

Using case based reasoning to build a learning environment for poverty workers

By Edward Bethel

The Problem

Poverty is caused by the failure at the conceptual level, rather than any lack of capability on the part of people. (Yunus, 2006)

Conventional wisdom tells us that poverty is an absolute measurable state of being, a lack of access to goods and services, and as such can be assessed by metrics and indices. Mohammed Yunus, founder of The Grameen Bank turns conventional wisdom on its head. For Grameen, poverty is a conceptual rather than spiritual lack. Poverty is in what we perceive. Recognizing this is a prerequisite for the formulation of genuine solutions. Our challenge was to design a learning environment that enables and encourages learners to view poverty in new ways.

People's models of poverty develop in response to poverty in one's own surroundings – familiar poverty as it were. As long as this familiar poverty is all they see, these models will work – that is behave as expected – because they are based on that familiar poverty in the first place. These models are only adjusted, or abandoned if the person is faced with a case that does not fit the expectations. This is where learning takes place. The learner is forced to adapt to the new and unfamiliar circumstances.

Case based reasoning (CBR)

The premise of case based reasoning (CBR), is that exposure to diverse cases in indexed case libraries exposes inadequacies in learners' cognitive models. Learning occurs as models are adapted, revised, or abandoned completely in favor more suitable models (Kolodner, 2000). Case libraries are most effective when (i) learners are forced to reflect on the inadequacies of their cognitive models, (ii) the case library is used as an indexed, searchable learning resource, and (iii) learners build indexed searchable cases themselves to populate the case library (Kolodner, 2000).

Overcoming poverty learning resource

CBR as presented above, is an instructional/learning strategy that is well aligned with our design challenge. Consequently we used CBR principles to guide the development of the [Overcoming Poverty](#) learning resource

(http://ernie.concordia.ca/e_bethel/methods/). The purpose of this resource is to train actual or potential NGO workers and volunteers to design empowerment solutions for poverty using microcredit. While Grameen is the most famous of the microcredit lenders and is the model upon which others are built, it is certainly not the only microcredit lender. In countries all over the world, microcredit has proven to be an important part of successful poverty solutions (Murdoch, 1999).

It must be understood, however that simply because microcredit is part of poverty solutions all over the world, this does not mean that microcredit provides you with a poverty solution template. Microcredit is about individual empowerment. Just as poverty has many different faces, so will empowerment, its converse. In fact the word microcredit can be seen as a rather broad catch-all term covering a wide variety of poverty solutions involving at one stage or another the provision of very small loans to individuals normally seen as too poor to qualify for loans.

CBR and other design models

Cognitive flexibility theory

Given the inherent complexity of our domain and the diversity, yet interconnectedness of the cases, cognitive flexibility theory seemed an appropriate design rationale. In fact our design relies on many of the same characteristics of cognitive flexibility hypertext (CFH) designs: avoidance of oversimplification and overregularization, multiple representations of knowledge, centrality of cases, conceptual knowledge as knowledge-in-use, schema assembly (from rigidity to flexibility), multiple interconnectedness, active support and guidance (Spiro et al, 1988). We hoped to achieve a similar shift from generic schema retrieval to context-specific knowledge construction. The use of hypertext links to encourage these requirements of cognitive flexibility was employed to meet our design requirements.

At the same time, cognitive flexibility theory as discussed by Spiro et al (1998) and Spiro et al (1991) is still focused on "advanced knowledge acquisition" and knowledge construction. That is mastering the knowledge domain is still the goal, as ill-structured and complex as that domain may be. On the other hand, our learning goal is design centered as opposed to knowledge centered. That is, although it is essential that our learners be "cognitively flexible", this flexibility is important not only to master a knowledge domain, but rather to design new, unique, context specific poverty solutions.

Further, cognitive flexibility theory attempts to study a knowledge domain from multiple perspectives to get a much more complete understanding, akin to an architect studying a house from many different perspectives (plan, elevation, iso), or from many different systems (structural, electrical, plumbing, climate). Looking at one problem from varying vantage points. Our environment, on the other hand has the learner look at many problems from

a single vantage point, akin to that same architect looking at numerous human dwellings from the point of view that they are all houses, though they share only the most rudimentary characteristics. What is gained here is

- the “essence” of the viewpoint (in the metaphor “houseness”, or in our learning environment, poverty) by looking at the similarities of the problems;
- the complexity and unbounded nature of the problem by looking at the differences of the problems; and
- the potential for new and previously unimagined solutions.

Our environment employs characteristics of CFH to increase design possibilities rather than knowledge domain master.

Problem Based Learning (PBL)

A second theoretical approach that we explored was Problem Based Learning. This approach has learners study and design solutions to ill-defined complex problems. Problem Based Learning (PBL) as a learning and curricular design empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem. (Savery, 2006)

Learners in groups are presented with an outline of a case. They attack it by collaboratively working through four steps in a series of iterations:

- hypothesis/solution – group members propose and commit to a hypothesis that is continuously revised in successive iterations;
- known facts – group members list all pertinent information from the problem and that they have at their disposal;
- learning issues – group members list all the information that is needed to solve the problem but that is not presently available;
- action plan – group members draw up a plan of action to research learning issues and refine hypotheses. (Savery & Duffy, 2001)

The groups meet to go through several iterations of this process to arrive at a workable solution to the problem. Tutors provide metacognitive support and guidance to students working through problems but do not provide content support.

The PBL approach is well suited to designing solutions to ill-defined problems. There is a built in mechanism for learners to define the problem space and from that design solutions. There is no predetermined framework for designing solutions to problems, so solutions will by necessity be context specific.

PBL is especially well suited to our learning environment for two reasons:

- poverty issues are complex and ill-defined – the process of defining the problem space and hence solving the problem is a fundamental part of what NGO poverty workers are called upon to do;
- solving problems in context is exactly what NGO poverty workers do. Doing so in a learning environment gives them training for their actual work.

For these reasons the first prototype of our environment was employed a Problem Based Learning design. Using Barrows PBL model, the learning environment was constructed in [Moodle](#). The problem is set using a document resource. Several topic specific resources are made available to users, as are external links to additional sources of information. Four wikis are provided for the collaboration that would take place on Barrows whiteboard: one for Known Facts, one for Learning Issues, one for Hypotheses/Decisions, and one for the Action Plan. A discussion board was also opened for general discussion. Some scaffolding was provided in the “guiding questions” resource.

In our initial evaluation of the prototype, we realized that PBL might not be the best approach to address our basic question, namely how do we challenge learners to abandon preconceived notions of poverty. In a PBL environment learners could still use their preconceptions to guide their hypothesis making and research. Because solutions do not adhere to a specific formula, there would be nothing to challenge the learner to expand their epistemological beliefs about poverty. We considered countering this in two ways: first, by presenting the first problem case as a worked example, learners could have an example of learners being forced to expand their conceptions in order to solve problems. Second, the case library containing diverse, complex examples of poverty would be provided as a primary resource. As we began to work with the case library, it became more apparent that focusing the learning on the case library might be a more suitable approach.

CBR

For CBR, learning from cases is neither a random nor serendipitous. CBR is based on a model of cognition that describes how we learn experience. This cognitive model serves as the guide for designing CBR learning environments (Kolodner, 2006). At the heart of the CBR as an instructional theory is the case library. This is designed to mirror the structure of our cognitive case libraries. The case library is not simply a collection of narratives of experiences. Rather, cases are carefully built to maximize learning and transfer. Within the library, cases are indexed according to themes common across cases. These indexes provide a framework for understanding cases. Presented with a new case, the case reasoner attempts to fit the new case into the framework. Where a case does not fit, the framework must be adjusted and new indexes assigned. The framework not only determines how cases are arranged within the library, but also how the cases themselves are structured (Kolodner, 2000).

For CBR as a model of instructional design, the case library should be similarly structured. Just as cognitive case libraries are indexed, the CBR case library should be similarly indexed. Designers must identify key learning points linking cases. It is also critical that the library contain diverse cases to ensure that learners’ cognitive and conceptual models are continuously challenged and forced to adapt. It is in this adaptation that learning takes

place (Kolodner, 2006). To create a successful CBR environment in which users are challenged to overcome their preconceptions of poverty and design innovative solutions to overcome poverty, we first had to create a case library.

The case library as a learning resource for poverty workers

Kolodner (2006) sees that case libraries can serve as a learning resource in five ways:

- Advice as stories
- Vicarious experiences
- Lay of the land and guidance on what to focus on
- Strategies and procedures
- How to use cases

We attempt to address each of these in our learning environment.

Advice as stories

The heart of the *Overcoming Poverty* resource is the case library. Cases are written as stories in the first person. The intention is to include audio files and video clips as well. More important though is that stories are chosen precisely because of their intrinsic instructive value and the lessons to be learnt through comparison to and contrast with the other cases. Learning points and key ideas in cases will be hyperlinked and tagged so that learners can link to relevant sections of different cases or search the case library using important keywords.

Vicarious experiences

It is our contention that learners' conceptions of poverty are limited by their experiences. The case library gives learners the opportunity to experience many different faces of poverty through the stories and thereby expand their perceptions of poverty.

"Lay of the land"

Case libraries give learners the opportunity to view the "lay of the land", both from the bird's eye view and from the worm's eye view. It is not unusual for learners' to have an overly broad, abstract view of poverty. Through studying actual stories of individuals living in poverty provided in the case library, those abstract, theoretical constructs will be "fleshed out" and personalized. In many ways, these stories can make poverty much more real for the learners. On the other hand, learners who have had much contact with a particular type of poverty will have a very real, but specific view of poverty. By experiencing a variety of poverty stories through the case libraries, these users will be able to broaden their view of poverty without losing the specificity and detail. Additionally, the key learning points of our library are

navigation menu items and can hence serve as always-visible advance organizers.

Strategies and procedures

The stories in the learning resource provide accounts of how different individuals in different communities in different countries experienced poverty in different ways and, with microcredit assistance, took different paths to empowerment. In many ways, the solutions themselves may not be as instructive as the decision points, the strategies used, or the framing of the problem. These strategies may be the most important resource of the case library.

How to use cases

After having worked through complete cases and partial cases, learners in our environment narrate a poverty story themselves, then build a case by presenting a description of and an argument for a microcredit solution. These cases are then fed back into the case library. It is anticipated that learners' cases will include references back to cases that helped them in the design of their solution. When added to the case library, these new stories will also provide new learners with models of how the case library can be used best.

The case library as a design support

Learners learn most when they attempt to teach or instruct others. In the same way CBR learners may benefit as much or more when they actually build the case libraries themselves, rather than when they just use it as a learning resource (Kolodner, 2006). It is with this in mind that learners are required to build their own cases to populate the case libraries. Not only will it require them to construct an empowerment solution to a real problem, but by designing and constructing this solution they will understand poverty, empowerment, and microcredit mechanisms in a much deeper way. This process-learning is particularly effective in our project because in building the case, learners have to build in links to other cases and to resources. They must anticipate ways that other potential users of this case might view poverty, empowerment, or microcredit, thereby further broadening learners views of poverty and awareness of perspectives on poverty.

The case library as a reflective support

The importance of reflection to learning cannot be overstated. Reflection provides the impetus for self-regulation by focusing learners' attention on how they learn (Kolodner, 2006). Importantly though, reflection allows us to learn from our and others' experiences. Reflection allows us to look back and ask "what worked?", "what didn't work?", "why didn't it work?", "what could we have done to make it work?". By having learners ask these kinds of questions of the stories in a case library, a case library promotes learning through reflection.

The *Overcoming Poverty* website already provides or will provide two types of support for reflection: guiding questions and case reflections. Guiding questions will draw learners' attention to learning issues specific to this case library, for example the role of gender in poverty, and are intended to assist learners in their evaluation of the case stories and design of their empowerment solutions. Case reflections will have learners evaluate their own cases by reflecting on general learning questions (what did and did not work). It is intended that these reflections can be linked to the cases and uploaded to the case libraries (with the authors' approvals) and hence serve as another level of complexity to the case stories. This tool as yet has not been built into the environment.

Conclusion

Our goal in designing this learning resource was to provide an environment where individuals interested in empowerment work involving microcredit could interact with and learn from stories of poverty, empowerment, and microcredit. We investigated several models of constructivist learning including Cognitive Flexibility Theory, Problem Based Learning and Case Based Reasoning. The latter was selected as the best option for our learning needs as it would expose them to a variety of poverty stories thereby weakening preconceptions about poverty and broadening the learners empowerment options.

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