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Abstract

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university-developed new media materials to market. Several methods have been proven effective for disseminating new media products into the marketplace: faculty as well as student testing, workshops, review, and other forms of faculty education are critical to acceptance of new media learning tools. These processes will be outlined along with some successful examples.
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add their own commentaries. The authors, reviewers, and anyone else who has 'subscribed' to this article via the website will receive email copies of your postings.

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1. Introduction - The Adoption Cycle

1.1 Why Does Good Media Go Bad?

New media, like the traditional textbook, is subject to certain metrics of quality. Unfortunately, these metrics are highly personalized: there is often no good quantitative way to say that an educational product is good or bad. However, all projects that are published professionally are subjected to a review process, much like academic papers, and the opinions of peers on pedagogy, writing style, accuracy, and level are fed back to an author, resulting in corrections that hopefully make published materials as broadly useful and error-free as possible. The review process is subjective, but at least represents a consensus about what educational materials, regardless of media, are worthwhile: they represent information more clearly, or in a more engaging way, they address a wider variety of learning styles, and so on. Projects that review well are considered to be successful, and are subsequently published, while projects that do not review well are not.

My contention from this point onward is that there are many new media projects that have this subjective but peer-confirmed level of quality, but they are still not widely adopted: they have low sales figures, or are not recognized by name when discussed at academic meetings; in other words, they are not being used, even though they are good teaching tools. If we assume that the products under

discussion are worthwhile, it then begs the question of why they are not being used, and what we as the authoring and publishing community can do to address that situation.

1.2 What Do Publishers Do?

Higher education publishers specialize in the effective dissemination of tools developed by and for the university educational system. Every member of a publishing team has a function in this process: acquisition editors take the pulse of the marketplace to identify new trends and advances in teaching, and requirements for adoptable teaching tools, developmental editors help authors to broaden their vision of their projects through revision and review, production editors help to design and convey information more effectively through visual design, and marketing editors and salespeople help to make this very broad and diverse marketplace aware of new products for sale.

This general description applies to any project which is produced through a professional publishing house. The difference for new media projects is that the barriers to entry are much higher than for the traditional textbook adoption. Even though practicing college faculty are often the developers of new media for the classroom, their software products are often viewed with far more suspicion or misunderstanding from fellow faculty than a textbook would be.

These barriers are some of the reasons that new media has a bad reputation in the publishing business, and are the reason why many publishers are shying away from these new projects, after an initial flush of optimism in the early '90s. Coupled with the difficulties in assigning rights and royalties between the university and the

authors (software development is often viewed differently by the university administration than book development) and the frequently high "plate" (production) costs of new media projects, the lack of interest in adoption from the community of customers makes these projects a serious risk for the average publisher. Moreover, the lack of widespread dissemination of university projects has been well documented by the funding agencies traditionally involved with getting these projects started. One of the primary concerns of the National Science Foundation (NSF) has been that many good new media projects, funded with an average budget of $100,000-$1,000,000, are never used outside of the university at which they are conceived, and sometimes not even within it (Project Impact, 1995).

A good publisher can be as successful in new media as in printware, but it is necessary to reexamine the process of adoption, and think of new ways to make it clear how products can benefit the instructor and their students, and how they can be assimilated into the classroom without undue hardship for the instructor. The new media tools we publish must address educational needs, just as textbooks do, or they will fail. Likewise, we must clearly convey their benefits and use, or they will fail just as surely.

1.3 How Does Textbook Adoption Work?

The dissemination, and hence the sale, of any product is dependent on meeting the needs and goals, and overcoming the objections, of the customer. To accomplish this, a publisher will try to understand the specific situations for adopting professors, and will make authors aware of them, so that the adopter's goals can be designed into the educational product. There are many standard techniques for meeting the educational needs and goals of the audience that are

applied during the textbook development process. Manuscript/beta reviews often result in revisions based on particular problems identified by reviewers. Likewise, the review process can be the impetus for the publication of ancillaries such as solutions manuals and lab manuals to make the use of the textbook easier. A book's page layout will be designed to be easier to read or to reference, and appendices can be added or provided electronically to be searchable, or to reduce the need for typing (such as with code files provided with a programming book.) Finally, appropriate trade shows and advertising channels are chosen to overcome the strongest objection of all: lack of awareness of a product's existence. These solutions all address the various needs of consumers of the book -- almost none of them are required by the author of the book, they are added to make the book easier to use.

Instructors are seldom confused or threatened by a textbook, because publishers have taken great pains to learn how to make books suit their market, using the means described above. Print is familiar teaching material, and instructors are frequently able to tell from the table of contents and a browse through the exercises if a book is appropriate for their course (publishers make sure this is true). The truth is, however, that every instructor uses a text slightly differently, and this is what makes teachers valuable -- a good teacher will give a student a good learning experience, but they may rely more or less heavily on the text. Sometimes a text is hardly necessary at all, but adopted out of habit. I believe it is because textbooks are familiar media, and because publishers have had many years to figure out what the associated objections can be, that they are no longer regarded with suspicion or annoyance by the academic

community.

1.4 What is the Experience with Multimedia Adoption?

There are many additional prejudices and objections to overcome with new media, and not all of them have to do with the inherent educational quality of the software. Software and its use in the classroom may be unfamiliar or frightening to an instructor. It may be expensive in terms of time and money to implement, and challenging as well, since it represents a real departure from traditional teaching styles. New media potentially represents many hurdles to an adopting professor. They must consider its impact on their schedule, on their students, on their teaching style and efficiency, and on the instructors who will teach these students after the class is over. More so than a textbook, there must be compelling reasons for them to move to this new, sometimes troublesome educational solution. A professor might, for example, be dealing with very large lecture classes, and wish to customize the learning experience for different learning styles, without impeding the flow of a large lecture class, or she may want the ability to motivate concepts contextually through hypertext, rather than through traditional linear presentation methods. Some professors wish to expose students to experiences that would be too costly or dangerous to provide by any means other than virtual, or they would like to provide immediate feedback on student performance at any time of the day or night. Many of these needs are addressed in existing products (Bondaryk, 1997a), and many more tools are being developed to address these, and other goals. For them to be seriously considered for adoption, the solutions represented by a new media product must be clearly communicated by both publisher and author.

There are different scenarios for new media adoption, because there are different types of new media. Software types common in the engineering and mathematics communities will be discussed, since that the area of publishing with which the author is familiar. There are interactive tools that are used in the professional marketplace, such as AutoCAD and Matlab, which publishers and authors were able to make palatable to the university educator through incorporation with more traditional media like textbooks (see, for example, the highly successful *Schaum's Interactive Outline* [1] series). These texts in general don't represent a serious departure from traditional syllabi (although not always), and so careful keying of information generally smoothes the adoption path. "Multimedia" CDs and, more recently, Web sites, including animations, simulations, and hypertext, can also be made acceptable by keying to familiar print products, and can extend an educator's view of the class if accompanied by appropriate instructor's guides and workbooks that demonstrate how subjects can be taught using the new media. Products such as *Interactive Heat Transfer* (Incropera and DeWitt, 1996), or the CDs produced by the University of Utah on *Electromagnetics and Calculus* [2] are examples of this approach. Radically different teaching tools, typically software simulators designed specifically for education, require an instructor to significantly modify their course and instruction style. There has been an explosion of this type of software lately with the advent of Java applets on the Web, as demonstrated by the developing TRP site for the Educational Object Economy [3]. Most new media research projects, such as the software discussed elsewhere in this special issue, follow this tack. If these products are to make it beyond the research lab, their revolutionary approaches likewise require a revolutionary level of author and publisher support through

workshops, conference presentations, and other support networks. There is crossover in each of these categories, but all types of new media can gain some measure of acceptance in the marketplace if their dissemination is strategized during the development process.

2. Causes of Reluctance

Any instructor trying to incorporate new media into their instruction must answer a series of pertinent questions before taking the plunge. If any project is to be successful, it must help to answer this set of concerns:

- **Pedagogical constraints:** does this product add something valuable to the learning experience?
- **Time constraints:** Can I fit this into my already exhausting schedule of course preparation?
- **Political constraints:** Will my students still learn the required curricular materials/do we need to ethink the curriculum to use these materials?
- **Technology constraints:** where will I get the facilities, the staff, the software support, and the raining?
- **Not-grown-here syndrome:** Is this tool, developed at another university, applicable in my course?
- **Multimedia dread:** Will I be able to understand how to use these materials as well as or better han my students?
- **Job security:** Am I being made obsolete?

Some of these questions address real constraints, and some psychological barriers, but either way, they are potential objections to the adoption of a new media project, and must be answered by the author and the publisher.

This list of questions is really an outline for a new media development plan. If, in addition to the primary goal of improving education, the goals of a new project also include widespread use, then the answers to these questions must be built into the structure of the project or the dissemination plan from the outset. The interface design should be built to accommodate both the instructional needs of the students taking a course, and the faculty member evaluating and implementing the course. The layout of materials in a hypermedia environment must address faculty cognitive styles as well as student cognitive styles. And there must be appropriate support materials ancillary to the media tool that demonstrate how it can be used in a class, give suggestions for customization, give examples of other instructors who have successfully used it, suggest how to recover from hardware and software incompatibilities, and so on.

3. Addressing the Problem

3.1 What Can the Author Do: Interface and Support Materials

Authors who are writing for new media for the first time should consider the following idea in order to better support the use of their software by adopting faculty: new courseware should include not only the syllabus, but also *the software author* within the new media project. For the instructor trying to implement the new tools, the software must take the place of (or compliment) not only a print text preface,

but also the lecture style of the instructor who has created it. There may be instructions or thought provoking exercises that the author imparts verbally as part of her own classes using the new tool; students and instructors outside the school may use the software, but they will have an aborted experience, because they are missing part of the intended educational material. This reduces the quality of the learning experience for the student, and also makes the materials review poorly; an experienced faculty member will feel the lack of the guiding presence, but may not be able to extrapolate the missing comments on his or her own.

Textbooks really have the same problem, but they have prefaces for the purpose of explaining how the materials should be used. In software, there are a variety of ways to include a "virtual" author. Online help and documentation can contain some of this information, if the software is designed so that using these resources is a necessary part of the learning cycle. Exercises and popups can be added in appropriate places, so the student gets a little extra push when the live instructor would be likely to intercede. This is a technique we used on John Russ' CD for Materials Science (Russ, 1996), and the interface element was known as the popup professor (see Figure 1). Dr. Russ included a little of himself for the student and also for the instructor through an icon which resembled the infamous picture of Albert Einstein. Clicking on Einstein brings up a popup window that extends the information on any screen, and poses thought-provoking questions of the student. This popups also serve to suggest ways that an instructor might use the material presented on that screen.

The whole idea is to guide the student (and hence the instructor) in

natural ways to the major concepts, and help the student (or the instructor) to assimilate/teach these concepts. This same type of guide can take the form of a print workbook that accompanies a new media tool. This is something we are trying with both a multimedia CD in *Materials Processing* [4] (Constant, 1998), and with an educational software tool for mechanics analysis called *Visual Mechanics* [5] (Miller and Cooper, 1998). In each of these projects, the workbook will contain some short theory sections, and some explicit exercises to be performed in conjunction with the electronic materials. This is a small and natural step, but a big leap in the type of packages the publishers have offered, given that many original project outlines have the goal of being "entirely online." The workbook, or other print component, and the electronic tools become compliments, rather than supplements. They are each part of an integrated whole. This type of publishing has been done successfully in the past by Kristina Woolsey and the *VizAbility* team (Woolsey and Curtis, 1995) as well, where each type of media is allowed to express the type of concepts for which it is best suited. In the case of the Materials and Mechanics workbooks, these projects are still under review and development, but initial reaction to the "guidebooks" are very positive, as is the response to the software, which tells us that the package makes it very clear both what the software does, and how to use it in the classroom.

These guidebooks can serve another important purpose. It is often the case that instructors would like to start using electronic materials, but don't want to abandon more traditional texts and tools that are familiar. It is possible to provide a comfort level to these instructors by keying new media to common traditional print tools

and syllabi. To give a very simple example of this mindset, consider the proliferation of print books which implement some subject matter using a computer algebra system, such as Mathcad or Matlab, or a simulation tool, such as SPICE. When the software companies that produce these calculation tools first introduced them to the educational marketplace, they expected that the benefit of doing complex mathematics quickly and simply would be so obvious that they would revolutionize the way mathematical subjects were taught. The reality was that instructors could see the professional benefits of using a calculation tool, but were concerned about the time and political constraints listed above: why should they take the time to figure out how to integrate the tool into their classes, and if they did, would their students still learn how to do mathematics?

It wasn't until there were formalized textbooks that integrated a software tool that their use caught on. The first step in this process was the publication of lab books and supplements that used the electronic tool in question, and these were keyed to more traditional texts (see for example Leinbach, 1994). These books save time for the instructor, and, assuming that they are well-conceived, show how to use the tool to enhance the learning process, rather than detract from it. The use of some of these tools is now considered derigeur in some areas, such as the use of Matlab in signal processing courses, or the use of SPICE in electronics courses, and there are now whole textbooks developed around these tools [6]. Publishers and authors had to recognize the need and implement the appropriate curricular supplements and texts before these tools became popular. In the software market, these are known as vertical applications, and they are now a recognized and important component of any

educationally-based tool development plan.

So, the author must build into an initial project design the notion of self as well as content. This can be part of a multimedia interface, a help system, or a printed guide, or perhaps other innovative forms of moving the student along, but it must be present in order for an adopting professor to see clearly how a tool can be used. Early experiments in electronic higher-educational publishing failed to include this sort of support built-in from the outset, and the result was that tools were either never adopted or never used. The form which these support tools take will depend on the project, and should developed as an outgrowth of the author's vision and reviews from the user community. Defining the user community sufficiently broadly is critical: most developers of new media acknowledge that interface and beta testing is a critical part of the development process, but they are typically referring to testing with the final end user. The adoption reality is that a program must be as clear to a 20-year-old student taking this course for the first time as to a 50-year-old professor teaching this course for the 100th time. The needs of both these groups must be met, or the project will not succeed in the wider marketplace.

As a final note, the inclusion of syllabus and instructional philosophy as part of the software and/or part of a related print publication does not obviate the need for good user documentation and software support. While there is a trend these days for software users to simply "shelve the manual," it must be there to answer basic technical questions about software use and trouble-shooting. The author should work with an experienced technical writer to develop documentation and support procedures that will help both the

novice and experienced user. Sooner or later, most adopters and students will turn to the manual, and poor documentation will lead to lost adoptions, which can be easily avoided with a little forethought. The publisher can assist with this development by providing tech writing partners, and by providing a good technical support group.

3.2 What Can the Publisher Do: Workshops and Class Tests

In general, the developers of higher educational software/new media tools have taken the burden of publicizing their work on themselves. Some of them have built a model for dissemination that should now be taken up by publishers. One of the most successful new media/new teaching method programs in higher education to date has been the Calculus Reform movement [7]. By successful I mean widely used, and with the result that instructors are more satisfied with a larger proportioin of their students' performance than they were with previous methods. Of these various initiatives, mostly funded by the NSF, far and away the most successful has been the Harvard Calculus Project [8]. All the calculus reform programs had interesting features and new ideas that incorporated technology (largely the computer algebra systems mentioned above, but also some multimedia support), and all were extensively class tested at their home institutions. The Harvard project, however, owed it's success largely to the many workshops and numerous class text/feedback cycles they conducted outside the universities which were developing materials. They were able to do this because they built the funding for these workshops into their proposal budget, but the point is that they thought to run them at all.

There is an important lesson here for publishers. These workshops are not only a way to familiarize an adopting community with a

product and its features, but also give them extended hands-on training in its use. The byproduct of a workshop is that it generates real-time consensus among attendees about what is necessary and sufficient for adoption of a new methodology or product and its effective use in the classroom. If workshops are run during a product development cycle, then they provide interactive feedback about what features and modifications should be made to educational software. If workshops are run after a new media product is "finished," then they provide a forum for educators to raise their objections and have them answered by a moderator, rather than reviewing the software, deciding against it for one or more of the five reasons above, and then burying it in a drawer without trying it in a class.

Presenting papers at academic conferences is sometimes a substitute for these workshops, particularly if there is time provided for questions and answers. I recently gave a talk at the Materials Research Society meeting (Bondaryk, 1997b), detailing several of the projects described above, and was bombarded with questions about their use, how to get copies, and what sort of experiences instructors have had with these media tools. The community was hungry for information about the products available, and paper presentations can at least make instructors aware of their existence. Greg Miller has had some success publishing papers (see for example Miller and Cooper, 1995) and demonstrating *Visual Mechanics* at NSF Coalition Workshops and other professional meetings [9]. The NSF-funded *Engineering Coalitions* [10] have started these "road shows" because some of the more passive dissemination efforts, such as databases on the Web [11], have not been entirely successful at getting the word out. Often these seminars and paper presentations can prime the

pump a project, because the name of the new media project will be familiar in the mind of the professor when it comes time to review or adopt it.

There is no substitute, however, for multi-day workshops where participants engage in exercises using a new media tool, are asked to design projects for their students using the tool, and are able to interact with others who have previously used the tool. One of the most successful workshops of this type that I've been involved with was the Boston University Differential Equations Project [12] workshop, conducted over a weekend at the university.

The form of the workshop was designed in conjunction with the editorial direction of the project. We designed them to serve the goal of widespread dissemination and effective use by helping instructors to feel confident teaching with the project materials, to get their questions and objections answered on the spot, and to introduce them to a community of instructors who would share their experiences using these new tools and techniques. The workshops were partially funded by PWS, and partially funded by an NSF Faculty Enhancement Grant, which made it possible to pay for travel expenses for the participants. This allowed us to involve faculty from colleges which were more remote or less able to pay for faculty training, as well as those from larger urban universities, who are typically able to get quality information about new projects through other channels.

Participants heard presentations about the development of the new Differential Equations teaching tools and philosophy. There were presentations from the authors of the tools, and from authors of

other, related tools at other universities. Participants were able to ask questions, and discuss their opinions both during panels, and in more informal, social settings orgznized throughout the weekend. Faculty also participated in group lab exercise development sessions, so that they left with a stable of pre-built labs that used the materials to try when they returned to their classrooms.

As a measure of the success of the workshop, 500 copies of the materials in question were sold before the product was published in a finished form: we had to run a special pre-publication printing to accommodate the requests. The requests were made because the instructors involved felt that they couldn't go back to teaching Differential Equations in the old way after having been exposed to the new ideas espoused at the workshop. A year after the workshop, this product has achieved over 10% market penetration, and has spawned numerous new efforts in teaching innovation in Differential Equations, all of which is a direct result of the success that instructors have had with the methods: their enrollments are up through word of mouth, their retention rate is higher and grade-point averages are up, and instructors who teach the students in subsequent semesters, particularly in the engineering disciplines, are more satisfied with the analytical abilities of students who are taught in the new way.

Certainly the BU project itself had to be of the highest caliber, or the results of using it wouldn't be positive. On the dissemination level, the success of this workshop can be attributed to several features:

- **Discipline Specific:** the tools in use were frequently off-the-shelf software tools, such as Mathematica and Quicktime. But their

specific application within the discipline of differential equations made the participants take careful notice.

- **Open Forum:** the audience consisted of approximately 50 university professors, who were encouraged during scheduled open forum sessions to share their ideas. The two-way flow of information showed them that their opinions were important to the authors, and they were participants in the creation of new ideas and instructor support materials.

- **Implementation Focused:** there were a number of sessions devoted to the application of the new tools and methods in the classroom or lab setting. These encouraged the participants to think about these new tools in the concrete sense, rather than the abstract.

- **Support Oriented:** instructors from the same university or from several geographically close universities were encouraged to attend together, so they could continue to consult with each other after the workshop was over, both on educational and technical challenges.

- **Long-term in Intent:** there was an effort to keep the participants involved and thinking about what they had learned after the workshop was over. Email lists and a Web site [13] were set up, and the participants were encouraged to check in with the authors after they had tried some of the materials in their classes to give feedback.

3.3 What Can the Community Do: Peer and User Groups

The most important facet of the workshop experience, and one which the publisher should assiduously foster when introducing new

media products to the marketplace, is that of the continuing support group. All of the objections to adopting new media outlined in the section on causes of reluctance can be traced in some part to isolation in the academic community. If there are no other instructors at a university who are investing the energy to incorporate new media into their classrooms, it is difficult to justify for the lone early-adopter. This burden is much easier to bear if there are resources for sharing the load.

Publishers can foster user communities by providing virtual and physical spaces in which they can occur, but the input and discussion must come from those who are actually using the new media. Novices can remind the authors what is still confusing or vague about the goals and implementation of new media, and experts can share their successes to inspire the novices. The *Visual Mechanics* (op. Cit., 4) software suite will have a Web site related to the pedagogical tool which will contain discussion groups, open areas for sharing new lab exercises and related educational resources, and feedback forms addressed to the publisher and the author. This virtual community will be publicized through traditional advertising, Web advertising, and through workshop and paper presentation activity. Our experience tells us that this type of support network is very important for widespread success of these projects.

During a recent (1996) NSF Workshop on Information Technology in Higher Education, the participants almost unanimously cited the need for better information on what is being done by their colleagues in new media. In the engineering disciplines in particular, there are few user communities or academic refereed publications that can

point the interested instructor towards new media resources. In response, the Web-based *Educational Technology Resource Center* [14] was founded. This center attempts to catalog some of the better developed new media projects in the science and engineering disciplines, and provides a discussion group which grew out of the email list associated with the Workshop. This resource center is fostered by the belief that instructors must be filling an educational need with new media, something they cannot achieve with texts and lectures alone. Further, the resources they find must be discipline-specific to be useful, and the prospective adopter of technology must be able to connect with other instructors to find answers to their implementation questions. The readership of this resource center grew from just the 50 participants of the workshop back in April 1996 to several hundred hits a week in recent weeks. This is a phenomenal readership considering that there are only approximately 300 engineering programs in the United States, and only some fraction of them have begun to seriously explore the use of interactive technology or have the equipment to run it. Although the discussion group section of this site does get some hits, many instructors are reading the existing commentary without adding their own. In future months, participation incentives will be offered, because most instructors won't begin to implement the ideas they see if they don't feel themselves part of a community of users. The first step will be a revision of the discussion group topics to include reviews of the software listed, with links from the review to the software and vice-versa.

In addition to raising conciousness and providing a sort of software safety-net, communities can help overcome the problems associated

with software upgrades. When a new revision of a textbook is released, it still resembles it's predecessor in form and function. The same is not true for software. Revised software can change interface, features, and basic functionality in some extreme cases. Having a solid community structure can help adopters of previous editions feel comfortable moving to the more advanced versions, thus perpetuating the continuous development and improvement that is one of the benefits of soft rather than hard copy. In the best instances of community, the participants will not only be reactionary, but also creative partners: innovations and upgrades to educational software will, in part, be a result of the requests and suggestions from the community.

The lessons here are that community builds consensus, support and acceptance, and that active participants are more likely to think creatively about the tools at their disposal, and apply them creatively to solve curricular problems or innovate new educational solutions. As we move forward, the community which cares about the implementation of new media would do well to foster more participation through open discussion, sharing of classroom experiences, sharing of additional instructional materials they may have developed through use of software, and extending offers to answer questions and concerns. Today, there are few evangelists who will actively seek to help their colleagues on the road to new media adoption. The Web is a step in the right direction, in that it offers the opportunity for colleagues to interact both on the use and even on the authoring of new media tools, but it is a silent partner, requiring more vocal advertising and incentives to encourage participation.

4. Recommendations

The best use of the ideas presented in this paper is at the proposal stage of a new media project. If the needs of the adopting instructor or the adopting community are considered along with the needs of the student, it will be much easier to transition the innovative work that is being done into the classroom at large. It should also result in a stronger multimedia product, because dissemination planning implies a much more thorough beta/class/workshop test phase than is typically done. The increased feedback in the cycle does mean that project development can take longer -- although not always -- but it also means that there will be an audience for the project by the time it is ready to be released, an audience that is already invested in the project's development, and one which it should suit, since they had their say about how to improve it.

When designing interfaces, support, help, and presentations for a project, remember that there are psychological as well as intellectual barriers to adoption of new media. Sometimes the right support and community is all that's required to help an instructor feel comfortable with new media. Sometimes they need ready-made course solutions to save them time. And sometimes they need help convincing the other members of their department or the client departments, as they are called, who will be the next to teach the students using new media. Consider how to help adopters overcome the five issues above in creative ways: both in software design and in support mechanisms.

Budget money for the dissemination process. Workshops, ancillaries, and user-group moderators are expensive. These activities require manpower, editorial time, and facilities, which can

cost some significant fraction of a development budget, typically on the order of 10-20% of the total. If they are built in from the start, the project will have a much greater chance of success. Planning and budgeting these activities after the fact wastes valuable time, and can result in dissemination delays of a year or more if new grant funding is needed.

Finally, it may be wise to think about new media project, Web-based, CD-based, or otherwise, in terms of extensible media, rather than as a finished entity. One of the best ways to build community support for a project is by allowing the community to feel like they are a part of the creative process. If you can allow a project to grow and change as it is adopted, it will be stronger and more flexible as a result. This is contrary to the traditional book publishing model, where the product is the vision of one author and one publishing team. The only user input is in the form of reviews. The Web and other collaborative software development techniques are introducing us to new ways of developing projects, which have the potential to make the community a community of authors, not just of adopters. This is frightening in some respects, because it is a shift from the commodity model of publishing. However, it leads to the notion of a much more devoted and involved adopter base, a base which not only voices its concerns and comments, but has the ability to actually address them apart from the efforts of the original author.

5. Conclusions

Our endeavors in educational technology have meaning and impact only if they are introduced and used in the community. It is the goal of publishers to achieve dissemination by best serving the needs of

the students and educators who are our customers. It is only by meeting the educational needs of both these groups that we will achieve success and our authors will be able to share their developments with a wide audience. No tool will achieve this kind of acceptance if it is not as useful for teaching as it is for learning, at least as long as the adoption model of higher education persists. This means that we must make it understandable, easy, and important for educators to adopt new media tools by any means possible to us: interface design, program design, ancillary design, workshops, and user community. If we aren't providing a superior solution to the current educational paradigm, we are doomed to -- and deserve to -- fail.

Publishers, and, by extension, their authors, will begin to assume more of a service role in the educational community, providing and facilitating instructor training, support groups, and information exchanges. In addition to creating paradigms for more efficient software development and dissemination for our own products, we will have to create paradigms for the community at large to actively participate in the development process. The systems for consensus building, training, and extended authorship will substantially change the way in which new media products are regarded and published, and will create a stronger user base who understand how to implement the tools, and who will perhaps produce the next generation of product based on what we offer them.

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[6] See, for example, *The Bookware Companion Series*, a series of Electrical Engineering textbooks that use *Matlab*, PWS Publishing Company, Boston (various copyright years).

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[10] National Science Foundation Engineering Education Coalitions

[11] National Engineering Education Delivery System Synthesis Coalition

[12] The Boston University Ordinary Differential Equations Project

[13] The Differential Equations Resource Center

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