locate all activities in meaningful work (the authenticity principle);
- Ensure a rich social context (the social context principle); and
- Use 'context-based motivators' to support interest (the context motivation principle).

Table 1. The Context Motivators[34]

Context Motivator	Description
Effectiveness	Motivation resulting from activities that enhance a learner's perception of personal effectiveness
Challenge	Motivation resulting from activities with an appropriate level of difficulty
Control	Motivation resulting from activities with an appropriate balance of structure and free choice.
Progress	Motivation resulting from progress through a sequence of activities.
Completion	Motivation to complete a task.
Investment	Motivation resulting from time or effort already expended on a task.
Social	Motivation resulting from the social context in which an activity takes place.
Role	Motivation to play a desirable social role in an activity.
Affiliation	Motivation to be a member of a desirable social group.
Obligation	Motivation to fulfil a perceived obligation to others.
Extrinsic	Motivation to receive a benefit that is not integral to the task or activity.
Reward	The motivation to receive a token with real value.
Advancement	The motivation to become eligible for a new opportunity.

The passion curriculum design approach enacts these principles through several design processes: theme selection, alignment of learning objectives with interest-based activities, designing student projects, designing 'certifications' for students, designing the community life of the passion curriculum, developing an apprenticeship progression, executing instructional strategies, and designing the infrastructure (space, time, materials, resources). The model provides specific guidelines for executing each of these processes.

Three of these elements, themes, projects, and certifications, are especially carefully designed to make use of learner motivation, using the IDLF. First, the classroom is organised around a theme of interest. In an ideal passion curriculum, learners have the opportunity to choose between classrooms that highlight different themes. The classroom community then consists entirely of students who have explicitly selected that theme, indicating a likely interest (though other motives might be involved in classroom selection as well). A second support for interest comes in the form of projects. Projects are significant works in the domain of the theme. They are well-defined processes that include a

proposal phase, an execution phase, and a culminating activity based on professional work related to the theme. Projects are organised to allow learners to determine the content, giving them the opportunity to highlight matters of personal interest in addition to the theme. Because content is generally open to student choice while processes are well defined, projects provide an environment that strikes an appropriate, motivating balance between freedom and structure. Certifications also echo the interest – they are assessment structures modelled on professional certification in the domain of the theme. In addition to interest, certifications are also designed to exploit context-based motivation, especially reward and social motivation, to press forward the most difficult and painstaking work of the curriculum. Specifically, certifications include a task set, a standard for each task, and task standards. Certifications provide explicit rewards in the form of a completion package – a set of rights, titles, and responsibilities accruing to certified individuals. Certifications are even more highly structured than projects, presenting a clear set of expectations to serve both pedagogical and motivational purposes.

Supporting interest when it wavers

In passion curriculum design, we expect that learner interest will flag over an extended period of time, as well as in the face of difficulty. We also expect that at the beginning of any project, learners will be faced with learning objectives whose connection to the theme of interest is not yet salient. We therefore use several specific techniques as initiators and maintainers to support motivation when necessary. These include 'Speed projects', contests, and interim checkpoints.

Speed projects are intended to exploit progress (deadline pressure) and challenge motivation in order to encourage students to engage with and practise particular skills that might not arise during the course of ordinary projects. These very short projects (generally less than 30 minutes) are highly structured, and demand high-intensity engagement in order to complete them within the timeframe. Contests invoke challenge and status motivation in the context of a competition. In practice, we use these sparingly, as we have seen that learners have very different motivational responses, not entirely in the best interests of their learning.

Interim checkpoints are intended to provide progress motivation. One technique we have used is a 'pluses and wishes' critique ritual, learned from a classroom teacher. In this ritual, participants note what they appreciate, as well as what they would change, about other students' project work. This particular kind of checkpoint also invokes social motivation.

The first passion curriculum, Video Crew, was designed and initially taught by Joseph as a curriculum enrichment project and as an after-school club at a large, diverse, low-income public elementary school in the Midwest 'Meadow' school (all names of schools and students have been changed). Since then, Joseph and two others have refined and taught Video Crew in an after-school club at 'Midway', which also hosted Multimedia Studio.[37] The fifth grade class in a small private school, 'Vista', in the suburbs of a Southern city, uses Video Crew as a central part of the regular curriculum. Plans have been made to use Video Crew within the ordinary curriculum at Midway school as well, beginning in Spring of 2003. Multimedia Studio, a new passion curriculum first implemented in Autumn 2002, is our first foray beyond the initial passion curriculum prototype.

The Multimedia Studio

Multimedia Studio was one offering in the extended day programme at a small urban charter school (Midway) in a large Midwestern city. Midway is a public school, required to draw from the entire city. Enrolment is highly desirable, and applicants are selected according to a lottery system. All students at the school are African-American. Family income levels vary, with approximately 70 per cent of students in the school qualifying for a free or reduced-cost lunch. The after-school programme at Midway offers two programmes for students in grades 5-8[38] – Multimedia Studio and Theatre Arts. Ten Midway students chose to join Multimedia Studio, including four girls and six boys. Three of the ten students attended on a limited basis in order to accommodate other interests such as swimming. The other seven attended Multimedia Studio for 90 minutes each Monday, Wednesday and Friday after school during Autumn 2002. Terrence and Anita were in eighth grade, Margaret, Reggie, Marcus and Kyron were in sixth grade, and Jordan was a fifth grader.

Studio goals

A central goal guiding the creation of Multimedia Studio in the extended day programme was to develop students as experienced designers who could sustain an actual working studio to serve the multimedia needs of the school. Towards this goal, the learning activities were based on authentic tasks of professional design practice, involving working with clients, developing ideas, building initial designs, reworking designs, and completing projects. Framing activities in this way also provided an authentic goal and context to motivate student learning.

The overall learning objective of the Multimedia Studio was for students to experience a multimedia project from idea formulation to development to evaluation – learning to bring a project from the idea stage to reality is an important element of any passion curriculum. Specifically, students were expected to:

- practise coming up with design ideas and expressing them through storyboards, written documents, and prototypes.

- practise making convincing arguments to justify design proposals and decisions.
- develop 'habits of mind' that encourage frequent and deliberate reflection on design ideas and the design process.
- apply specific technical skills involved in multimedia design, including HTML coding, image scanning, and graphics creation.
- adopt knowledge and practices from the domain of computer programming.

The studio was designed to support both personal connections to learner interest and authentic epistemological connections[39] to ways of thinking in the world of web development.

These skills are some of the same ones needed in professional web design. They are thus profoundly connected with real-world needs. At the same time, they encompass many skills that middle-school students need at school and in their lives. MMS thus provides a context for students to learn and improve skills such as writing, planning, expressing ideas, argumentation and reflection, in addition to technology skills.

Studio structure Initial learning activities engaged students in making websites so that they could learn basic HTML programming skills. Students produced simple websites on various topics of their own choosing. Web projects centred on topics such as a video game fan page, contemporary music artists, and roller coasters. Materials created for the students included HTML code sheets, guidelines for coding and troubleshooting, a brainstorming template, and a design proposal template. Most of the meeting time was unstructured, except for occasional group instruction on specific skills and peer reviews. The everyday work in the Multimedia Studio was guided by students' work on their individual web projects. Students were encouraged to seek help from sources other than the teacher. They were reminded to try troubleshooting on their own before requesting help, to refer to materials the teacher provided, ask peers for help, and research on the web.

Studio staff Denise Nacu was the teacher of MMS and also served as design researcher, along with Diana Joseph. In the following analysis, *teacher* refers to Nacu. We use this designation to separate her role as teacher engaged in on-the-fly decision-making to serve her students' needs, from her role as design researcher engaged in careful reflection and analysis to serve goals of improving curriculum design and investigating learner motivation.

Instructional support by the teacher was given 'just-in-time' as students requested help in troubleshooting or programming desired features. The majority of the teacher's time was spent sitting with students individually

helping solve problems and discussing their progress and future directions. Nacu taught MMS three days per week beginning 9 September 2002. Joseph visited the classroom approximately once per week, and taught MMS in Nacu's place on one occasion. Each day that MMS met, Nacu prepared an agenda for the day, and wrote reflective fieldnotes after each session, noting particularly what each learner accomplished, and how they appeared to engage on that day. Joseph prepared fieldnotes during or after each session she attended. Both authors conducted informal interviews with particular students as we deemed them useful. In addition, Nacu augmented fieldnotes with teacher memories, through interviews conducted by Joseph and through systematic reflection on particular events, during MMS and during the analysis process. We collected copies of all paper-based planning documents and recorded the state of each student's website on a regular basis. We also audiotaped the formal interviews associated with the certification process (described below) within the curriculum.

Studio work MMS was designed to parallel the work of adult web designers. The main area of work in MMS was web design – each project required a planning process and interim checkpoints. During Autumn 2002, students were expected to create two website projects, each of which was to last several weeks. At the end of each term, learners held an 'Open House' in which they presented their work to their families, friends, and teachers. Concurrently with their work on projects, learners worked to become certified as HTML programmers. This certification was designed to require three stages: Web Site Building Experience, HTML practical exam, and HTML programmer interview. Earning the HTML programmer certification meant that learners received a wallet-sized card identifying them as an HTML programmer. With the certification, each learner took on the right and the responsibility to help teachers create educational websites.

Day-to-day life in the studio We begin this section by describing what a day in the curriculum might look like, in order to provide a background for our description of the experience of specific learners.

At approximately 3:40 in the afternoon, the ten students of Multimedia Studio walk in the door and seat themselves at one of the computer desks, which are arranged in the middle of the classroom in two long banks. The computers are placed below clear glass tabletops – students must look down to see the screen. Students drop their jackets and backpacks next to their stations, boot up the computers and open a web browser.

Students work independently on their websites, shifting back and forth between typing into a text editor to create HTML code and browsing the web for content ideas. For instance, Reggie searches for websites

featuring 'cheats' and tips for a favourite video game. Kyron finds sites for most of the major professional sports teams to add to his 'sports' page. Terrence seeks websites featuring the height and speed specifications of roller coasters around the world, along with pictures and videos. Students chat across their desks about what they find on the web, and occasionally get out of their seats to look onto others' screens. Students use HTML coding handouts prepared by their teacher to support their coding.

Instruction is driven by student needs. As errors and problems inevitably arise, the teacher moves from student to student helping to troubleshoot and suggesting areas to work on. Sometimes a quick answer is enough to allow the student to continue their work; other times, the teacher brings up a chair and sits with the student for a longer period, working on content ideas and coding. As students raise needs for new coding techniques likely to be useful and appropriate to the needs and HTML skill development levels of the class, the teacher creates mini-lessons. For example, a student might say, 'I want to click on this picture and have it go to that website'. The teacher explains to the group how code is structured and how it can be used. She writes sections of code on the whiteboard for the whole group to see. Students who need this piece of code copy the characters into the text editor and adapt the code for their own purposes. At various times, students are called upon to troubleshoot for their colleagues. Throughout the course of the 90-minute session, students work on code, create graphics, browse the web, and play web-based games.

A timeline of events

MMS in Autumn 2002 consisted of four extended phases: Project 1, Project 2, Certification, and Culmination (Certification and Culmination happened concurrently – we split them out here to highlight these two different streams of work). These were interwoven with milestone events set at strategic moments in the curriculum. For each phase and milestone, we had a specific set of pedagogical purposes and a specific motivational need in mind. We will use the experience of a number of different students to illustrate events. In order to provide a consistent backbone for our timeline, we return consistently to Margaret. Margaret was neither the strongest nor the weakest learner, and neither the most nor the least engaged. Like many other students, her motivations changed in complex ways during MMS. Our focus on her illustrates times that our design did and did not serve the motivations of a particular individual.

Milestone one: foregrounding learner interest

In order to meet the demands of the passion curriculum design approach, we needed to ensure that learners were genuinely interested in the curricular theme of making web pages, and that that interest was foremost in their minds as a motivator of their work. In addition, we wanted to bring learners' other personal interests to the surface in order to make them available as motivators of learning in our design. Our intention was to pull learner interests directly into the curriculum, rather than leaving students to think of their interests as irrelevant to or intrusions upon on the curriculum.

Learners were recruited through voluntary enrolment in an after-school enrichment programme, so we were confident that they had a baseline interest in creating websites. To assure ourselves of this, to remind students that they had claimed such an interest, and to provide them with a sense of control, the teacher invited them to write down three goals they had for the course. The one concrete goal that all students held in common was to create a website. (Most of the other goals expressed were very generic, for example 'to learn as much as I can'.) This confirmed our assumption that participants chose to join the curriculum because it offered web development opportunities. For students in the MMS, web development was an a priori interest, as it is for many young people.

At the same time, we thought it likely that students had little notion of what web design practice entailed. Our learning objective at this stage was to introduce learners to programming ideas through HTML. We anticipated that the difficulty and less-than-flashy process of creating HTML tags might interfere with learners' stated interest in web page development. We therefore needed to *initiate* learner interest in HTML coding. We chose to do this by bringing other personal interests into alliance with the web design interest, on the basis that these other interests were likely to be in areas that were more familiar, longstanding, and reliable. The teacher introduced a 'speed project' as a way to initiate interest in web design by placing other personal interests in a web design framework. The speed project was also designed to make use of progress and structure motivation. In the speed project, students used paper printouts of a browser window as a canvas for sketching out website ideas, and sharing them with others. Though content was entirely left to free choice on the part of students, how

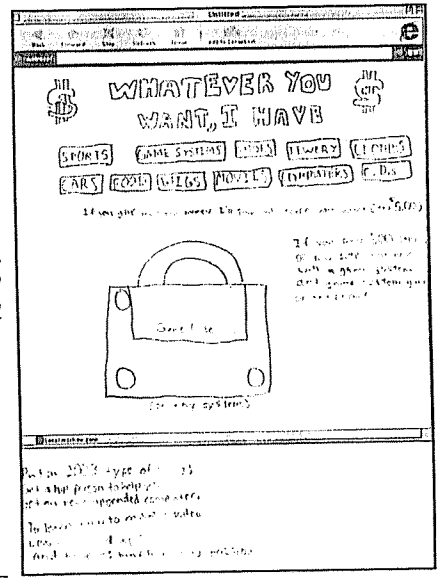


Figure 1. Jordan's speed project, 9 September 2002

that content was to be expressed was constrained by the structure of the browser window and the limited time allowed for the activity. Jordan used his interest in entrepreneurial activities as a basis for his speed project.

Margaret created two speed projects, one of which imitated Jordan's (she was seated immediately next to him), and one of which imitated the example presented by the teacher.

Phase one: first project, weeks 1-3

The first major project was introduced on the first day. This project was framed as practice, to be shared within the classroom but not on the World Wide Web. Students used their 'speed project' sketches as an initial plan for their website. In the design/development phase, students collected the images and links they wanted, and created their desired formatting. Learners were in control of their work on a day-to-day basis, meaning that they changed design trajectory and topic at will, some more than others.

The overall learning goal for the first two weeks of MMS was to help students become comfortable with the basics of HTML coding. Consistent with the curriculum framework, activities during this period were deliberately grounded in students' expressed interests. As the basic process of typing code into a text editor and viewing the code in a web browser was introduced, students used their own topic of interest as their content source. The nature and organisation of content on the web pages was also left entirely up to each student. This provided students the *control motivation* that results from giving students an appropriate level of choice in the work they take on. As students faced needs or problems in realising their ideas in the web page, the teacher provided individualised support in the form of troubleshooting help and constructive guidance. In this way, the design of learning support in the curriculum simultaneously maintained *effectiveness motivation* by helping students create effects they wanted to implement in their web pages. Students could see themselves successfully turning their ideas into reality.

By the second week, most students could successfully use simple HTML codes to display content in a web page. Some students created lines of code rather quickly while others worked at a slower pace. Margaret fell into the slower group. While she verbally expressed a strong and consistent interest in movies and music, she typically added only one new movie image and title per class during the first few weeks of programming. Margaret's limited productivity stood out, particularly by comparison with the other four students who like Margaret expressed a strong and stable interest.

Table 2. Stability of interest across students through the course of MMS

Student	Expressed interest(s)	Stability of interest
Reggie	Kingdom Hearts video game	Stable interest: topic never changed
Margaret	Movies and music	Stable interest: topic did not change
Marcus	Anime	Stable interest: topic did not change
Terrence	Roller coasters	Stable interest: topic did not change
Jordan	Video games, gaming websites, jokes, sneakers	Unstable: topics changed four times
Anita	Pop music articles, Poetry, AIDS awareness	Unstable: Topic changed three times
Kyron	Sports, cars, music	Unstable: Topic changed three times
Mari	Justin Timberlake, Beyonce Knowles, Aaliyah	Unstable: topics changed at least three times

Among the five students who showed a focused interest, Margaret was least productive in terms of lines of code and design quality. She spent considerable time surfing the web for movie images and glancing at web page code, but rarely used any images and never used any code from these sites. What code she did produce had many typographical and syntax errors.

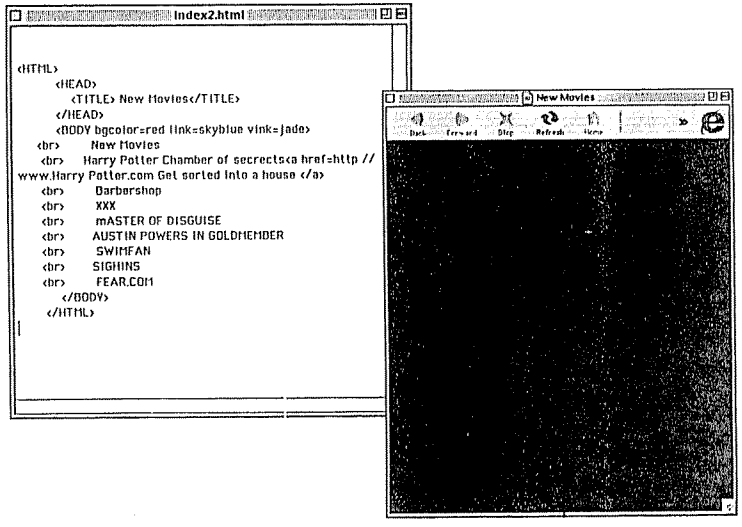


Figure 2. An early version of Margaret's website, 23 September 2002

During every class, the teacher sat with each student to check their progress and provide guidance. In these daily one-on-one instruction sessions, the teacher encouraged Margaret to make improvements to her site, such as fixing 'broken' HTML tags and trying to develop a consistent way to display the images of movies and their descriptions. Compared to other students, she less frequently requested help to troubleshoot a problem she saw in her code. Rather, she tended let even the most apparent errors lie (broken image links, for example) until the teacher noticed them and offered to help. The teacher provided suggestions for using headings and formatting to convey organisation to the content. This help was limited in its effectiveness. Margaret often stopped her work on her own web page to interact with other students, often in teasing and joking, sometimes to watch another student's coding work.

Milestone two: initiating interest in new learning objectives

After three weeks of working at their own pace, students were effective in creating a variety of HTML codes. Students were beginning to experiment with a larger repertoire of codes. The teacher judged that the class was ready to be pushed toward raising the quality of their productions. Two important design issues were salient across the class: students were creating very long pages rather than organising content on multiple, linked pages. Furthermore, content organisation was weak – page goals and information were not clear. We needed to initiate interest in these new learning objectives, and maintain interest in the face of rising standards increased with respect to earlier learning objectives.

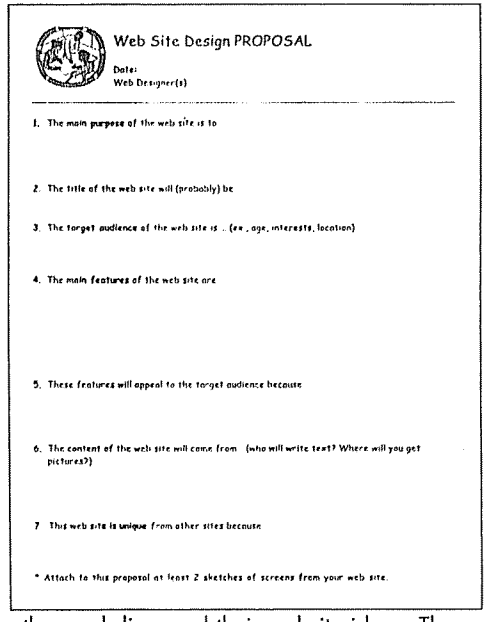
To address these issues, a 'pluses and wishes' activity was introduced as a way for students to begin to more formally share work and provide each other with feedback. In this activity, students review other websites and write down 'pluses' indicating what they like about a website, and 'wishes' for what they would like to see improved. The pluses and wishes event provided several motivational tools for the teacher. First, it provided progress motivation, in that it set a deadline for 'public' (class-wide) display of productions. Second, it provided social motivation to please or impress other students and avoid the converse. Third, it provided an authentic, quasi-professional context in which the teacher could alert the class to the need to attend to content design issues. Students were told two class meetings ahead of the scheduled activity so that they could use the opportunity to prepare their work for an audience.

After the students reviewed each other's sites, the teacher led a discussion about why some websites were more effective than others. An important learning goal the teacher had for the discussion was to help students develop standards for effective use of web page elements to communicate information to an audience. This was intended to provide an opportunity to talk about the use of text and pictures in a way that was more relevant to students.

Margaret asked to postpone the critique so that she could have more time to work, indicating that the social motivation design was effective for her. Anita provided specific compliments and suggestions. In general, however, the activity did not have the motivational impact we intended. Most students engaged at a superficial level, providing only the most general critiques, and more than one complained about this activity – they recognised it from their regular classes and were not eager to participate in it in MMS.

Phase two: second project, weeks 4-10

To introduce students to more quasi-professional practice of web design, students were asked to conceptualise, plan, and build a more complex web site as their second project. The second site was a more elaborate site containing many pages to be stored on the school's web server, and presented on the World Wide Web from the school's official website. Students were expected to consider more complex issues in design such as designing for a particular audience and organising content and navigation.



Web Site Design PROPOSAL

Date:
Web Designer(s)

1. The main purpose of the web site is to

2. The title of the web site will (probably) be

3. The target audience of the web site is . (ex , age, interests, location)

4. The main features of the web site are

5. These features will appeal to the target audience because

6. The content of the web site will come from (who will write text? Where will you get pictures?)

7. This web site is unique from other sites because

* Attach to this proposal at least 2 sketches of screens from your web site.

Figure 3. Website Design Proposal

To support this learning, the teacher introduced a Web Site Design Proposal template. These templates are intended to structure steps in a rather complex process in order to make the project more manageable for students. In this way, providing such guidance creates *effectiveness* and *structure* motivation at a time when the design process can be overwhelming.

Students shared their proposals with each other and discussed their website ideas. They also met with the teacher individually to develop their themes and strategies for managing their work process. Throughout the development of the second project, students received direct individual support from the teacher and helped each other troubleshoot problems as needed.

In one-on-one meetings with the teacher, students were quite effective in brainstorming and conceptualising regarding their sites. The teacher was able to draw out students' interests and connect them with possible design ideas. Most students expressed enthusiasm for their topics and the ideas that were developed collaboratively with the teacher.

While the process of proposal development appeared to be engaging, the proposals did not provide sustained motivation as we intended. For example, in a one-on-one design meeting, Marcus and the teacher discussed his great interest and knowledge of Japanese anime[40] and brainstormed some ideas for sections he could include in his site. The teacher helped him sketch out what the structure might look like – a revision of his first project which was also on anime. After the meeting, he made almost no progress in executing the plan and continued his design as he did before, adding pictures in one long web page. The teacher prompted him to revisit the plan created. Not until the tenth week, when the certification process required him to create another linked web page did he implement some of the sections described in the proposal.

Margaret elected, as her second project, to continue to pursue her interest in movies and music. Margaret, like all but two of her classmates, required repeated prompting by the teacher to work on her proposals. She never completed the proposal process. Her project ultimately moved forward not on the basis of the proposal, but after she found a way to pursue a technological interest.

Milestone three: maintaining motivation through introduction of new tools

By the seventh week, students were getting better at adapting new codes that the teacher introduced. At the same time, engagement was diminishing. In contrast to earlier weeks when students were more engaged finding content, adding it to their web pages, and helping each other troubleshoot, students were showing less effort and asked to play games instead. Discerning this lull in activity, the teacher introduced new techniques to use such as simple JavaScript and embedding sound files into web pages. The teacher pointed them to youth-oriented HTML coding sites that contained many examples for students to take and adapt into their own projects. This approach worked by providing opportunities for students to discover and choose techniques for themselves that they could use in their own work and share with others. For example, Reggie found a JavaScript code that displayed graphics that appeared to fall like snow on a page. He adapted the code so that images from a video game displayed instead of snowflakes. Upon seeing Reggie's new effect, two other students also added this code to their sites.

In order to press forward on the students' attraction to JavaScript, the teacher brought a JavaScript book to class. Her intentions were largely

pedagogical here, rather than motivational – students needed a resource to support their investigation of JavaScript techniques.

For the first six weeks of the course, Margaret's coding of tags remained less than satisfactory from the standpoint of the curriculum, though Margaret herself appeared satisfied with her progress. Margaret responded to the book with a powerful shift in engagement.

Upon first sight of the book, Margaret seemed drawn to it. When the teacher presented it to the class as a resource, Margaret immediately raised her hand and asked to look through it. She read the book during most of the meeting period that day. At the next session, she selected a section of the book and tried on her own to implement it (using cascading style sheets to put a 'glow' effect around text). In contrast with her previous behaviour, she noticed that her code did not work as she expected, and sought out the teacher's help. She expressed pleasure in the achievement of having followed the book's instructions and executing detailed code correctly. Her interest in JavaScript seems to have emerged from her reading of source code on websites while browsing.

> Margaret: I saw that a lot of websites had Java on them, and I like those websites.
> DJ: How did you find out that those websites use Java?
> M: I looked at the source code, and it says Java on there.
> (20 November 2002)

Subsequent to her introduction to the JavaScript book, Margaret's design practices were more extensive and appeared more deliberative. She appropriately divided her music and movie links into separate pages. When the teacher presented the technique of coding tables to the class, Margaret was one of the few students to try creating tables in her code. This technique can be difficult for a novice since it requires code to be exactly correct in order for a simple table to display in a browser. Margaret was successful in coding a table, and in addition, she was able to extend the code for her own purposes (adding additional cells to the table). This demonstrated an understanding of the coding syntax. At this stage, her coding capacity exceeded curricular expectations for writing precise code, understanding syntax, and understanding how to create organisation and layout on a page.

Reggie was the only other student in the class who borrowed the JavaScript book and read through some of it, although he never adopted any of its techniques.

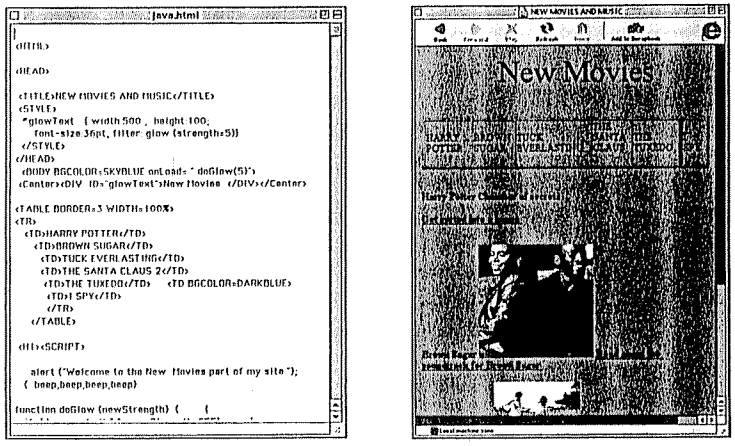


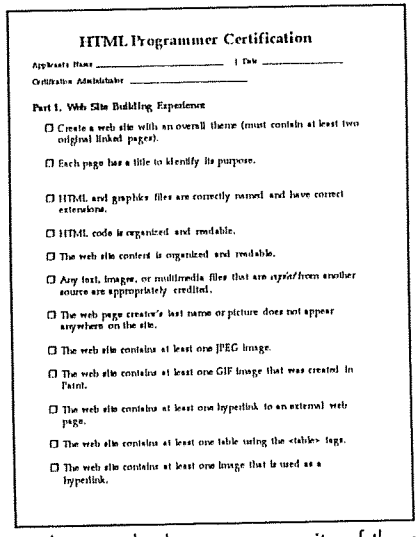
Figure 4. A later rsion of Margaret's website, 18 November 2002.

Phase four: certification, weeks 8-10

We introduced certification as a way to exploit reward motivation in the service of raising student standards for their work, and transferring their web skills to new situations. The HTML programmer certification process was the first step within a larger scheme of developing students' skills in web design and production. Other certifications students could eventually receive include Graphic Designer and Web Producer. Pedagogically, the certification represented an assessment designed to ensure that students met a defined set of learning objectives. In order to complete the HTML programmer certification, students were expected to be able to use a basic set of codes that are needed to create a simple web page. They also had to have experience creating a site with multiple, linked pages and demonstrate a basic understanding of how an HTML file they write becomes a website that can be accessed from anywhere on the internet. From a motivational point of view, as we have described, the certification process was designed to connect with learner interest in web development, and to support that interest with reward and social motivation to acquire a desired identity.

Students were expected to achieve their HTML programmer certification by the end of November 2002. This certification had three major parts: The Web Site Building Experience (Part 1), which used the students' first project to demonstrate their learning; the HTML practical exam (Part 2); and the HTML programmer interview (Part 3).

Students were provided a copy of the Web Site Building checklist in the eighth week so that the requirements for completing that part of the certification were very clear. In this way, the document itself scaffolded students in learning the skills necessary to complete it. The practical exam component was also highly structured, asking students to create specific links and use specific predetermined images, simply to demonstrate their coding skills. The HTML programmer interview, on the


HTML Programmer Certification

Applicant's Name _____ | Date _____

Certification Administrator _____

Part 1. Web Site Building Experience

- ☐ Create a web site with an overall theme (must contain at least two original linked pages).
- ☐ Each page has a title to identify its purpose.
- ☐ HTML and graphics files are correctly named and have correct extensions.
- ☐ HTML code is organized and readable.
- ☐ The web site content is organized and readable.
- ☐ Any text, images, or multimedia files that are *typed/from* another source are appropriately credited.
- ☐ The web page creator's last name or picture does not appear anywhere on the site.
- ☐ The web site contains at least one JPEG image.
- ☐ The web site contains at least one GIF image that was created in Paint.
- ☐ The web site contains at least one hyperlink to an external web page.
- ☐ The web site contains at least one table using the <table> tags.
- ☐ The web site contains at least one image that is used as a hyperlink.

Figure 5. HTML Programmer Certification Sheet

other hand, deliberately did not make specific standards available to the students – the goal here was for students to develop the most effective answers they could create, rather than to prepare to meet a specific bar. The completion package for the HTML programmer certification centred on an 'identity card' denoting successful completion.

The HTML programmer certification was designed to engage learners' identity motivation, as well as to highlight the status of these students in the larger community of the school. Furthermore, certified students were expected to help teachers create websites. This requirement was intended to create a sense of obligation that could carry learners forward in their learning – teachers' needs would drive continued engagement and continued learning on the part of students.

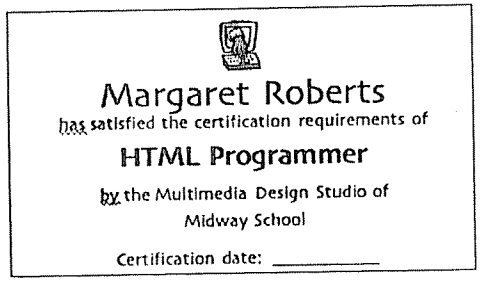

Margaret Roberts
has satisfied the certification requirements of
HTML Programmer
by the Multimedia Design Studio of
Midway School
Certification date: _____

Figure 6. 'Identity Card' declaring completion of certification requirements

Margaret satisfied Part 1 (web building experience) and for Part 2 (the HTML practical), she demonstrated a level of competence that exceeded curricular expectations. She immediately knew what to do, did not have to ask technical questions during assessment, and her site used a colour scheme and organised content at a level beyond what other students were able to create. She was also the only student to go beyond the bare requirements by modifying the text given in the exam. On her own initiative, Margaret later helped other students who struggled with their HTML practical exams. The certification structure created an opportunity for Margaret to demonstrate her knowledge and earn a high status within the MMS community.

Milestone three: the contest To initiate interest in using a larger repertoire of codes with precision, and to prepare students for what was expected of them in the HTML programmer certification process, the teacher set up an HTML game that used reward and challenge as motivational strategies in the eighth week of MMS.

In the contest, students were divided into two teams. For each round, the teacher announced a challenge and a representative from each team would write out the code on the white board. For example, the teacher would say: 'Display the phrase *roses are red, violets are blue* on a web page, and make the word "red" appear red and the word "blue" appear blue.' In this way, the game required knowledge of HTML codes and syntax. Team members were allowed to help each other and refer to handouts as they revised the code until the teacher judged it as effective in achieving the challenge goal.

Four students in the class were especially engaged by the competition. They eagerly listened for the teacher's announcement of the next challenge, and rushed to beat their opponents and get the code right. The other students never volunteered to represent their teams, stayed in their seats, and continued working on their sites or surfing the web. For the students who participated, the competitive approach was successful in reinforcing the need for exactness in coding, as well as introducing coding techniques they hadn't yet tried themselves (like coding text to change its size, colour, and position all at once). It was also a useful tool for the teacher to assess student understanding of syntax and general facility with HTML programming. However, the teacher decided to end the game when Reggie's competitive fervour grew to the point where he sabotaged Jordan's work by impulsively erasing his codes. Jordan then quit the game. For both students, winning became more important than demonstrating their skill – Reggie resorted to cheating, and Jordan to opting out entirely. Our design of the contest did not accommodate the strength of the feelings that arose from the challenge and social motives involved. The teacher elected not to use this style of milestone again.

Phase five: culmination, weeks 8-10 The final weeks of Multimedia Studio focused on preparing for the Open House event in which other members of the school and family were invited to see the student websites. Like the pluses and wishes critiques, the Open House event was designed for motivational affordances that exploit the desire to perform well in the eyes of others (in this case, family and other members of their school), as well as obligation motivation (motivation that arises when someone else is relying on the learner) and deadline pressure.

The teacher relied on students to take charge of planning and building a class page from which all the sites would be linked. She collaborated

with students to develop ideas on what to include on the site, but left the organisational work to the students. Three students in particular (Reggie, Margaret, and Jordan) stepped into leadership roles when the teacher requested help from the class in preparing the group site to be showcased 'live' on the internet at the Open House. For example, Reggie and Margaret helped encourage students who hadn't yet got their project on the group site by letting them know what they needed to do and helping them save their files. Jordan volunteered to write some introductory text to the site and created an animation for visual appeal on the site's homepage. After doing some informal surveying of the class, Margaret suggested the title 'Creative Minds' for the group website. These students in particular were very excited to see their sites on the web, and took on these tasks eagerly at the teacher's request. The other four students showed little interest in helping the group effort to create the collective website; instead, they continued to work on their own sites or surf the web.

As the Open House drew closer, Reggie, Margaret, and Jordan designed and distributed invitations for the event as preparations continued. On the day of the Open House, all of the students spent the first hour preparing their websites for visitors by typing in last minute additions and getting their work onto the web server. The teacher began the process of transferring students' HTML files to a web server. Reggie and Margaret chose to take on this process – they learned how to do file transfer by standing at the teacher's side and listening to her step-by-step explanations of the FTP software. Ultimately, they were able to handle the transfer themselves with the teacher in a supervisory role.

The Open House was framed as a fun and casual event. About 20 visitors – including parents, grandparents, siblings, and teachers – stopped by. Students sat or stood near their computers and explained what they did in their projects to onlookers. A few students watched over their parents' shoulders as they sat at their computers and explored the 'Creative Minds' site and their own. Many parents were impressed with the students' work and expressed their thanks to the teacher.

The Open House event was designed to promote motivation to bring their work to a state of completion by a deadline. Overall, students did not seem to increase their productivity in order to improve the quality of their websites as the day approached. Reggie, Margaret, and Jordan were most concerned with getting the group site together. The other four students were also the last ones to complete their HTML programmer certifications, so they spent more of their time working on parts of the certification they hadn't yet completed. For these students, finishing the certification seemed more important than preparing their sites for the eyes of the Open House audience.

The event was successful in sharing the students' efforts and newly acquired skills with the greater school community. In this sense, the Open House was similar to many school performances. Our intentionality about the motivational purposes of the event may have given the teacher additional flexibility and resources for supporting individuals in the process.

We used events like the Open House to appeal to the motivation to look good in the eyes of others in order to push students to improve their quality of work. While the teacher expected the Open House to motivate a higher quality of work, students generally seemed pleased with the work they did all along. Students may have needed other ways of developing standards of quality that are aligned with learning objectives and developing the skills they need to meet them.

In future designs, we plan to link the HTML certification more directly to the Open House – earning the certification earns a more public role in the Open House. We also plan to institute a lower-stakes public event midway through the semester, as an additional motivating milestone and as pedagogy regarding public performance and event planning.

rning from our experience

In the course of MMS, we were able to observe the ebb and flow of learner engagement. Student responses to our design suggest three key areas of theoretical and design work that need to be addressed as we press forward our model of interest-centred curriculum design: variations in stability of learner interest, ebb and flow of engagement over time, and creating relevance for individual learners

Stability of interest

Four of the eight MMS students expressed specific topics of interest early on that persisted throughout autumn 2002, and the other four shifted between topics from session to session. Beginning from her first HTML coding experience in the first week of MMS, Margaret expressed a personal interest in movies that remained stable throughout the course. Her interest in movies was a predominant theme in her communications with the teacher. In the first two weeks, she identified movie-related activities as a highlight of her prior experience with computers (for example, downloading movie trailers). Twice she requested a 'movie day' as a club activity. In addition she chose to focus her first web project on presenting pictures and links to websites about new movies. One possible source for her interest is affiliation – she reports that her father likes to download movies from the web.

For half of our students, our design was successful in identifying stable, persistent personal interests beginning on the first day. For the other half, the design did not identify such interests. We have argued that interest is a key motivator for learning, and committed ourselves to developing curricula that centralise interests. Students who do not

exhibit stable interests represent a problem for us. In MMS, fully half of the students fell into this category.

In order to address this problem, we need first to understand better what is happening. Some students may genuinely be eclectic in their interests. Rapid shifts in topic might represent for them true shifts in interest. For these students, we need to find ways for them to engage with a single topic long enough to pursue the learning objectives we care about. For other students, what appears to be a shift in interest might be nothing more than a 'loss of interest' in the face of difficulty – precisely the kind of wavering of interest that we expect. These students may prefer to change topics and start a new project using familiar skills, rather than engage with a more difficult set of learning objectives. In this case, we need to design ways of addressing the obstacles, to help students become willing to face them.

Still a third possibility is that those students who do not exhibit a stable interest are students who tend to act more powerfully from context-based motives than from interest. Kyron, for example, might have been motivated by social goals, changing his topic to match what he thought other students were interested in. For students like this, our commitment to serving their interests means finding more powerful ways to foreground their own interests. Another technique would be to find ways to connect their strong context-based motives to interest. We need research on why students want to change topics, we need instruments to allow teachers to understand particular topic change requests on the fly, and we need pedagogical responses to topic changes, depending on how they are motivated.

For some students, interest in the technologies and process of web development was sufficient to engage motivation, in spite of instability of topic interest. For example, Jordan's website topic changed four times (more than any other student). The teacher decided to introduce him to new technology tools after noticing that he seemed to have greater interest in the technology tools than in any content interest. To address Jordan's shifting motivation, the teacher taught Jordan how to use an animation program to create graphics that can be placed in web pages. Jordan engaged with this tool more than with any previous activity, and created several animated graphics for himself and others during the subsequent weeks. This process parallels Margaret's in responding to new tools (JavaScript in her case) with an increase in motivation. This suggests that one powerful pedagogical strategy is to shift between topic and process interests as necessary.

Motivational trajectories

In the first few weeks of the curriculum, we viewed Margaret as a low-productivity student who needed extra guidance. She appeared to be disengaged. We saw her social motives acting to draw her into social

contact with other students, and her interests acting to draw her into web surfing, but our design appeared not to be making use of these motives in driving her learning forward. Margaret's productivity shifted dramatically with the introduction of JavaScript. Her curiosity about JavaScript appeared to emerge from her activities during what appeared to be weeks of limited productivity. Margaret's early slow pace bears some resemblance to 'lurking',[41] – she may have been quietly exploring the social and cognitive space of MMS, intending to engage once she understood well what was expected of her. On the other hand, she may truly have been disengaged, or distracted by social motives. Other students exhibited differential productivity at different times in the curriculum.

This experience raises important design and instructional questions. How can we judge more effectively when to intervene in a low-productivity phase? The MMS teacher intervened on the basis of her intuitions about learner motivation. The passion curriculum model can and should provide teachers with more specific guidance for grounding those kinds of intuitions in real-world learner behaviour. Our commitment to student learning means that we must take some stand in regard to assessing learning. We must be prepared to intervene when a slow pace of learning indicates a failure on our part as designers and teachers to meet our commitment. When is a low-productivity phase a problem, and when it is masking important cognitive activity? What structures would have allowed Margaret to make salient her emerging curiosity in JavaScript, in a way that would allow her teacher to exploit that curiosity to drive learning? Our goal in the next phase of design will be to develop guidelines to support teachers in timing the introduction of new tools and techniques, based on both pedagogical and motivational considerations. These guidelines will need to support teacher understanding of learner trajectories as well as teacher decision-making about timing.

Creating relevance

The failure of the second project proposal to lead to engagement suggests a lack of connection between the activity of proposal development and how the proposal itself might be useful as a plan. One issue is that the proposal may need to provide more structure – we are not certain the students understood how to use these tools. A more compelling concern is that we did not create a strong need for creating a proposal. In future designs, we will place the proposal within a formal production process, grounded in real-world professional practice. Couching this process in the authentic context of working with an actual client might convey its importance and hence motivate the effort to complete it.

The differential responses to the 'pluses and wishes' and contest milestones raise another question about relevance – these events were

deliberately designed to invoke strong context-based motivations at moments where we thought the strength of interest was insufficient to motivate learning. Resistance to these activities from some of our students, and anxious, highly competitive participation from others might indicate a clash between the social and reward motives we intended as boosters for interest, and interest itself. We can address this in design by setting these events in a more authentic context. Rather than pluses and wishes, an experience familiar to these students in their school, we might have framed a public critique as an interaction between 'professionals' looking to improve their design work. Rather than a competition between students, we might have offered an opportunity to impress an outside client – either a simulated client or an actual teacher needing help with web development. These contexts might have made the milestone events more directly relevant to students' interest in web design, in addition to engaging context-based motives to move their work forward.

Authenticity is a core principle of the passion curriculum design approach, and it permeates activity development processes. Authenticity is a powerful tool for providing learners with a sense of relevance. However, we have not integrated real-world professional life fully into the design of activities. Furthermore, we have not provided guidance for teachers to help them make the case for relevance of particular activities to particular learners during instruction. Shaffer and Resnick propose four interacting types of authenticity in activity design: personal meaning for the learner, resonance with the real world outside of school, faithfulness to disciplinary modes of thinking, and matching the means of assessment to the learning process.[42] Our design practices have emphasised the first of these. We now look to integrate the other three types, so that we can make full use of the power of authenticity to enrich motivation in learning environment design.

Learner responses to our design of MMS suggest new areas for building upon the passion curriculum model. We need to understand what is really happening motivationally, at the level of the individual, when a learner's interest shifts or their productivity slows. Based on that understanding, we need to determine whether to intervene. We can begin to investigate three kinds of intervention raised by this design work: shifting between topic and process interests, finding points of contact between context-based motives (such as affiliation or obligation motives) and interest, and creating relevance through authentic connections to real-world practice in the domain of the theme.

Conclusion

Fundamentally, though we were aware of the complexity of motivational issues at the level of learning environment design, we did not anticipate the need to understand individual motivational processes and to develop strategies to respond to these processes. We entered this

enactment with a certain degree of confidence in passion curriculum design practices, tested as they were through several iterations of an earlier curriculum, the Video Crew. These practices provided guidelines for our development of activities in Multimedia Studio. The experiences of our students pointed to a major gap in our design understanding: intervention into learner process. What triggers should cause a passion curriculum teacher to change motivational tactics for a particular learner? How can the teacher get insight into the meaning of shifts in interest and slow-downs in productivity? How can the teacher act to expose the relevance of each activity in the context of learner interest? How can we anticipate which students are likely to have trouble seeing the relevance of particular activities? Our next step in design will be to institute a weekly interview – teachers using the passion curriculum model in extended day settings will interview learners about their progress, their interests, and specific learning issues, and create maps of learning and motivational trajectories. This routine should inform immediate pedagogy and ongoing design research on instructional practices for passion curricula.

We note a further area for research: interest-centred learning contexts open up new possibilities for the study of motivation and learning. In MMS, for example, because learners select their own topics and had room to change their minds, we have access to consideration of how interests shift. The traditional classroom leaves no such space. Motivation in the traditional classroom operates mainly through social motives involving the relationship between teacher and child, and reward/punishment structures such as grades. What might we discover about the relationship between interest and learning by focusing on contexts where interest is exposed?

The need to design with a complex view of motivation is not universally accepted among learning environment designers. Consider, for example, the case of the Computer Clubhouse model.[43] MMS and the Clubhouse have similar intentions, including helping students pursue their interests, and fostering learning of twenty-first-century skills through design activities. The Clubhouse design honours learner interest, and leaves room for learners to define their own processes by encouraging self-directed learning, making sample projects available as ideas of what to do and where to start from, and providing access to mentors as coaches, catalysts, and consultants. How learners will interact with these resources is left up to the learners. Passion curriculum design complicates this picture of how motivation to learn works by building motivational considerations into the design of activities. In our ongoing design work we recognise the need to account for individual differences across learners, variation in engagement/productivity, and leveraging kinds of motivation for different situations. One important difference between these two models is that the passion curriculum approach

commits to addressing target learning objectives, while the Clubhouse approach does not. The Clubhouse model thus avoids the tension between child and adult goals that is the central problem in passion curriculum design. We do not yet have validation studies of either design model. An investigation that compares these two approaches in terms of learner engagement, and in terms of learning, would be a very powerful context for research on this kind of learning environment design. The challenge of developing meaningful measures of motivation and of learning would pay off in supporting future design to serve the needs of young learners.

Like the Clubhouse, our curriculum design has made use of the motivational affordances of new media development. When students create their own websites, animations, and movies they can connect them to personal interests. Even with the remarkable motivational power new media design offers to help students meet adult-identified learning goals, we discovered that the terrain of motivation design of learning environments is rugged. We need to have better ways of navigating it given the complexity and variation of individual student motivation.

Acknowledgements We wish to thank Amy Bruckman, Ben Loh, and two anonymous reviewers for their extremely helpful feedback.

Notes

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