MANAGING CSCL PROJECTS

Managing Towards Evaluation

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1 Introduction

Preparing, managing and evaluating educational technology initiatives, including projects that involve computer support for collaborative learning (CSCL), is a difficult task due to the numerous variables involved. One common preparation method is to use project-planning models. However, these models do not focus on change, but on resource planning, time schedules, milestones, and interdependencies of deliverables.

In this paper, we propose a model to implement a "theory of change" approach to educational technology projects in higher education. This academic-sounding phrase "theory of change" is basically a way to ask, "What is the project designed to accomplish, and how are its components intended to get it there?" The model helps project teams articulate their own theory of change and specify goals, outcomes and indicators, leading to an evaluation plan for the project that is satisfying to the target group, the implementers, and the funding parties.

In our model, we focus on the preparation, management and evaluation of change, which encompasses design, planning, management, and evaluation of educational technology projects. By providing a model, we intend to offer a handle for building consensus on best practices in educational technology projects. Our model aims at all participants involved, but in particular those who have the responsibility to design the educational technology projects. The model also offers assistance in determining evaluation criteria for the project. As in good research, good change projects start by defining a *clear* theory.[1]

In the first half of the paper we discuss problems inherent in the articulation, planning and evaluation of CSCL initiatives. The second half draws out the initial steps necessary to implement a theory of change approach.

2 The Need for Accountability

The explosive growth and functionality of Information and Communication Technology (ICT[2]) in general, and the Internet in particular, has spurned discussion how to embrace this revolution for learning. Universities are under increasing pressure to use this technological innovation as a means to control costs, improve quality, and operate more flexible and client-centered. Given the millions of dollars that are spent on ICT, there is an increasing call for accountability. Therefore, in order to find the right answers for higher education, we have to find out what works and

[1] Please note that *clear* does not imply *easy*.

[2] ICT stands for Information and Communication Technology and thus stresses the integrated nature of information and communication. ICT better describes the kinds of projects we focus on in this paper. It is also the prevailing term used in Europe; its use is gaining ground in the United States.

does not work. The question is simple: does teaching and learning benefit from these investments? Obtaining the answer, however, is complicated. It means appraising the effect of our intervention. An often-heard complaint is that evaluation methodology is subverted by a myriad of confounding variables brought on by others involved in the project. Why is this happening and how can we avoid this?

We suggest that this problem arises out of four common misconceptions or myths about educational technology projects. These myths cause a "garbage in, garbage out" effect, i.e., the evaluation cannot be better than the parameters that were built in the project from the start.

In the remainder of this paper, we first discuss these misconceptions and then propose a model to help projects avoiding these evaluation traps. What we propose is a pluralistic approach to project execution that draws explicitly upon theory-based evaluation and is strengthened by tenets of change and project management found in the information technology community. The proposed model is intended for the designer, developer, evaluator and the management, whether in multidisciplinary teams or working alone. It should be applied before starting an intervention. However, it can be used in the middle of a project or afterwards as a checklist and a resource for guidelines to develop best practices.

3 Four Prevailing Misconceptions

In this section, we describe the above-mentioned four prevailing problems to illustrate the problems tackled by our model.

3.1 Misconception I: The Common Goal

Many projects start out by trying to create one common goal. This appears to be a sensible way to start a project: make sure that everyone is heading in the same direction. However, heading in the same direction does not require each stakeholder adhere to the same single goal. It is possible to state one goal, but it is very unlikely that everyone is pursuing this same goal. In reality, projects are fraught with a myriad of goals. The reason for this is simple: there is probably a different goal for every stakeholder, in particular for stakeholders operating on different domain levels. The failure to recognize this results in projects with *hidden* goals, *conflicting* goals, *creeping* goals, and *dead* goals. (See Figure 1)

The way to resolve this is not to try to create one common *goal*, but a common *vision* to be strived for by a set of explicit and interconnected goals. A vision is "the act or power of imagination", a "mode of seeing or conceiving", and "unusual discernment or foresight[3]." The advantage of using a vision, as a common denominator is twofold:

1. A vision is not precise. It is a visualization of the future, a future that can be arrived at in different ways and different means, by pursuing a balanced set of goals.
2. A vision is an idealized visualization of the future. We know upfront that the idealization cannot be realized completely, let alone tested.

The idea to use a common vision as a way to coordinate efforts is supported by Eric Brown in a review of Peter Senge's book "The Fifth Discipline: The Art and Practice of the Learning Organization".[4, 5] In this review, Brown noted that: "A major problem

[3] Merriam-Webster Collegiate Dictionary, http://www.merriam-webster.com
[4] Senge, P. (1990) The Fifth Discipline: The Art and Practice of the Learning Organization. New York: Doubleday.

confronting those who attempt to foster educational improvements is the fragmentation that exists in the present educational system." Senge's solution to use systems thinking neglects the problem of fragmented systems, i.e., systems with completely different goal. Brown asks, will a common vision help "each participant—irrespective of his or her level in the organization—(to) coordinate efforts with others (…)?". He continues, "Indeed a common vision is the cornerstone of the learning organization, for it defines the proper nature of the organization's work. And an organization must understand what work it is to accomplish (…)". The problem, however, with visions is that there is no decisive way of testing them. What we *can* do is test to see which aspects of this idealized visualization of the future are realized. The ultimate verdict on whether the vision is realized is a subjective one.

Although a common vision does not have to be very precise, the goals that should lead us there must be precise. A goal is "the end toward which effort is directed"[6]. The goals to support a common vision should form a coherent network supported by the cooperation of many people. Educational technology projects require goals at different domain levels, such as the organizational domain and the technical domain.

The CSCL initiatives conceived of, and executed, at the Stanford Learning Laboratory and the Maastricht McLuhan Institute Learning Laboratory represent projects with a vision and a supporting set of goals. These labs address this common vision by housing technical development staff, educational product developers, learning designers, and social science researchers together under one roof.

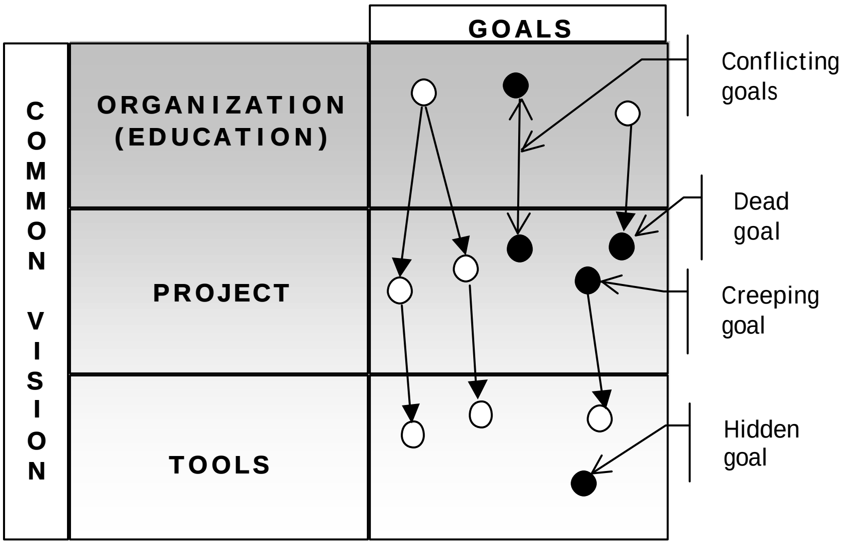

Figure 1 Conflicting goals, Dead goals, Creeping goals, and Hidden goals

Thus, Learning Lab projects involve a mix of product design with curricular innovation and teacher development. They all pursue different goals, but the idea is that these goals are balanced in such a way that together they help realizing a shared vision.

Personnel charged with evaluating the success of these projects face the challenge to serve many stakeholders, and thus many goals. In general, applied research and evaluation personnel have clients from three major stakeholder groups: the group that is charged with the technical functionality of the project's product, groups concerned

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[5] Brown, E. (2000) The Fifth Discipline, review. URL: http://coe.asu.edu/edrev/reviews/rev92.htm
[6] Merriam-Webster Collegiate Dictionary, op cit

with the ultimate project outcomes, and the students who are supposed to benefit from all this.

Having different goals is by itself is not the problem. The problem lies in acknowledging that there *are* different goals, and how to make them clear and balanced in such a way that they do not become conflicting goals, creeping goals, hidden goals or dead goals. The importance of clear and balanced (coherent) goals is evidenced by the Kraft Report about the space shuttle Challenger disaster. The first recommendation of the Kraft report[7] concerning the Challenger disaster read (emphasis by the authors):

> *"Recommendation 1: **Establish a more balanced set of goals** for the Shuttle Program (…)"*

The Kraft Team made this recommendation because it noted that there were several conflicting goals: safety, efficiency, and innovation. NASA was expected to innovate space exploration, while on the other hand it was expected to lead as a commercial payload facility. Additionally, NASA was also expected to reduce costs, even though everyone knew that innovation requires high and costly safety standards.

These conflicting goals were the result of two conflicting visions: 1) exploration of space, and 2) commercial exploitation of space. This also laid down the foundation for a failure of communication between the large numbers of parties involved in the project. The Kraft Team noted this communication problem within the Shuttle Program:

> *"Numerous contractors exist supporting various program elements, resulting in ambiguous lines of communication and diffused responsibility."*

Starbuck and Milliken[8] noted that this problem of imperfect communication is commonplace in organizations:

> *"Neither Morton-Thiokol nor NASA could be called a typical organization, but their behaviours preceding the Challenger accident had many characteristics that we find commonplace in organizations. Organizations often communicate imperfectly, make errors of judgement, and provide playing fields for control games."*

Although on a much smaller scale, the same problem arises in many educational technology projects. Indeed, the majority of the problems are caused by communication problems between stakeholders. For example, designers and clients in a consultant-client relationship do not and cannot always articulate clearly what they want or need in the final product. Unbalanced stakeholder goals add to this problem through the introduction of conflicting requirements. Interestingly, the Kraft Report's fourth recommendation reads:

> *Recommendation 4: Initiate **a requirements review** (…)*

This review is needed to make sure that no assumptions are being made about the requirements, and that they are relevant to the common vision and fit the individual goals. Assumptions also burden educational technology projects. Clients often assume

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[7] Kraft, C. Report of the Space Shuttle Management Independent Review Team, Feb. 1995, URL: http://www.fas.org/spp/kraft.htm

[8] Starbuck, William H.; Milliken, Frances .J. (1998). Challenger: Fine-Tuning The Odds Until Something Breaks. New York University, New York, NY, USA, Journal of Management Studies, 1988, 25: 319-340. (http://www.stern.nyu.edu/~wstarbuc/mob/challenge.html)

that the designer understands, and designers often assume that they do understand. Moreover, both make assumptions departing from their perspective and responsibility. We can draw from Information theory[9] and Communication theory[10] to predict what will cause this assumption problem and how it can be avoided. Information theory identifies three possible sources of noise that cause communication problems:

1. Technical: how accurately are information symbols transmitted?
2. Semantic: how precise are the symbols in transferring the desired meaning?
3. Effectiveness: how effective is the meaning of the received information?

The methods of communication in a project affect the first level. For example, long communication lines, as in the Shuttle Program, are less accurate than short communication lines. Long communication lines increase the chance of information loss or deformation. Cultural differences between project members affect the second level, i.e., the semantics. For example, differences in jargon cause problems in transferring the desired meaning. This problem is sometimes aggravated when one party must speak a foreign language in order to communicate with a project partner. Finally, the third level is affected by the differences in ability or ways to express thoughts. Some people like to be precise and concise, while others tend to be vague or wordy. Making communication accurate, precise and effective takes time and is expensive, while making assumptions is a lot faster and cheaper, in the short run. It is one of the problems that can ultimately lead to disaster, as in the Challenger tragedy.

3.2 Misconception II: The Common Problem

The second problem is closely related to the first misconception: it is the belief that we are addressing a common problem. Analog to the different goals, project participants deal with completely different problems. Some have to solve technical problems; others have to deal with organizational problems. Project participants work from different perspective and operate on different levels of change. Even when both the design team and the evaluation team are working to realize a common vision, their individual problems can be very different. These differences depend on the difference in the domains they operate. (See Figure 2)

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[9] Shannon, C. E. and W. Weaver (1949). The mathematical theory of communication. Urbana, University of Illinois Press.
[10] Wiener, N. (1997). Information Theory of Claude Shannon & Warren Weaver. A First Look at Communication Theory. E. Griffin, McGraw-Hill, Inc.: 48-56.

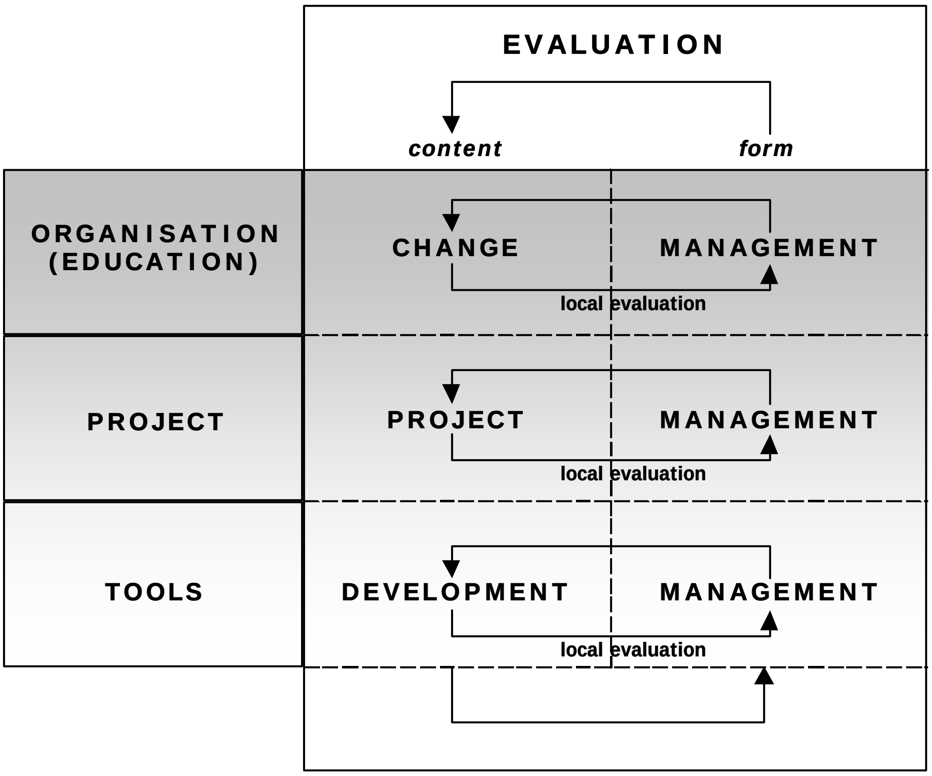

Figure 2 Domains and levels of change

For example, a faculty member might endorse the common vision to create a more student-centered environment, but still have as his/her personal goal not to increase the workload or even to reduce it. If these personal problems, that fit a certain domain, are not recognized as valid and justified, then they will behave as a hidden goal. These types of goals seriously handicap the chance of success of a project.

3.3 Misconception III: The Reductionism's Simplicity

Given the intricate network of different goals, and the number of interrelated problems, we face yet another difficulty: the inability to reduce the project's complexity such that it becomes a simple problem. Applying rational and reductionist models of thinking here will only lead to frustration. We believe that the challenge of preparing, managing and evaluating educational technology projects is a so-called "wicked problem." Rittel and Webber[11] describe wicked problems as follows:

> *For wicked planning problems, there are no true or false answers. Normally, many parties are equally equipped, interested, and/or entitled to judge the solutions, although none has the power to set formal decision rules to determine correctness. Their judgments are likely to differ widely to accord with their group or personal interests, their special value-sets, and their ideological predilections.*

[11] Rittel, H; Webber, M. (1969). Dilemmas in a general theory of planning. Policy Sciences, 4, Elsevier Science, pp 155-173.

Conklin and Weil[12] give the following four criteria for a problem to be wicked:

- *The problem is an evolving set of interlocking issues and constraints. Indeed, there is no definitive statement of the problem. You do not understand the problem until you have developed a solution.*
- *There are many stakeholders, i.e., people who care about or have something at stake in how the problem is resolved. This makes the problem solving process fundamentally social. Getting the right answer is not as important as having stakeholders accept whatever solution emerges.*
- *The constraints on the solution, such as limited resources and political ramifications, change over time. The constraints change, ultimately, because we live in a rapidly changing world. Operationally, they change because the stakeholders, who come and go, change their minds, fail to communicate, or otherwise change the rules by which the problem must be solved, generate many.*
- *Since there is no definitive* Problem, *there is no definitive* Solution. *The problem-solving process ends when you run out of time, money, energy, or some other resource, not when some perfect solution emerges.*

To see the difference between a wicked problem and a tame problem, it is enlightening to see how Herbert Simon failed to prove that computers could solve wicked problems. Herbert Simon is an artificial intelligence proponent who stated that the game of chess is a wicked problem, i.e. an evolving set interlocking issues, no right answer, and no definitive solution. Computers play chess, therefore computers can solve wicked problems. However, Simon forgot one thing: the game of chess has a clearly defined set of rules that do not change during the game. In wicked problems they do.

Let us see how educational technology projects meet the wicked problem criteria. The first criterion states “you do not understand the problem until you have developed a solution”. This holds for many software design problems, and in particular for educational technology projects. Clients usually do not know exactly what it is they need due to a lack of knowledge and experience with educational technology. There is usually no definitive problem statement other than “support learning”, “support collaborative learning,” “improve insight,” etc. This is in concordance with our idea about the common vision and the lack of a common problem and goal. It is usually much easier to start building and criticize that solution.

The second criterion requires that there are many stakeholders, making the problem solving process fundamentally social. Educational technology projects involve many stakeholders, such as management, faculty, students, system operators, designers, developers, and evaluators. All these are involved in finding solutions for many different problems, making these projects necessarily a highly social activity.

The next, third, criterion states that constraints change rapidly. These changes can come from outside sources, but often they emanate from the stakeholders. This also

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[12] Conklin E.J. & Weil, W. 1997. Wicked Problems: Naming the Pain in Organizations. http://www.gdss.com/wp/wicked.htm

corresponds with the creeping goals (leading to creeping requirements), and communication failures we mentioned in section 3.1 above.

Finally, the fourth criterion, states that there is no definitive problem. Educational technology projects consist of many problems (and sub-problems), but no definite problem. For example, the problem is not just “how do we introduce information technology into education.” Neither is it “how do we make information technology work for education?” It is a composition of these and many more problems. Since there is no definitive problem, there is no definitive solution. In other words, we could discuss the problems forever without arriving at a resolution.

Thus, in our opinion, educational technology projects are wicked problems. Figure 3 depicts graphically our feeling for the level of wickedness of educational technology projects. The figure portrays the many important stakeholder groups that bear on the solution space for a given problem. All of the groups tend to share three basic traits: stakeholders all worry about idiosyncratic issues; they all have opinions about the solution; and they fear not being heard in the discussion leading to the solution. In solo development efforts these issues do not bear so significantly on the problem. Complex development efforts, however, increase the burden several fold. As such, complex initiatives begin to defy simplification and abstraction, and cannot be solved in a linear way. However, that is usually the way we approach educational technology projects: we treat them as *tame problems.*[13] Tame problems lend themselves for traditional, linear, problem-solving methods: define the main goal; formulate the main problem, and think of the best solution. This is the method we are familiar with and therefore approach wicked problems as if they were tame problems. When all you have is a hammer, everything looks like a nail.

[13] Conklin E.J. & Weil, W. 1997. Wicked Problems: Naming the Pain in Organizations http://www.gdss.com/wp/wicked.htm

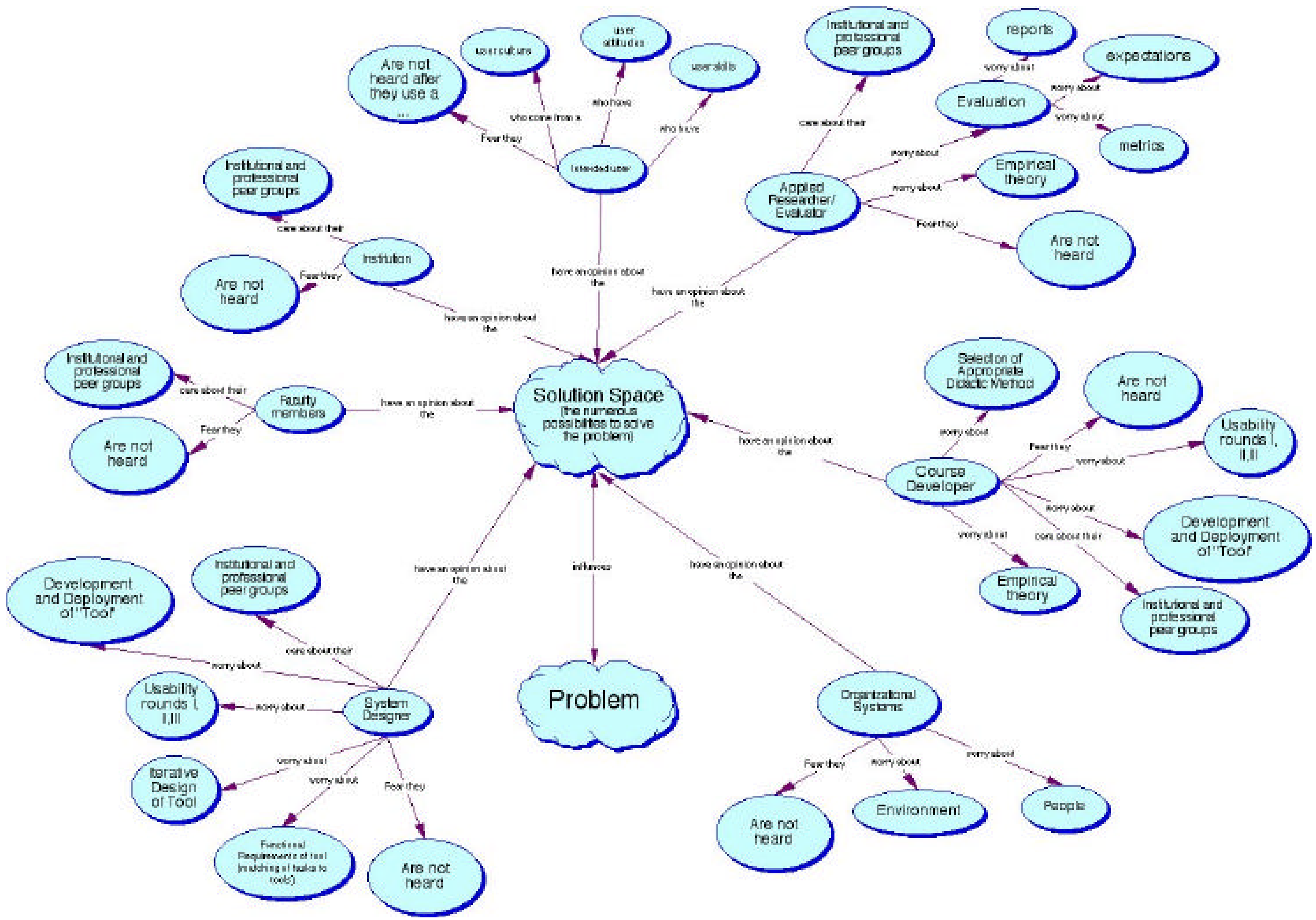

Figure 3. Wickedness of CSCL Initiatives in Colleges and Universities

3.4 Misconception IV: Usefulness of Traditional Research Paradigms

CSCL initiatives can exhibit broad variations in strategies and activities being pursued. In most cases, the efforts represent complex, multifaceted interventions. There is a growing sentiment that complex multifaceted interventions do not lend themselves to traditional evaluation methods involving randomized control groups or comparison groups to establish counterfactuals. Furthermore, many of the projects are developed with a bottom-up approach, thus producing agendas that are dependent on unique contexts of the target stakeholders. Designing cross-site or even cross-project evaluation frameworks with rigorously specified and consistent outcome measures is very difficult[14],[15].

Lisbeth Schorr[16], Harvard lecturer in social medicine, and director of the Harvard Project on Effective Services, proffered the following thoughts about research and evaluation of complex initiatives[17].

> *Because of the narrow range of interventions that can be assessed with current evaluation techniques, and the narrow range of information about impacts that current evaluation techniques are able to capture, prevailing approaches to evaluation have not provided the knowledge needed to make good judgments about a range of social programs that may hold the most promise. But current evaluation techniques have managed to systematically bias program design and policy development away from what is likely to be most effective.*

CSCL projects as complex instructional technology initiatives have proven difficult to evaluate because they also do not lend themselves to traditional experimental methods, i.e. methods that are suitable for *tame problems*.

By adapting Schorr's thinking[18], one begins to see that in order to be rigorously evaluated with traditional methods, CSCL initiatives must be standardized and uniform—across sites and across students and faculty, and over time. They must be sufficiently constrained such that their activities and effects can be discerned in isolation from other attempts to intervene. Furthermore they must be sufficiently susceptible to outside direction so that features such as how participants are recruited and selected can be controlled. However, these are conditions that are incompatible with what we know contributes to CSCL project effectiveness:

1) Effective projects are adapted to respond to particular sites and individuals;

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[14] See Hebert, S. & Anderson, A. (1998). Applying a Theory of Change Approach to Two National, Multisite Comprehensive Community Initiatives: Practitioner Reflections. In New Approaches to Evaluating Community Initiatives, Volume 2: Theory, Measurement, and Analysis. Aspen Institute: http://www.aspenroundtable.org/vol2/hebert.htm.

[15] Hollister, R. & Hill, J. (1998). Problems in the Evaluation of Community-Wide Initiatives. In New Approaches to Evaluating Community Initiatives, Volume 1: Concepts, Methods, and Contexts. Aspen Institute: http://www.aspenroundtable.org/vol1/hollister.htm.

[16] Lisbeth B. Schorr (1995). New Approaches To Evaluation: Helping Sister Mary Paul, Geoff Canada and Otis Johnson While Convincing Pat Moynihan, Newt Gingrich and the American Public. Speech at the Annie E. Casey Foundation Annual Research/Evaluation Conference September 29, 1995

[17] Kubisch, A.; Weiss, C.; Schorr, L.; Cornell, J. (1998). Introduction. In New Approaches to Evaluating Community Initiatives, Volume 1: Concepts, Methods, and Contexts. Aspen Institute: http://www.aspenroundtable.org/vol1/intro.htm.

[18] Lisbeth B. Schorr (1995). New Approaches To Evaluation: Helping Sister Mary Paul, Geoff Canada and Otis Johnson While Convincing Pat Moynihan, Newt Gingrich and the American Public. Speech at the Annie E. Casey Foundation Annual Research/Evaluation Conference September 29, 1995

2) they change over time, with continuing mid-course corrections to raise the odds of success;
3) they are comprehensive, complex, interactive, and multi-faceted; they include efforts to change learning conditions; they recognize their dependence on organizational and other forces; and
4) they count on being able to make operational decisions locally.

The complexity does not end here. The fact that CSCL projects involve ICT brings its own set of difficulties[19]:

- Technology is only one piece—and often not the most important piece—of a complex intervention.
- Interventions involving technology require an infrastructure for their implementation
- Technology-supported interventions are often ill-specified and subject to dramatic change over time.
- Readily available measures of student learning do not capture many of the hypothesized enhancements.
- Student, faculty, and institution variables are likely to moderate the effects of technology-supported innovations.
- Since so many factors are changing at once, it's difficult to attribute measured effects to technology use.

Keeping in mind the notion attributed to George Box[20] that "All models are wrong, some are useful," we turn to the second part of the paper, providing the reader with a model we feel is exceedingly useful in addressing the misconceptions one finds common in the design, deployment and evaluation of complex CSCL initiatives.

4 First Steps in a Theory-Based Evaluation Approach

The first part of this paper introduced some of the misconceptions adopted by project managers and researchers who manage and evaluate CSCL-like projects (often complex educational technology initiatives). These misconceptions included *the common goal, the common problem, reductionistic simplicity,* and *traditional research paradigms.* In the remainder of the paper we outline the beginning steps of a theory-based model that is designed to help designers, evaluators and managers avoid these misconceptions. Theory-based evaluation looks at the linkages between a program's input and its outcomes via intermediate variables[21]. Why should complex initiatives be evaluated using a model rooted in theory-based evaluation? Weiss[22] notes four purposes:

- It concentrates evaluation attention and resources on key aspects of the project.

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[19] Means, B. (2000). Measuring Technology's Role and Impact. Plenary presentation at the 2nd Annual OERI Technology Evaluation Institute. Ann Arbor, Michigan. Aug. 20-23, 2000.
[20] George E. P. Box, G; Hunter, J.; Hunter, W. (1978). Statistics for Experimenters: An Introduction to Design, Data Analysis, and Model Building. John Wiley & Sons.
[21] Claremont Graduate University, Evaluation Core Courses: http://eval.cgu.edu/lectures/lecturen.htm
[22] Weiss, C. (1998) Nothing as Practical as Good Theory: Exploring Theory-Based Evaluation for Comprehensive Community Initiatives for Children and Families. In New Approaches to Evaluating Community Initiatives, Volume 1: Concepts, Methods, and Contexts. Aspen Institute: : http://www.aspenroundtable.org/vol1/weiss.htm.

- It facilitates aggregation of evaluation results into a broader context based of theoretical program knowledge.
- It asks project practitioners to make their assumptions explicit and to reach consensus with their colleagues about what they are trying to do and why.
- Evaluations that address the theoretical assumptions embedded in programs may have more influence on both policy and popular opinion.

Furthermore, Cornell and Kubicsh[23] identify three reasons why the design and evaluation of a complex initiative should begin with articulation of its theory of change:

- A theory of change approach can sharpen the planning and implementation of an initiative.
- With a theory of change in hand, the measurement and data collection elements of the evaluation process will be facilitated.
- Articulating a theory of change at the outset and gaining agreement on it by all stakeholders reduces, but does not eliminate, problems associated with causal attribution of impact.

Among the literature espousing a theory of change approach, little of it makes operational suggestions for developers, designers and evaluators of complex projects[24]. Many references to its implementation are in the context of specific project descriptions, leaving the reader to tease out relevant strategies for their own use. In reviewing the literature on theory-based evaluation, theory of change, program logic, as well as functional requirements specifications practice, we present here the first five steps in implementing a theory of change approach to complex ICT projects. The steps are as follows:

1. Identify stakeholders;
2. Determine the outcomes of interest for the project;
3. Construct a program logic map of the project's theory of change;
4. Describe the functional requirements for the elements of the map;
5. Revisit the map.

4.1 Identifying Stakeholders

Including the right stakeholders in the program theory development process is a crucial aspect of this approach. For some project designers it can also be a threatening proposition. The Kellogg Foundation Evaluation Handbook notes that

> *Although this step may be time-consuming and fraught with the potential for conflict, it is one well worth the time and effort. Involving many stakeholders will help ensure that the evaluation process goes more smoothly: more people are invested and willing to work hard to get the necessary information; project staff concerns*

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[23] Connel, J. & Kubisch, A. (1998). Applying a Theory of Change Approach to the Evaluation of Comprehensive Community Initiatives: Progress, Prospects, and Problems. In New Approaches to Evaluating Community Initiatives, Volume 2: Theory, Measurement, and Analysis. Aspen Institute: http://www.aspenroundtable.org/vol2/connell.htm.

[24] Milligan, S.; Coulton, C.; York, P.; Register, R. (1998). Implementing a Theory of Change Evaluation in the Cleveland Community-Building Initiative: A Case Study. In New Approaches to Evaluating Community Initiatives, Volume 2: Theory, Measurement, and Analysis. Aspen Institute: http://www.aspenroundtable.org/vol2/milligan.htm

> *about evaluation are reduced; the information gathered is more reliable and comes from different perspectives, thus forcing the team to think through the meaning of contradictory information; and the recommendations are likely to be accepted by a broader constituency and implemented more fully and with less resistance*[25].

Because of this importance, we spend considerable time discussing stakeholder selection as well as the vetting of stakeholders. Intimate knowledge of the initiative's stakeholder groups shapes the selection of who should participate in the articulation of the initiative's theory of change. The term "Stakeholders"[26] in our approach includes "Clients," "Customers," "Users," and "Other Stakeholders". The client is the person or group that is paying for the development, design and deployment of the project. They can be considered the owner of the delivered system. One should be able to name the client or clients. It is permissible to have several names, but more than three negates the point. For purposes of definition in this approach, the client has the final acceptance of the "system", (end product, project outcome, etc.) and thus must be satisfied with the "system" as delivered. Where the "system" is being developed for in-house consumption, the same person may fill the roles of the client and the customer. If you cannot find a name for your client, then perhaps you should not be executing the project.

The customer is the person/s who will "buy" the project results or educational product (the CSCL initiative) from the client. In the case of in-house development the same person often plays the roles of the client and the customer. In the case of a product that is being developed for an international market, there might be a different customer (or customer profile) in each country.

Next, list of the potential users who will experience the product[27] or tool or innovation in the project. This is most likely to be the name of a user group like: "college students," "design engineers," "project managers." Operationally defined, "users" are human beings who interface with the product, tool or innovation in some way.

Attach to each category of users a priority rating. This gives the importance and precedence of the user. The Volere[28] template suggests prioritizing the users into:

1. *Key users*. These are critical to the continued success of the product. Give greater importance to requirements generated by this category of user.
2. *Secondary users*. They will use the product, but their opinion of it has no effect on its long-term success. Where there is a conflict between secondary users' requirements and those of key users the key users take precedence.
3. *Unimportant users*. This category of user is given the lowest priority. It

[25] W.K. Kellogg Foundation (1998) Evaluation Handbook. Battle Creek, MI: Kellogg Foundation. http://www.wkkf.org/Publications/evalhdbk/

[26] We are grateful for the Volere Requirements Specifications Template for guiding us in this area. We have modified the Volere sections on stakeholders and users for our purposes here. See: Robertson, J. & Robertson, S. (2000). Volere requirements specification template. Edition 6.1. London: Atlantic Systems Guild.

[27] Here on out we use the term "product" to refer generically to the experience, service, tool, innovation or other outcome that is expected from the CSCL initiative.

[28] Robertson, J. & Robertson, S. (2000). Volere requirements specification template. Edition 6.1. London: Atlantic Systems Guild.

includes infrequent, unauthorized and unskilled users, and people who misuse the product.

By assigning a percentage to each type of user one can assess the amount of consideration given to a user. If some users are considered to be more important to the project, or the organization, then this should be stated because it should affect the way project is designed. Some users may be listed as having no impact on the product. This means that the users will make use of the product, but have no vested interest in it. In other words, these users will not complain, nor will they contribute. Any special information from these users will have a lower design priority.

Finally, consider the roles and (if possible) names of people and organizations who are affected by the initiative or whose input is needed in order to develop, design and deploy the project. Failure to recognize stakeholders results in missing requirements in the project.

Examples of stakeholders include:

- Users (detailed above)
- Sponsor
- Testers
- Technology Experts
- System Designers
- Marketing Experts
- Legal Experts
- Domain Experts
- Usability Experts
- Representatives of external associations

For each type of stakeholder identify:

- *Stakeholder Identification* (some combination of role/job title, person name, organization name),
- *Stakeholder Knowledge* needed by the project.
- Stakeholder Influence on the design.

4.2 Determine the Outcome of Interest for the Project

The activities described in this section and the following section occurs as a meeting of the stakeholders. Generally the creation of a logic model or theory of change illuminates how complex (and overly large or ambitious) projects are when first articulated. Care should be taken to reduce the model to the components that are necessary to achieve the ultimate goals, beginning by determining the outcome of interest.

Lohr[29] goes to some length to discuss policy relevance of research and evaluation, and we think it bears some repeating here. We like to think ourselves, as evaluators, scientists, developers, and researchers, as apolitical beasts, immune from the heavy cloak of influencing policy. We merely do our work for the sake of knowledge, regardless of its use. After all, it's the creation of knowledge that counts, right? In the arena as-

[29] Lohr, L. (1995). Impact analysis for program evaluation. Thousand Oaks: Sage

sociated with the development, deployment, and assessment of CSCL initiatives, this could not be further from the truth. Sure, it's about creation of knowledge, but it doesn't end there. Empirical experimental research can occur in an a-contextual black box, but evaluation of CSCL cannot.

Keeping this in mind, what are the guidelines for selecting the outcome of interest—the outcome on whose measurement the value or success of the program is to be judged? Lohr argues that the outcome of interest must be "inherently valued". The idea here being that the policy relevance of the project—the probability of its usefulness—will be enhanced if the outcome of interest is inherently valued.

How does a project team know if they have inherently valued outcomes? Inherently valued outcomes are those in which there is an interest for its own sake rather than for the sake of achieving something further. Outcome Y is said to be inherently valued as follows:

- If ***Y*** is attained, the attainment of outcomes to the right is immaterial—one does not particularly care to learn whether they occurred or even what they are.
- If ***Y*** is attained, one is willing to *assume* that the specified outcomes further to the right will also be attained at a satisfactory level.[30]

Why bother with this? This method enables evaluators, system designers, managers, and clients, via discussion, to select the outcome of interest to their own satisfaction. Furthermore, when the two considerations above are met, support for the project among the necessary interested parties in significantly strengthened.

A strategy for eliciting the desired outcomes of interest in a project is Vanezky's "History of the Future" exercise[31].

> *To facilitate this process for complex projects, we propose that the project staff write a history of the future. Imagine that your intervention project is completed and that it succeeded in all of its goals. You are to appear tomorrow at a press conference to explain what you have accomplished. Write a press release for distributing at this meeting, explaining in a few paragraphs what it is that you have accomplished, who is benefiting from this, why it's important (that is, what problem it solves and why this problem needed to be solved), and what it was that you did that led to or caused this success. (p. 7)*

Vanezky notes that this exercise forces project participants to clarify exactly what the outcomes of interest are, why they're important, and how they might be achieved.

4.3 Construct a Program Logic Map of the Project's Theory of Change

Program logic maps are constructed during a meeting of the stakeholder group. The map graphically links the inputs to the outputs for the project. A sample program logic map, shown in Figure 5, is comprised of three basic component shapes:

[30] Lohr, L. (1995). Impact analysis for program evaluation. Thousand Oaks: Sage (p. 19)

[31] Vanezky, R. (2000). Procedures for evaluating the impact of complex educational initiatives. Unpublished manuscript.

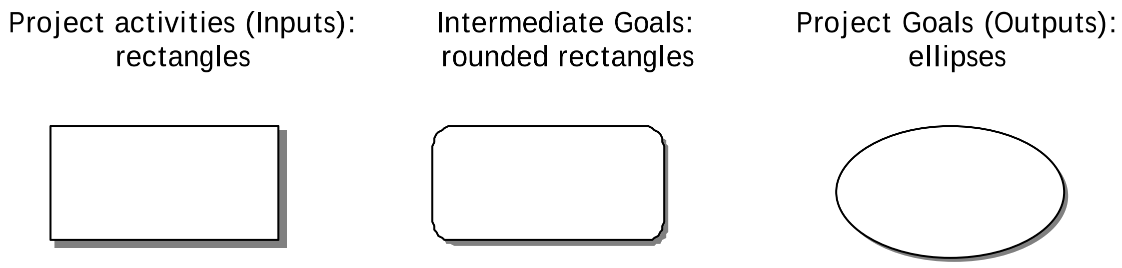

Figure 4 Basic shapes for a program logic map

Moving backward from the outcome of interest, a facilitator (likely the initiative's evaluator) should take the group of stakeholder representatives through a graphic articulation of the initiative's theory of change. From the program logic map one can derive a succinct summary statement of the project's logical path. We provide an example here based upon the sample program logic map shown in Figure 5.

> A course offered to college students in geographically disparate sites, is theorized to operate as follows: a project-based community curriculum, coupled with curricular support will lead to increased engagement in the local community by students and increased collaboration among students across communities. Internet connectivity and technology support will lead to increased technology skills on the part of the student thus increasing their ability to collaborate. Increased collaboration is theorized to lead to the creation of a learning community and therefore improved student outcomes.

In time the evaluator should be aware of the underlying assumptions and hypotheses about the relationships among elements in the theory of change and state them explicitly. It is useful to number the arrows in the program logic map and have them correspond with narrative descriptions of the assumptions or hypotheses they represent in a companion document.

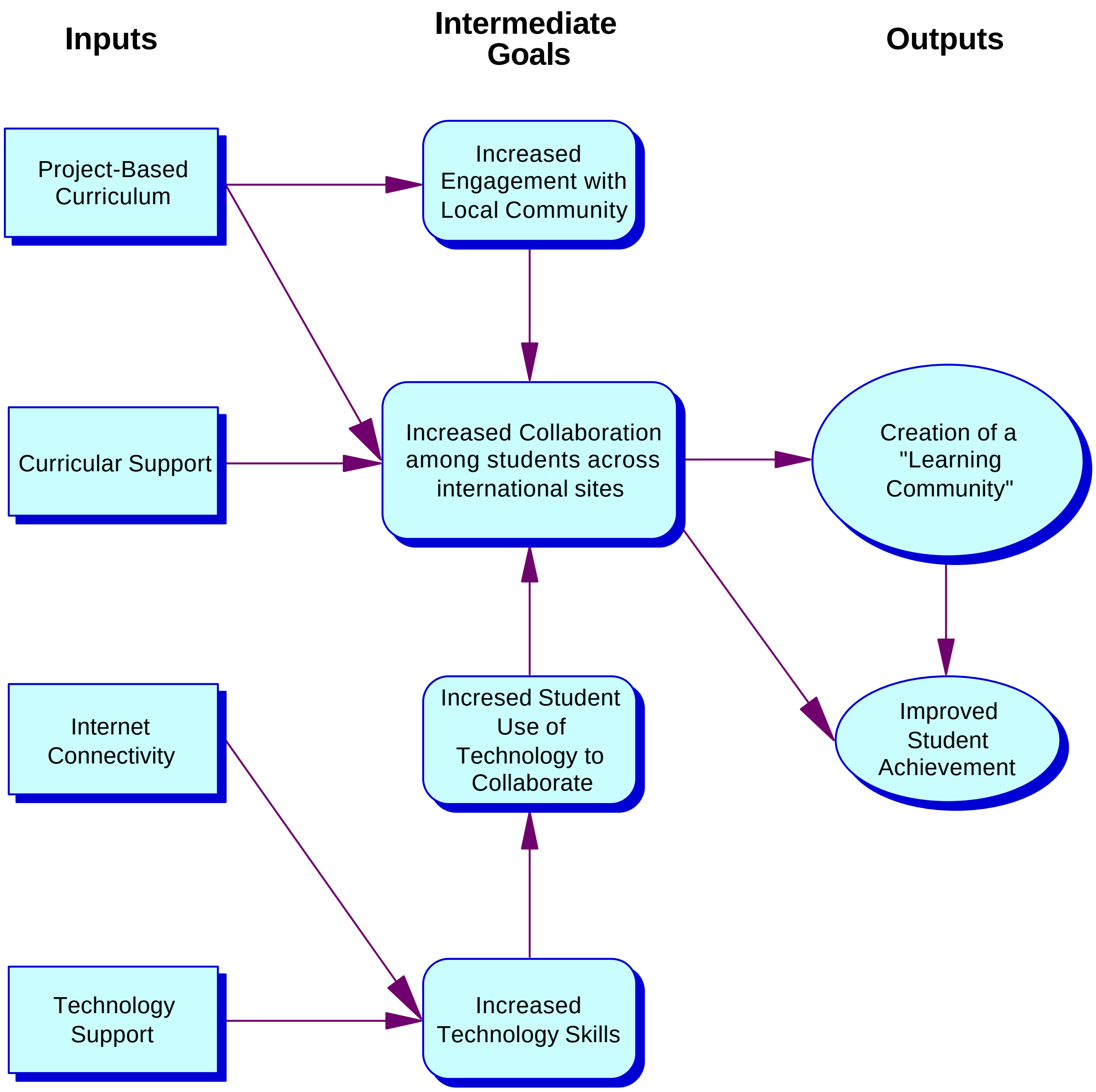

Figure 5. Sample Project Logic Map for Fictitious Project

In creating a program logic map, Vanezky[32] suggests that the following questions be answered:

1. What is innovative about the project? What will the project prove, if implemented properly, that will help others understand how CSCL can improve outcomes?
2. Is the map complete and are all necessary intermediate goals identified?
3. Are the inputs well planned and are they based upon both experience and empirical research?
4. Are the outputs identified with the precision needed to design appropriate evaluations of them?

[32]Vanezky, R. (2000). Procedures for evaluating the impact of complex educational initiatives. Unpublished manuscript.

4.4 Describe the Functional Requirements for the Activities in the Map

We discussed above the misconception of the common goal (section 3.1). Initiating a requirements review is a recommended strategy to allow initiative stakeholders to avoid having a false sense of goal alignment. By engaging in an requirements review of the elements of the program logic map, project teams ensure there are no hidden assumptions about the elements of the initiative. Planners must ask themselves, for every element (rectangle, rounded rectangle, and ellipse): "What is the plan for this input or activity?" Be specific in answering this and ask the source-person of the activity or input to provide some rationale for the activity.

We draw from Volare[33] again here, but modifying it for our own purposes to suit the data needs of CSCL projects. Our Review your list of stakeholders and attach statement of the participation that you think will be necessary from them to provide the requirements. Describe the contribution that you expect this stakeholder to provide. Is it design-expertise, tool prototyping, usability requirements etc. If possible, assess the minimum amount of time that this user must spend for you to be able to determine the complete requirements.

- Name of map element
- Is the element an input, intermediate goal, or ultimate goal?
- What are the immediate elements that have some dependency on this element?
- Definition of element (a one sentence statement of the intention of the element):
- Rationale (a justification for the element)
- Source (who raised this element?)
- Is this element a piece of software?
- Is your organization building it?
- Data or indicators that will tell you the element has been reached or completed:
- Who do you need help from to get these data and what is the likely time commitment they will need to provide you with?
- How long it will take you to get all the data necessary to indicate that the element is completed or reached?
- Degree of stakeholder happiness if this element is successfully implemented. Scale from 1 = uninterested to 5 = extremely pleased.
- Measure of stakeholder unhappiness if this element is not part of the final product. Scale from 1 = hardly matters to 5 = extremely displeased.
- Pointers to supporting materials about this element

4.5 Continue to Revisit the Map.

Any program logic map expires the moment it's developed. It is extremely important to continually revisit the map with stakeholders to refine its usefulness as a tool in

[33] Robertson, J. & Robertson, S. (2000). Volere requirements specification template. Edition 6.1. London: Atlantic Systems Guild.

managing and evaluating the project. Lohr[34] notes that “what matters is only that someone is interested in the truth or falsity of the theory that a certain program ***X*** results in a certain outcome ***Y*** and is willing to devote some resources to testing and explaining this.” In this vein, two questions should be asked repeatedly:

Question 1. Why perform or accomplish ***X*** (an activity or an outcome)?

A) What is expected to result from ***X***?

The answers to this first question and its sub-question help move the line from the left to the right. Answers to these questions help identify the intermediate outcomes that are needed to lead to the ultimate goals on the right.

Question 2. How can ***Y*** be expected to follow from ***X***?

A) What other things, if any, must be done or must occur to make the jump from ***X*** to ***Y*** believable?

The answers to these questions help to fill gaps in the line and forge stronger links.

5 Conclusion

In this paper we have described four common misconceptions or myths about educational technology projects. In light of these misconceptions we offer a management model that enables participants to work together towards better evaluations. This model also offers a handle to develop consensus on best practices methods in educational technology projects. Our model is aimed at all participants involved, but in particular those who have the responsibility to design and evaluate the projects.

To some readers, the approach we have described may sound familiar. Members of the design community may feel as though our approach sounds like how one articulates design rationales. In some ways it does. That is because it draws explicitly on the notion that one must paint a rationale for, and logical picture of, the change they hope to have happen in a CSCL initiative. Design rationales, however, tend to be described within the design community, in language that marks the rationale as the domain of the designer, and thus increasing the probability that the rationale's articulation outside that community will be misconstrued. One finds the same phenomenon in the community that attempts to place a scientific methodological approach to evaluating the outcomes of the design process. The rationales for using a scientific method tend to be articulated in language that marks them as the domain of the social researcher. The theory of change process borrows from both but is not the language of either, thereby shunning any attempts by any disciplinary group to exercise "ownership" of the process. The theory of change process places ultimate goals of the project at the center of the planning and deployment levels, ensuring the project is not only about developing a usable tool, or only about learning outcomes, or only about anything else that could be thrust to the front of a project but only represents a small portion of the project. It ensures that the project is about the collective, intended goals of the project stakeholders.

[34] Lohr, L. (1995). Impact analysis for program evaluation. Thousand Oaks: Sage (p. 2)