Student Projects as a Funding Source

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ABSTRACT

Prompted by restricted funding for a lab which supported student software development work on real-world projects, a contribution program was established to facilitate monetary support from the external clients. The paper explores the relationships between instructor, students and client and how a funding component can affect these ties. Instructors who follow the guidelines provided can be successful with such a fund raising approach, but specific legal, ethical and organizational entanglements may disrupt these relationships and so should be avoided.

Keywords: Program Funding, Real-World Projects, Action Learning, Experiential Learning

1. INTRODUCTION

General trends in information systems curricula include greater exposure to technology and expanded exposure to real-world experiences. As business needs demand an ever dynamic set of development tools and technology platforms (Lee and Mirchandani, 2009), the impetus for information systems programs to expose students to a variety of tools and technologies has also increased. Regardless the amount of emphasis an academic information systems program places on technical vis-á-vis managerial abilities, exposing students to technology-based tools is necessary. Acquisition and support for such technology can be costly, prompting institutions to look to new funding sources, especially in lean economic times.

This paper will describe an approach taken at one institution in building loose relationships with businesses and agencies at the convergence of real-world student projects and external funding. While providing rationale and reflections upon real-world student projects based in the literature and personal experience, the primary focus here will be the impact of requesting contributions from the external client upon the project experience from the student's, client's and instructor's perspectives. Its context is lessons learned in incorporating group and individual real-world projects into Internet development courses. Emphasis is placed upon how this project structure has been adapted to create a funding source for a student computer lab. This adaptation faces many of the same issues associated with any real-world project structure; however, when external funds are requested, certain issues are accentuated and new concerns are introduced. The strategy can be successful, yet it also has several inherent pitfalls that should be avoided.

2. NEEDS: EXPOSURE TO THE REAL-WORLD

Exposing IS/IT students to the applied, in addition to the theoretical, has been thoroughly documented with root of the discussion traced back to Reginald Revans and David Kolb. Revans' (1971, pp. 105-106) action learning proposes that learning occurs as one reformulates existing knowledge through application when challenged by examining a real-time problem. Kolb's (1984, pp. 42) experiential learning theory suggests a student learns by testing concepts derived from reflecting upon "experience" or applying the conceptual. Information technology curriculum guidelines recognize non-lecture learning activities in that "students are unlikely to acquire the practical knowledge described in the learning outcomes without a significant experiential learning component in their program of study" (Lunt et al., 2008, pp. 28-29).

Instructors put the theory to practical use in the classroom using a variety of exercises and activities. For instance, Czajkowski et al. (2001) describe student groups examining the usability of mechanical designs and instructors at the author's institution have used Bill Geraats' Bridge Game in project management classes. For more comprehensive experiences, term-long case studies and hypothetical, in-class projects are often used. Examples include Harris and Vaught's (2008) as well as Steiger's (2009) database projects.

However, the "experience" in experiential and active learning can also be facilitated through partnerships with entities outside the classroom in a variety of ways. Semester and summer internships have long been a valuable path for students to gain job experience both within the institution (Van Over and Dangerfield, 1993) and in conjunction with external firms (Goddard, 1974). As a class project, students

have developed applications for administrative departments at their institution (Stutzman, 2004; Magboo and Magboo, 2003) and for-profit businesses external to the university (Parker and Holcombe, 1999). Service learning, although obtaining recent emphasis, has for some time facilitated student projects (Erickson and Leidig, 1997; Heinrichs, 1987; Jamieson, 2002; Tan and Phillips, 2005).

As used here, a "real-world" project addresses an organization's current business problem and fulfills course requirements. Instructors may structure the project by specifying course requirements and limiting project scope, but the project becomes "real" as students directly interact with the client to address the client's needs. Clients may originate internal or external to the institution and may be for-profit or not-for-profit.

Real-world projects differ from written case studies in that the latter present problems that are more, if not completely, static. While requiring reading comprehension and analytic skills, the textual form of case studies does not require students to interact with users, gather requirements, structure the problem description, nor respond to dynamics of ad hoc problems as with real-world experiences (Schuldt, 1991). It is possible to introduce dynamic requirements into a case study, perhaps at the instructor's peril (Dawson, 2000), but emulating the interaction with a real-world client is most difficult.

In a real-world project, the student, the client and the instructor have different motivations. These purposes can conflict and should be managed for a successful project experience. Incorporating a fund-raising component into the project, as described below, has further implications for these purposes and the relationships between the parties.

2.1 Student Needs: Professionalism and Relevance

The project structure described here was a response to a survey of the author's departmental advisory board which rated real-world experience among the most important skills needed by information systems graduates. This is consistent with a broader perspective reflected in trade publications. In a ComputerWorld survey of IT professionals, over 70% of respondents indicated higher education institutions were not adequately preparing students for jobs in information technology (Hoffman, 2003). The most important academic program shortcomings identified by these professionals were communication/people skills, business skills and real-world/hands-on experience. More recently, McGee (2008) summarizes employer demands of new IT professionals as communication skills, business knowledge and technical skills applied to real-world problems. Academic literature echoes these thoughts as Lee and Mirchandani (2009) conclude the desire for technical skills will continue while demand for business and project management skills is projected to increase. To some degree, students may obtain such experience through classroom activities and perhaps self-initiative; however, organizational expectations are enhanced within the context of the organization, i.e., real-world projects.

Skok and Wardley (1998) perceive such projects as an "Initial opportunity for students to acquire the skills and confidence to deal professionally with people in a business environment." Need for professionalism, as a curriculum goal, is extended by Little et al. (1999) in suggesting responsibility for professionalism lies with the institution, instructors, accrediting agencies and students. Information system programs should not ignore their responsibility in exposing students to elements of professionalism. Little et al. (1999) go on to identify important facets of professionalism that include interpersonal communications, personal values consistent with professional practice and knowledge of legal issues such as intellectual property rights and corporate liability. Real-world projects are an excellent canvas on which students can observe and demonstrate these professional qualities. During a project, students interact with the client, other team members and faculty through written and/or oral communication. Students will be challenged to see and adopt the values of the client organization. The importance of deadlines becomes more apparent as do dynamics of the work environment and sometimes less-than-static project expectations. Issues of intellectual property rights of their work product and liability thereof should also be addressed. These qualities are also reflected in student learning outcomes related to real-world projects described by Sabin (2008).

Education theory concludes that students who perceive relevance in course content are more motivated to learn (Frymier and Shulman, 1995). Students seek relevance in their course work, relevance to context in which they will work. Real-world experience directly addresses this desire and can give students a greater appreciation for the relevance of conceptual material presented in class. Application extends the conceptual.

2.2 Client Needs: Systems Development and Public Relations

Organizations look for cooperative opportunities with information systems programs for several reasons: to reduce development costs by using cheap labor, to improve public relations within the community, to increase tax deductions and/or to increase involvement with students who are potential employees. In the instance described here, businesses and non-profit organizations in the community contacted the department inquiring about students and classes to do a variety of web-related projects from static web site design to e-commerce applications requiring server-side processing. Some of these organizations were looking for an inexpensive path to a web presence; however, others considered development by students a viable alternative to hiring a consultant.

2.3 Instructor Needs: Relevance and Resources

The instructor, as teacher and institution representative, also desires a relevant curriculum as well as the resources to support student learning. In addition to making the content relevant to students, curriculum should be relevant to the discipline as reflected in possible accreditation, model curricula and industry relationships. Among ABET's (2008, pp.5) general criteria for computing programs seeking accreditation is "educational objectives that are based on the needs of the program's constituencies." Assessing constituent needs has been conducted in several ways including examining entry-level employment advertisements (Haga et al., 2007) and surveying employers (Janicki et al., 2007). A survey of a program's own alumni has also been used (Ballou

and Huguenard, 2007). As previously discussed, in this example the department's advisory board strongly desired that students possess real-world experience, business knowledge and communication skills in addition to a sound, technical foundation.

Relevance can also be sought in comparing program structure to model curricula. IS 2002 foundational assumptions of ongoing, desired characteristics of IS professionals include a "broad business and real world perspective" as well as "good interpersonal communication and team skills" (Gorgone et al., 2002, pp. 6). The most recent Information Technology guidelines suggest curricula identify "professional practice . . . based upon real-world issues" (Lunt et al., 2008, pp. 42ff). The path to consistency with model curricula will lead to placing students in real-world experiences.

The ongoing demand for computing technology at academic institutions is driven in part by facilitating student access to the exploding information technology base. The impetus to maintain current hardware and software is affirmed in ABET's (2008) accreditation criteria; however, in light of projected, reduced IT spending at many institutions during economic downturns (Campus Computing Project, 2003; Carter, 2009), it is a substantial challenge to provide current versions of a variety of software titles, and thus, new hardware. Funding is not always readily available. Colleges and universities have addressed this demand in a variety of ways including a requirement for student-owned computers (Virginia Commonwealth University, 2008), but some institutions are moving away from this model to recoup supplemental funding from the program (Moltz, 2009). Funding difficulties are exacerbated by a relative sparse number of external funding sources. As Watson and Huber (2000, pp. 28) suggest "Many IS programs must engage in revenue producing activities, because as 'the new kid on the block,' they do not have the accumulated resources of more established disciplines such as accounting and finance." Financial challenges prompt new funding models.

In the instance motivating this paper, as new Internet development courses were being developed within an information systems program, it became obvious that a separate computer lab would be helpful to facilitate student access to specific software titles and hardware unique to the new curriculum. While internal grants were obtained to purchase equipment, there were no funds budgeted for ongoing hardware and software expenses. Competition for future funding prompted a search for other sources of funds.

In examining possibilities for external funding, conversations with small business owners prompted the department to create an opportunity for organizations, as they benefitted from the students' work, to support the ongoing needs of the computer lab. The challenge was to structure a program where the needs of students, clients and instructors could be addressed.

3. A SOLUTION

To facilitate student exposure to real-world project experience, to aid organizations in obtaining applications at a reduced expense, building community relations and identifying potential employees, and to assist instructors in making course content relevant, implementing real-world student projects is an obvious solution. This approach places the instructor in a role very different from the traditional lecturer and introduces substantial concerns in coordination and communication, but as financial support is sought from the client, the structure and related issues become even more complex.

So how was a funding component added to the real-world project model? Initially, establishing students as consultants was considered; however, ethical and legal issues inhibited an explicit contractual arrangement. Ultimately, providing an optional opportunity for clients to financially support lab infrastructure was determined to be a better alternative. The department worked with the fund-raising foundation associated with the institution to create a dedicated fund to which organizations and individuals may contribute. The contributions are optional as no specific connection is made between an organization's contribution and the student's project. Deliverables intentionally are not considered work product; however, students do provide a copy of the project deliverables to the client organization at the end of the project; thus, the organization benefits. In addition to real-world experience, contributions are used to maintain lab technology; thus, the students benefit and the instructor has a funding source that does not require repeated, competitive grant proposals or other requests for funds.

3.1 Structure of the Funding Arrangement

On the surface, it appears adding an external funding component is a simple addition to real-world projects; however, this addendum requires thought and effort to structure the program properly and promote success. Working with the foundation to establish the fund was a fairly easy process once certain parameters were established. Per a suggestion from the university's general counsel, the instructor has discretionary spending authority over the account; however, the college's Dean counter-signs for all disbursements to protect the instructor from accusations of mismanagement. Contributions to the fund can only be used for the purposes specified when the account was created: purchasing hardware, obtaining software and funding training for the instructor in technologies relevant to course content.

When a potential client is identified an information page is distributed that describes the general intent of student projects as an academic experience and includes contact information. It also describes the opportunity to make contributions, how these funds will be used to aid students and that no specific contribution amount is required. As the foundation exists as a legal entity separate from the university and contributions to the foundation account are tax deductible, there should be no connection between a contribution and a work product; thus, unlike Janczewski (2008), no specific amount is requested. The objective of the information page is simply to inform so no client signature is required.

A form is also distributed to the students at the beginning of the course. It describes the academic nature of the project, states that project deliverables will be made available to the client and indicates clients will have opportunity to make contributions. It specifically requires students to waive all intellectual property rights to their project work, freeing the

client to use the product without future obligations. Unlike the client form, students are asked to sign and return the waiver. While it might appear this contrition might bother students, the instructor has encountered very few objections. Students understand the intent of the contributions is to support their labs and they accept the restrictions imposed by this arrangement.

When the project ends and the deliverables are presented to the client, the client is reminded of the purposes of any contributions and given the foundation's mailing address. As the foundation administers the account and receives all donations, no gifts are requested or received when the deliverables are presented, but reminding the client of the benefits of a contribution in the context of perceived project benefits can encourage giving.

3.2 Two Examples

The basis for this discussion is a four-year period involving seventy-one students working on sixteen projects. Some projects were assigned to individual students and others were completed by multiple groups, introducing a competitive aspect to the experience. Clients consisted of local businesses, community and tourism organizations as well as internal, regional and national educational entities. Of the sixteen projects, three were not implemented because of scope creep, lack of client cooperation and on one individual-study project, lack of student ability. Four organizations made contributions of which one was a not-for-profit regional education agency.

In a first example, the instructor was contacted by a regional educational agency after the successful deployment of a student project for a related organization housed on campus. The instructor met with the agency's representative to discuss the scope of the project deliverables and the parameters of the agreement including the opportunity to make a contribution. An undergraduate student, who had completed a course in web development and was seeking an individual project as an elective, readily agreed to this assignment and initiated contact with the client to identify scope and functional requirements. A meeting between student and instructor followed to ensure agreement on scope and the student's readiness for the project. The site was to include scripting on the client and server.

The student did a superb job of maintaining contact with the client located forty miles away and, as issues such as working with the web host arose, the student did seek the instructor's advice. The instructor also maintained contact with both the client and the student every few weeks to ascertain progress on the project and identify any concerns. In a concluding conversation, the client assessed the student's work and professionalism and the instructor expressed appreciation for the client's participation, reminding the client of the contribution option. In this instance, the student addressed the needs of the client who was most pleased with the student's work. Although a non-profit agency, the client did contribute several hundred dollars.

In a second example, a local medical practitioner sought a web presence. Conversations with the client revealed a static web site was needed and appropriate for a first course in web design and development. The client agreed to work with multiple student groups. He attended one class period where student groups asked questions to determine scope and functional requirements and later the instructor worked with the class to establish a common statement of scope before the student groups began their work. Students groups scheduled follow-up meetings with the client, as needed. The instructor occasionally contacted the client and talked with students during the weekly class meetings. At the end of the term, the client attended class presentations by the groups and provided feedback. Although generally pleased with the students' efforts, the client did not perceive one site superior to the others, instead preferring specific elements of each. The client inquired about possibly combining these elements into a single site, but the term's imminent end did allow such. Ultimately, the client incorporated these elements into a separate site he had created and made no contribution.

4. RELATIONSHIPS BETWEEN PARTIES

No matter the number of students or the client's requirements, the relationships between the three parties are important to project success. Student projects involving real-world clients, while rewarding, challenge the instructor to facilitate, but not manage, the project. Overstepping this role will remove students from much of the learning experience. Within the academic literature, instructors have shared numerous insights into facilitating real-world projects (Laware and Walters, 2004; Schuldt, 1991). While some perspectives may be similar, subsequent discussion seeks not to repeat these insights, but to consider new concerns imposed when seeking contributions.

Each party, the student, client and instructor, have expectations of the project experience and these expectations will vary by course and client. Expectations may compete for attention (Longo, 1998); thus, each party's needs should be identified and addressed as a successful student project is built upon these relationships. In a normal consulting relationship, the obligations and expectations of the consulting firm and its client are contractually specified. Although sharing some characteristics with a commercial consulting arrangement, academic student projects involving real-world clients modify these relationships. The instructor's goals should include maintaining good relationships with both the client and the student and monitoring the relationship between the students and client.

4.1 Student-Client Relationship

Students should view their relationship with the client in a professional manner. Research suggests potential employers and students consider professionalism important and expect instructors to convey related values without imposing their own (Fuller et al., 2009). Exposing students to client expectations facilitates this professionalism objective without instructor intrusion into personal values. In addition, students should practice professionalism as it may influence the client's attitude toward the students' academic preparation, and thus, the institution. This in turn may influence the client's propensity to contribute.

Although students should be expected to act professionally, clients should be encouraged to view students as students. Clients may have heightened expectations that the systems solution will be of mature, professional quality, perhaps accentuated by plans to make a contribution; yet, they

should understand students are to have the opportunity to fail without repercussions for the instructor, the institution or, aside from a course grade, the student. The academic experience should encourage students to take risks and test their own abilities. This attitude gives the instructor greater latitude to make academic objectives a higher priority than the project solution so instructors should help the client embrace this perspective from the beginning of the project while promoting expectations of success with the students.

A client may be tempted to complete some of the work itself and the instructor may be tempted to allow it. While the client and students may see mutual benefit in substantial client participation, this arrangement will not adequately reflect the students' academic progress. Whether motivated by a lack of trust in students to create a quality solution or a desire to expedite when students are struggling, the client should avoid doing the students' work and instead work through the instructor to address concerns. Regular client-instructor contact will help the client avoid this temptation. As for the instructor, academic goals should supersede meeting client expectations to encourage monetary reward.

In some cases, students may be required to rely on a third party. For example, students developing and deploying a web site using a hosting service may find it mandatory to select scripts from the host's script library instead of writing scripts themselves. This can be addressed by requiring students write scripts on a testing platform to demonstrate their competency, but integrating the commercial script into the deployed project. Of course copyright, patent and trademark law as well as cost considerations may limit use (Henson, 2009). In any case, students should gain permission from the client and instructor before including third party components.

The students' relationship with the client may extend beyond the academic term as an employee or in a consulting, support role for the project deliverable. Seeing a student obtain such a position is a credit to the student, instructor and the real-world project experience; however, the student-client relationship may evolve such that the client is inclined to pay the student rather than make a contribution to the fund and the instructor can exert little influence to redirect the funds without introducing work-for-hire into the project. But, more importantly, students should only be hired at the conclusion of the project; otherwise, expectations of the three parties may conflict.

4.2 Student-Instructor Relationship

The instructor's role in a real-world project varies from that of a case-based project (Laware and Walters, 2004). Since the project experience is less structured, students should be more independent and see the instructor as advisor rather than teacher. This new perspective can be very beneficial as students work more closely on an applied task, but the instructor should proactively establish boundaries for this advisory role. Students may strive to rely heavily on instructor for help and, in an effort to ensure a successful solution for the client, the instructor may be tempted to contribute, but the instructor must find an appropriate balance between enabling the learner and aiding students in meeting client requirements. Establishing parameters for instructor involvement at the beginning of the course can reduce potential problems during the project. Just as the client should understand that students may fail, the instructor should allow it, even at the expense of a successful solution and potential monetary benefits.

Project structure can be imposed by the instructor or be self-directed, but in either case, student accountability to the instructor is essential. Establishing project scope, a work breakdown structure and a project plan can help, but regularly updating the instructor about the status of the project, obstacles encountered and planned responses encourages students to remain on task.

4.3 Instructor-Client Relationship

The instructor-client relationship is very important to a successful system solution and the learning experience. Instructor and client have differing needs so initial communication and cooperation are imperative to address all requirements and communication throughout the project is essential to ensure students manage the project; yet, this communication should remain in the background lest students rely on the instructor to formalize the requirements and manage the project. It is advisable that the instructor and client establish project scope before students meet with the client. The instructor can then follow-up with the students to ensure the scope is appropriate. Consistency between client and instructor expectations of students is crucial to success and can help avoid student-client conflict; thus, the instructor must remain in contact with the client.

When opportunities for client contributions are included in the project structure, the instructor also becomes an informal fund raiser. This can motivate the instructor to be more attentive to the project; however, the primary motivation should ever be supporting students' learning experience.

An important aspect of the instructor-client relationship is its termination. Although continued communication beyond the current project may prompt future opportunities for projects with an experienced client, the instructor's responsibility should conclude at each project's end, else the instructor may be faced with a growing list of maintenance tasks. The client must understand the instructor will not guarantee project deliverables nor provide continued support. Again, the students should be allowed to fail without repercussions for the instructor.

5. PROJECT SELECTION

Project selection is very critical to student success. It involves identifying potential projects from a variety of sources (Gorka, Miller and Howe, 2007). It also requires considering selection criteria such as mission-criticality, time requirements, logistics, rigor and consistency between project skill requirements and student abilities (Novitzki, 1998; Van Over and Dangerfield, 1993). Harris (1994) identifies "finding suitable projects" first among potential problems for real-world projects.

5.1 Selecting Clients

Potential clients may arise from professional contacts, advisory board members, area professional and non-profit organizations as well as area Chambers of Commerce. In this case, clients within the community initiated the contacts as awareness of the student projects spread. An early project for the local Chamber of Commerce established our presence.

Prior to considering a specific project, the client's predisposition to cooperate in an academic endeavor should be examined by assessing the client's motivation, general expectations and past experience working with students. Placing financial benefits above educational objectives is inappropriate so appraising the potential for a contribution should be secondary to other issues; however, this may be futile in any case as experience suggests the perceived ability of clients to contribute is not indicative of their tendency to do so. As in the examples above, for-profit organizations may give little, if any, while non-profit entities may indeed contribute. Projects for institutional clients may generate little, direct support for the information systems program as use of students is often seen as a way to supplement the institution's own systems support staff (Magboo and Magboo, 2003).

5.2 Project Selection Criteria

All development projects involve risk as described in the long-standing risk matrix that considers project size, client's experience with technology and the amount of ambiguity in the project's definition (Cash, McFarlan and McKenney, 1988). These issues are accentuated in student development projects as it is a challenge to find projects, ideally low-risk projects, which fit course requirements in both scope and content. The scope should be sufficient to match the rigor of academic requirements while being of significant use to the client, yet be limited enough to be completed within the academic calendar. Clients accustomed to full-time, seasoned professionals may easily over-estimate the students' productivity; thus, the instructor should spend sufficient time in initial analysis of the project to evaluate personnel requirements and the amount of ambiguity in the problem definition. Of course the size of the student group may be increased for a relatively large project, but this also increases communication complexities (Brooks, 1982, pp. 16) that are further exacerbated by students new to the group project format.

Also, the instructor must assess the consistency between technical requirements of the client and the course. This is especially true for projects that extend to development and implementation. The client should have the infrastructure to support the solution and personnel who can maintain the solution after the project concludes. A project for a prospective client that supports only PhP on a Linux® platform is not an option for a project course requiring use of Microsoft® tools. Also, the instructor should examine whether academic or commercial software licenses are adequate in this context. Although the contribution structure described here strives to avoid work-for-pay, implications for proper licensing may be unclear. Consulting the institution's legal counsel is advisable.

Clients' plans for the project solutions may vary. Some may wish the deliverables be implemented while other clients use the student projects as a disposable prototype or see their role as only providing a cooperative learning experience. In any case, Magboo and Magboo (2003) offer wise advice in suggesting the project not be mission-critical. Project failure should not hinder the client, thus permitting students an academic experience with less pressure. Parker and Holcombe (1999) echo this concern especially when the mission-critical project is technically challenging. Meeting critical client needs may increase the client's propensity to contribute, but this must be balanced with academic goals. Project failure is a risk, but failing students' academic needs can have a more significant impact.

Student access to the client is essential. Hall et al. (2007) suggest communication skills may be as essential to project success as technical skills. Students need to practice communicating, not only with other students in a team setting, but with the external client as well.

6. CONCLUSION: ENHANCING CONTRIBUTION POTENTIAL

Real-world projects provide a beneficial opportunity for students to gain new perspectives about conceptual material, gain maturity in project work and enhance their employment potential. External organizations can also benefit from outsourcing low-risk design and development work to students. Although obtaining contributions should not supersede academic objectives, the instructor can address both needs by properly facilitating the project. The potential for contributions are enhanced by

- selecting projects of appropriate scope. Ensure the project is small enough to be completed by students within the academic term, yet large enough to address student and client needs.
- properly matching student technical abilities with requirements of the client's architecture.
- identifying clients who are academically oriented and interested in student learning.
- making students accountable on a regular basis.
- monitoring communication between students and the client throughout the project.
- conveying information about contribution opportunities at the beginning and end of the project.
- communicating how contributions will specifically be used to provide tangible benefits to students.

Through careful planning and continued communication, real-world projects give students an exciting, personal experience unlike the traditional lecture. If properly managed, real-world projects can also address client needs and, in turn, generate necessary funding to maintain student labs. It can indeed be a win-win-win experience.

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8. ATTRIBUTIONS

Linux is a registered trademark of Linus Torvalds.
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